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Office of
Fissile Materials Disposition

United States Department of Energy

Surplus Plutonium Disposition Final Environmental Impact Statement

Volume II

November 1999

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DOE/EIS-0283

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United States Department of Energy
Office of Fissile Materials Disposition

November 1999

Cover Sheet

Responsible Agency: United States Department of Energy (DOE)

Title: *Surplus Plutonium Disposition Final Environmental Impact Statement* (SPD EIS) (DOE/EIS-0283)

Locations of Candidate Sites: California, Idaho, New Mexico, North Carolina, South Carolina, Tennessee, Texas, Virginia, and Washington

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Abstract: On May 22, 1997, DOE published a Notice of Intent in the Federal Register (62 Federal Register 28009) announcing its decision to prepare an environmental impact statement (EIS) that would tier from the analysis and decisions reached in connection with the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic EIS*. At that time, the U.S. Environmental Protection Agency decided to be a cooperating agency. The *Surplus Plutonium Disposition Draft Environmental Impact Statement* (SPD Draft EIS) (DOE/EIS-0283-D) was prepared in accordance with NEPA and issued in July 1998. It identified the potential environmental impacts of reasonable alternatives for the proposed siting, construction, and operation of three facilities for the disposition of up to 50 metric tons (55 tons) of surplus plutonium, as well as a No Action Alternative. These three facilities would accomplish pit disassembly and conversion, plutonium conversion and immobilization, and mixed oxide (MOX) fuel fabrication.

For the alternatives that included MOX fuel fabrication, the SPD Draft EIS described the potential environmental impacts of using from three to eight commercial nuclear reactors to irradiate MOX fuel. The potential impacts were based on a generic reactor analysis that used actual reactor data and a range of potential site conditions. In May 1998, DOE initiated a procurement process to obtain MOX fuel fabrication and reactor irradiation services. In March 1999, DOE awarded a contract to Duke Engineering & Services, COGEMA Inc., and Stone & Webster (known as DCS) to provide the requested services. A *Supplement to the SPD Draft EIS* was issued in April 1999, which analyzed the potential environmental impacts of using MOX fuel in six specific reactors named in the DCS proposal. Those reactors are Catawba Nuclear Station Units 1 and 2 in South Carolina, McGuire Nuclear Station Units 1 and 2 in North Carolina, and North Anna Power Station Units 1 and 2 in Virginia.

DOE has identified the hybrid approach as its Preferred Alternative for the disposition of surplus plutonium. This approach allows for the immobilization of 17 metric tons (19 tons) of surplus plutonium and the use of 33 metric tons (36 tons) as MOX fuel. DOE has identified the Savannah River Site near Aiken, South Carolina, as the preferred site for all three disposition facilities (Alternative 3). DOE has also identified Los Alamos National

Laboratory in New Mexico as the preferred site for lead assembly fabrication, and Oak Ridge National Laboratory in Tennessee as the preferred site for postirradiation examination of lead assemblies.

Public Involvement: In preparing the SPD Final EIS, DOE considered comments on the SPD Draft EIS and the *Supplement to the SPD Draft EIS* received via mail, fax, and email, and comments recorded by phone and transcribed from videotapes. In addition, comments were captured by notetakers during interactive public meetings held on the SPD Draft EIS in August 1998 in Amarillo, Texas; Idaho Falls, Idaho; North Augusta, South Carolina; Portland, Oregon; and Richland, Washington, as well as during a public meeting on the *Supplement to the SPD Draft EIS* held in June 1999 in Washington, D.C. Comments received and DOE's responses to these comments are found in Volume III, the Comment Response Document, of the SPD Final EIS. Information on the surplus plutonium disposition program can be obtained by visiting the Office of Fissile Materials Disposition Web site at http://www.doe-md.com.

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List of Acronyms

AEA	Atomic Energy Act of 1954
AECL	Atomic Energy of Canada Limited
AED	aerodynamic equivalent diameter
AIRFA	American Indian Religious Freedom Act
ALARA	as low as is reasonably achievable
AMWTP	Advanced Mixed Waste Treatment Project
ANL–W	Argonne National Laboratory–West
APSF	Actinide Packaging and Storage Facility
AQCR	Air Quality Control Region
ARF	airborne release fraction
ARIES	Advanced Recovery Integrated Extraction System
AVLIS	Atomic Vapor Laser Isotope Separation
BEA	Bureau of Economic Analysis
BEIR V	Report V of the Committee on the Biological Effects of Ionizing Radiations
BIO	Basis for Interim Operation
BLM	Bureau of Land Management
BNFL	British Nuclear Fuels
BWR	boiling water reactor
CAA	Clean Air Act
CAB	Citizens Advisory Board
CANDU	Canadian Deuterium Uranium (reactors)
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Central Facilities Area
CFR	Code of Federal Regulations
CPP	Chemical Processing Plant
CWA	Clean Water Act of 1972, 1987
D&D	decontamination and decommissioning
DBA	design basis accident
DCS	Duke Engineering & Services, COGEMA Inc., and Stone & Webster
DNFSB	Defense Nuclear Facilities Safety Board
DOC	U.S. Department of Commerce
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOL	U.S. Department of Labor
DOT	U.S. Department of Transportation
DR	damage ratio
DU PEIS	*Final Programmatic Environmental Impact Statement for Alternative Strategies for Long-Term Management and Use of Depleted Uranium Hexafluoride*
DWPF	Defense Waste Processing Facility
EA	environmental assessment
EBR	Experimental Breeder Reactor (I or II)
EIS	environmental impact statement
EPA	Environmental Protection Agency

ES&H	environment, safety, and health
ESTEEM	Education in Science, Technology, Energy, Engineering, and Math
ETB	Engineering Test Bay
ETTP	East Tennessee Technology Park
FAA	Federal Aviation Administration
FDP	fluorinel dissolution process
FEMA	Federal Emergency Management Agency
FFCA	Federal Facility Compliance Agreement
FFF	Uranium Fuel Fabrication Facility
FFTF	Fast Flux Test Facility
FI	field investigation
FM	Farm-to-Market (road)
FMF	Fuel Manufacturing Facility
FMEA	failure modes and effects analysis
FMEF	Fuels and Materials Examination Facility
FONSI	finding of no significant impact
FPF	Fuel Processing Facility
FPPA	Farmland Protection Policy Act
FR	Federal Register
GAO	General Accounting Office
GDP	gaseous diffusion plant
GE	General Electric Company
GENII	Generation II, Hanford environmental radiation dosimetry software system
GPS	global positioning satellite
HE	high explosive
HEPA	high-efficiency particulate air (filter)
HEU	highly enriched uranium
HFEF	Hot Fuel Examination Facility
HHS	Department of Health and Human Services
HIGHWAY	(computer code for distances and populations along U.S. highways)
HLW	high-level waste
HLWVF	high-level-waste vitrification facility
HMIS	Hazardous Materials Information System
HWTPF	Hazardous Waste Treatment and Processing Facility
HYDOX	hydride oxidation
IAEA	International Atomic Energy Agency
ICPP	Idaho Chemical Processing Plant
ICRP	International Commission on Radiological Protection
ID DHW	Idaho Department of Health and Welfare
INEEL	Idaho National Engineering and Environmental Laboratory
INRAD	Intrinsic Radiation
INTEC	Idaho Nuclear Technology and Engineering Center
IPE	Individual Plant Examination
ISC	Industrial Source Complex Model
ISC3	Industrial Source Complex Model, Version 3
ISCST3	Industrial Source Complex Model, Short-Term, Version 3
ISLOCA	interfacing systems loss-of-coolant accident
ITP	In-Tank Precipitation Process

LANL	Los Alamos National Laboratory
LCF	latent cancer fatality
LDR	Land Disposal Restrictions
LEU	low-enriched uranium
LLNL	Lawrence Livermore National Laboratory
LLW	low-level waste
LOCA	loss-of-coolant accident
LPF	leak path factor
LWR	light water reactor
M&H	Mason & Hanger Corporation
MACCS2	Melcor Accident Consequence Code System (computer code)
MAR	material at risk
MD	Office of Fissile Materials Disposition
MEI	maximally exposed individual
MIMAS	Micronized Master
MMI	Modified Mercalli Intensity
MOX	mixed oxide
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAS	National Academy of Science
NCRP	National Council on Radiation Protection and Measurements
NDA	nondestructive analysis
NEPA	National Environmental Policy Act of 1969
NESHAPs	National Emissions Standards for Hazardous Air Pollutants
NIOSH	National Institute of Occupational Safety and Health
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPH	natural phenomena hazard
NPS	National Park Service
NRC	U.S. Nuclear Regulatory Commission
NRU	National Research Universal
NTS	Nevada Test Site
NWCF	New Waste Calcining Facility
NWPA	Nuclear Waste Policy Act
NWS	National Weather Service
ORIGEN	ORNL Isotope Generation and Depletion Code
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
OSHA	Occupational Safety and Health Administration
PBF	Power Burst Facility
PEIS	programmatic environmental impact statement
PFP	Plutonium Finishing Plant
PIE	postirradiation examination
$PM_{2.5}$	particulate matter with an aerodynamic diameter less than or equal to 2.5 microns
PM_{10}	particulate matter with an aerodynamic diameter less than or equal to 10 microns
PNNL	Pacific Northwest National Laboratory
PRA	probabilistic risk assessment
PSD	prevention of significant deterioration
PUREX	Plutonium-Uranium Extraction (Facility)
PWR	pressurized water reactor
R&D	research and development

RADTRAN 4	(computer code: risks and consequences of radiological materials transport)
RANT	Radioactive Assay and Nondestructive Test
RAMROD	Radioactive Materials Research, Operations and Demonstration
RCRA	Resource Conservation and Recovery Act, as amended
REA	regional economic area
RF	respirable fraction
RfC	reference concentration
RfD	reference dose
RFETS	Rocky Flats Environmental Technology Site
RFP	Request for Proposal
RIA	Reactivity Insertion Accidents
RIMS II	Regional Input-Output Modeling System II (computer code)
RISKIND	(computer code: risks and consequences of radiological materials transport)
ROD	Record of Decision
ROI	region of influence
RMF	Radiation Measurements Facility
RWMC	Radioactive Waste Management Complex
S/A	Similarity of Appearance (provision of Endangered Species Act)
SAR	safety analysis report
SARA	Superfund Amendments and Reauthorization Act of 1986
SCDHEC	South Carolina Department of Health and Environmental Control
SCE&G	South Carolina Electric & Gas Company
SCSHPO	South Carolina State Historic Preservation Officer
SDWA	Safe Drinking Water Act, as amended
SEIS	supplemental environmental impact statement
SHPO	State Historic Preservation Officer
SI	sealed insert
SMC	Specific Manufacturing Complex
SNF	spent nuclear fuel
SNM	special nuclear material
SPD	surplus plutonium disposition
SPD EIS	*Surplus Plutonium Disposition Environmental Impact Statement*
SPERT	Special Power Excursion Reactor Test
SRS	Savannah River Site
SSM PEIS	*Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management*
SST/SGT	safe, secure trailer/SafeGuards Transport
SWMU	solid waste management unit
SWP 1	Service Waste Percolation Pond 1
TA	Technical Area
TCE	trichloroethylene
TNRCC	Texas Natural Resource Conservation Commission
TPBAR-LTA	tritium-producing burnable absorber rod lead test assembly
TRA	technical risk assessment
TRANSCOM	transportation tracking and communications system
TRU	transuranic
TRUPACT	TRU waste package transporter
TSCA	Toxic Substances Control Act
TSP	total suspended particulates

TVA	Tennessee Valley Authority
TWRS	tank waste remediation system
TWRS EIS	*Tank Waste Remediation System Final Environmental Impact Statement*
UC	Regents of the University of California
UFSAR	updated final safety analysis report
USACE	U.S. Army Corps of Engineers
USC	United States Code
USEC	United States Enrichment Corporation
USFWS	U.S. Fish and Wildlife Service
UV	ultraviolet
VOC	volatile organic compounds
VORTAC	very high frequency omnidirectional range/tactical air navigation (facility)
VRM	Visual Resource Management
WAG 3	Waste Area Grouping 3
WERF	Waste Experimental Reduction Facility
WIPP	Waste Isolation Pilot Plant
WM PEIS	*Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste*
WNP–1	Washington Nuclear Plant–1
WNP–2	Washington Nuclear Plant–2
WPPSS	Washington Public Power Supply System
WROC	Waste Reduction Operations Complex
WSRC	Westinghouse Savannah River Company
ZPPR	Zero Power Physics Reactor

Chemicals and Units of Measure

°C	degrees Celsius (Centigrade)
°F	degrees Fahrenheit
µCi	microcurie
µg	microgram
µm	micrometer (micron)
46°26'07"	46 degrees, 26 minutes, 7 seconds
Ci	curie
cm	centimeter
CO	carbon monoxide
CO_2	carbon dioxide
dB	decibel
dBA	decibel, A-weighted
DUF_6	depleted uranium hexafluoride
eH	oxidation reduction potential
ft	foot
ft^2	square foot
ft^3	cubic foot
g	gram
g	gravitational acceleration
gal	gallon
GWD	gigawatt days (per ton)
ha	hectare
hr	hour (in compound units)
in	inch
kg	kilogram
km	kilometer
km^2	square kilometers
kV	kilovolt
l	liter
lb	pound
m	meter
m^2	square meter
m^3	cubic meter
mg	milligram
mi	mile
min	minute
mph	miles per hour
mrem	millirem
MTHM	metric tons of heavy metal
MVA	megavolt-ampere
MW	megawatt
MWe	megawatt electric
MWh	megawatt-hour
N_2	nitrogen
nCi	nanocurie
NO_2	nitrogen dioxide
pCi	picocurie
pcm/F	percent mille/Farenheit
pH	hydrogen ion concentration
$PM_{2.5}$	particulate matter less than or equal to 2.5 µm in diameter
PM_{10}	particulate matter less than or equal to 10 µm in diameter
ppm	parts per million
PuO_2	plutonium dioxide
rad	radiation absorbed dose
rem	roentgen equivalent man
s	second
SO_2	sulfur dioxide
t	metric ton
ton	short ton
UF_6	uranium hexafluoride
UO_2	uranium dioxide
yd	yard
yd^3	cubic yard
yr	year (in compound units)
wt %	weight percent

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

Metric Prefixes

Prefix	Symbol	Multiplication Factor
exa-	E	1 000 000 000 000 000 000 = 10^{18}
peta-	P	1 000 000 000 000 000 = 10^{15}
tera-	T	1 000 000 000 000 = 10^{12}
giga-	G	1 000 000 000 = 10^{9}
mega-	M	1 000 000 = 10^{6}
kilo-	k	1 000 = 10^{3}
hecto-	h	100 = 10^{2}
deka-	da	10 = 10^{1}
deci-	d	0.1 = 10^{-1}
centi-	c	0.01 = 10^{-2}
milli-	m	0.001 = 10^{-3}
micro-	μ	0.000 001 = 10^{-6}
nano-	n	0.000 000 001 = 10^{-9}
pico-	p	0.000 000 000 001= 10^{-12}
femto-	f	0.000 000 000 000 001 = 10^{-15}
atto-	a	0.000 000 000 000 000 001= 10^{-18}

Appendix A
Federal Register Notices
and
Joint Statement

A.1 RECORD OF DECISION FOR THE STORAGE AND DISPOSITION OF WEAPONS-USABLE FISSILE MATERIALS FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT

Responses: 18,620 Burden Hours: 64,310.

Abstract: The LESCP is being conducted in response to the legislative requirement in P.L. 103–382, Section 1501 to assess the implementation of Title I and related education reforms. The information will be used to examine changes—over a 3-year period—that are occurring in schools and classrooms. Teachers and teacher aides will complete a mail survey, and district Title I administrators, principals, school-based staff, and parents will be interviewed during on-site field work.

[FR Doc. 97–1307 Filed 1–17–97; 8:45 am]

BILLING CODE 4000–01–P

DEPARTMENT OF ENERGY

Record of decision for the Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement

AGENCY: Department of Energy.

ACTION: Record of Decision.

SUMMARY: The Department of Energy (DOE) has decided to implement a program to provide for safe and secure storage of weapons-usable fissile materials (plutonium and highly enriched uranium [HEU]) and a strategy for the disposition of surplus weapons-usable plutonium, as specified in the Preferred Alternative in the Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement (S&D Final PEIS, DOE/EIS–0229, December 1996). The fundamental purpose of the program is to maintain a high standard of security and accounting for these materials while in storage, and to ensure that plutonium produced for nuclear weapons and declared excess to national security needs (now, or in the future) is never again used for nuclear weapons.

DOE will consolidate the storage of weapons-usable plutonium by upgrading and expanding existing and planned facilities at the Pantex Plant in Texas and the Savannah River Site (SRS) in South Carolina, and continue the storage of weapons-usable HEU at DOE's Y–12 Plant at the Oak Ridge Reservation (ORR) in Tennessee, in upgraded and, as HEU is dispositioned, consolidated facilities. After certain conditions are met, most plutonium now stored at the Rocky Flats Environmental Technology Site (RFETS) in Colorado will be moved to Pantex and SRS. Plutonium currently stored at the Hanford Site (Hanford), the Idaho National Engineering Laboratory (INEL), and the Los Alamos National Laboratory (LANL) will remain at those sites until disposition (or movement to lag storage at the disposition facilities).

DOE's strategy for disposition of surplus plutonium is to pursue an approach that allows immobilization of surplus plutonium in glass or ceramic material for disposal in a geologic repository pursuant to the Nuclear Waste Policy Act, and burning of some of the surplus plutonium as mixed oxide (MOX) fuel in existing, domestic, commercial reactors, with subsequent disposal of the spent fuel in a geologic repository pursuant to the Nuclear Waste Policy Act. DOE may also burn MOX fuel in Canadian Deuterium Uranium [CANDU] reactors in the event of an appropriate agreement among Russia, Canada, and the United States, as discussed below. The timing and extent to which either or both of these disposition approaches (immobilization or MOX) are ultimately deployed will depend upon the results of future technology development and demonstrations, follow-on (tiered) site-specific environmental review, contract negotiations, and detailed cost reviews, as well as nonproliferation considerations, and agreements with Russia and other nations. DOE's program will be subject to the highest standards of safeguards and security throughout all aspects of storage, transportation, and processing, and will include appropriate International Atomic Energy Agency verification.

Due to technology, complexity, timing, cost, and other factors that would be involved in purifying certain plutonium materials to make them suitable for potential use in MOX fuel, approximately 30 percent of the total quantity of plutonium (that has or may be declared surplus to defense needs) would require extensive purification to use in MOX fuel, and therefore will likely be immobilized. DOE will immobilize at least 8 metric tons (MT) of currently declared surplus plutonium materials that DOE has already determined are not suitable for use in MOX fuel. DOE reserves the option of using the immobilization approach for all of the surplus plutonium.

The exact locations for disposition facilities will be determined pursuant to a follow-on, site-specific disposition environmental impact statement (EIS) as well as cost, technical and nonproliferation studies. However, DOE has decided to narrow the field of candidate disposition sites. DOE has decided that a vitrification or immobilization facility (collocated with a plutonium conversion facility) will be located at either Hanford or SRS, that a potential MOX fuel fabrication facility will be located at Hanford, INEL, Pantex, or SRS (only one site), and that a ''pit'' disassembly and conversion facility will be located at Hanford, INEL, Pantex, or SRS (only one site). (''Pits'' are weapons components containing plutonium.) The specific reactors, and their locations, that may be used to burn the MOX fuel will depend on contract negotiations, licensing, and environmental reviews. Because there are a number of technology variations that could be used for immobilization, DOE will also determine the specific immobilization technology based on the follow-on EIS, technology developments, cost information, and nonproliferation considerations. Based on current technological and cost information, DOE anticipates that the follow-on EIS will identify, as part of the proposed action, immobilizing a portion of the surplus plutonium using the ''can-in-canister'' technology at the Defense Waste Processing Facility (DWPF) at the Savannah River Site.

The use of MOX fuel in existing reactors would be undertaken in a manner that is consistent with the United States' policy objective on the irreversibility of the nuclear disarmament process and the United States' policy discouraging the civilian use of plutonium. To this end, implementing the MOX alternative would include government ownership and control of the MOX fuel fabrication facility at a DOE site, and use of the facility only for the surplus plutonium disposition program. There would be no reprocessing or subsequent reuse of spent MOX fuel. The MOX fuel would be used in a once-through fuel cycle in existing reactors, with appropriate arrangements, including contractual or licensing provisions, limiting use of MOX fuel to surplus plutonium disposition.

The Department of Energy also retains the option of using MOX fuel in Canadian Deuterium Uranium (CANDU) reactors in Canada in the event a multilateral agreement is negotiated among Russia, Canada, and the United States to use CANDU reactors for surplus United States' and Russian plutonium. DOE will engage in a test and demonstration program for CANDU MOX fuel as appropriate and consistent with future cooperative efforts with Russia and Canada.

These efforts will provide the basis and flexibility for the United States to initiate disposition efforts either multilaterally or bilaterally through negotiations with other nations, or unilaterally as an example to Russia and

other nations. Disposition of the surplus plutonium will serve as a nonproliferation and disarmament example, encourage similar actions by Russia and other nations, and foster multilateral or bilateral disposition efforts and agreements.

EFFECTIVE DATE: The decisions set forth in this Record of Decision (ROD) are effective upon issuance of this document, in accordance with DOE's National Environmental Policy Act (NEPA) Implementing Procedures and Guidelines (10 CFR Part 1021) and the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 CFR Parts 1500-1508).

ADDRESSES: Copies of the S&D Final PEIS, the Technical Summary Report For Long-Term Storage of Weapons-Usable Fissile Materials, the Technical Summary Report for Surplus Weapons-Usable Plutonium Disposition, the Nonproliferation and Arms Control Assessment of Weapons-Usable Fissile Material Storage and Plutonium Disposition, and this ROD may be obtained by writing to the U.S. Department of Energy, Office of Fissile Materials Disposition, MD–4, 1000 Independence Avenue, SW., Washington, DC 20585, or by calling (202) 586–4513. The 56-page Summary of the S&D Final PEIS, the other documents noted above (other than the full PEIS), and this ROD are also available on the Fissile Materials Disposition World Wide Web Page at: http://web.fie.com/htdoc/fed/DOE/fsl/pub/menu/any/

FOR FURTHER INFORMATION CONTACT: For information on the storage and disposition of weapons-usable fissile materials program or this ROD contact: Mr. J. David Nulton, Director, NEPA Compliance and Outreach, Office of Fissile Materials Disposition (MD–4), U.S. Department of Energy, 1000 Independence Avenue, SW., Washington, DC 20585, telephone (202) 586–4513.

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SUPPLEMENTARY INFORMATION:

I. Background

The end of the Cold War has created a legacy of surplus weapons-usable fissile materials both in the United States and the former Soviet Union. Further agreements on disarmament may increase the surplus quantities of these materials. The global stockpiles of weapons-usable fissile materials pose a danger to national and international security in the form of potential proliferation of nuclear weapons and the potential for environmental, safety, and health consequences if the materials are not properly safeguarded and managed.

In September 1993, President Clinton issued a Nonproliferation and Export Control Policy in response to the growing threat of nuclear proliferation. Further, in January 1994, President Clinton and Russia's President Yeltsin issued a Joint Statement Between the United States and Russia on Nonproliferation of Weapons of Mass Destruction and the Means of Their Delivery. In accordance with these policies, the focus of the U.S. nonproliferation efforts in this regard is five-fold: (i) To secure nuclear materials in the former Soviet Union; (ii) to assure safe, secure, long-term storage and disposition of surplus weapons-usable fissile materials; (iii) to establish transparent and irreversible nuclear arms reductions; (iv) to strengthen the nuclear nonproliferation regime; and (v) to control nuclear exports. The policy also states that the United States will not encourage the civil use of plutonium and that the United States does not engage in plutonium reprocessing for either nuclear power or nuclear explosive purposes.

To demonstrate the United States' commitment to these objectives, President Clinton announced on March 1, 1995, that approximately 200 metric tons of U.S.-origin weapons-usable fissile materials, of which 165 metric tons are HEU and 38 metric tons are weapons-grade plutonium, had been declared surplus to the United States' defense needs.[1] The safe and secure storage of weapons-usable plutonium and HEU, and the disposition of surplus weapons-usable plutonium, consistent with the Preferred Alternative in the S&D Final PEIS and the decisions described in section V of this ROD, are consistent with the President's nonproliferation policy.

II. Decisions Made in This ROD

This ROD encompasses two categories of decisions: (1) The sites and facilities for storage of non-surplus weapons-usable plutonium and HEU, and storage of surplus plutonium and HEU pending disposition; and (2) the programmatic strategy for disposition of surplus weapons-usable plutonium. This ROD does not encompass the final selection of sites for plutonium disposition facilities, nor the extent to which the two plutonium disposition approaches (immobilization or MOX) will ultimately be implemented. Those decisions will be made pursuant to a follow-on EIS. However, DOE does announce in this ROD that the slate of candidate sites for plutonium disposition has been narrowed. This ROD does not include decisions about the disposition of surplus HEU, which were made in July 1996 in the separate ROD for the Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement, 61 FR 40619 (Aug. 5, 1996).[2]

III. NEPA Process

A. S&D Draft PEIS

On June 21, 1994, DOE published a Notice of Intent (NOI) in the Federal Register (59 FR 31985) to prepare a Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement (S&D PEIS), which was originally to address the storage and disposition of both plutonium and HEU. DOE subsequently concluded that a separate EIS on surplus HEU disposition would be appropriate. Accordingly, DOE published a notice in the Federal Register (60 FR 17344) on April 5, 1995, to inform the public of the proposed plan to prepare a separate EIS for the disposition of surplus HEU.

DOE published an implementation plan (IP) for the S&D PEIS in March 1995 (DOE/EIS–0229–IP). The IP recorded the issues identified during the scoping process, indicated how they would be addressed in the S&D PEIS, and provided guidance for the preparation of the S&D PEIS. DOE issued the Storage and Disposition of Weapons-Usable Fissile Materials Draft Programmatic Environmental Impact Statement (S&D Draft PEIS, DOE/EIS–0229–D) for public comment in February 1996. On March 8, 1996, both DOE and the Environmental Protection

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[1] The Secretary of Energy's Openness Initiative announcement of February 6, 1996, announced that the United States has about 213 metric tons of surplus fissile materials, including the 200 metric tons the President announced in March, 1995. Of the 213 metric tons of surplus materials, the Openness Initiative announcement indicated that about 174.3 metric tons are HEU and about 38.2 metric tons are weapons-grade plutonium. Additional quantities of plutonium may be declared surplus in the future; therefore, the S&D Final PEIS analyzes the disposition of a nominal 50 metric tons of plutonium, as well as the storage of 89 metric tons of plutonium and 994 metric tons of HEU.

[2] The material considered in the S&D Final PEIS, and covered by the decisions in this ROD, does not include spent nuclear fuel, irradiated targets, uranium-233, plutonium-238, plutonium residues of less than 50-percent plutonium by weight, or weapons program materials-in-use.

Agency (EPA) published Notices of Availability of the S&D Draft PEIS in the Federal Register (61 FR 9443 and 61 9450), announcing a public comment period from March 8 until May 7, 1996. In response to requests from the public, DOE on May 13, 1996 published another Notice in the Federal Register (61 FR 22038) announcing an extension of the comment period until June 7, 1996. Eight public meetings on the S&D Draft PEIS were held during March and April 1996 in Washington, DC and in the vicinity of the DOE sites under consideration for the proposed actions.

During the 92-day public comment period, the public was encouraged to provide comments via mail, toll-free fax, electronic bulletin board (Internet), and toll-free telephone recording device. By these means, DOE received 8,442 comments from 6,543 individuals and organizations for consideration. In addition, 250 oral comments were recorded from some of the 734 individuals who attended the eight public meetings. All of the comments received, and the Department's responses to them, are presented in Volume IV (the Comment Response Document) of the S&D Final PEIS. All of the comments were considered in preparation of the S&D Final PEIS, and in many cases resulted in changes to the document. The Notice of Availability for the S&D Final PEIS was published by EPA in the Federal Register on December 13, 1996 (61 FR 65572). DOE published its own Notice of Availability for the S&D Final PEIS in the Federal Register on December 19, 1996 (61 FR 67001).

B. Alternatives Considered

The S&D PEIS analyzes the reasonable action alternatives in addition to the Preferred Alternative and the No Action Alternative. The Preferred Alternative, which is described below in section V, Decisions, and which DOE has decided to implement, represents a combination of alternatives for both storage and disposition.

1. The Proposed Action

The proposed action, as described in the S&D PEIS, would involve the following actions for U.S. weapons-usable fissile materials:

- Storage—provide a long-term storage system (for up to 50 years) for nonsurplus plutonium and HEU that meets the Stored Weapons Standard[3] and applicable environmental, safety, and health standards while reducing storage and infrastructure costs.
- Storage Pending Disposition—provide storage that meets the Stored Weapons Standard for inventories of weapons-usable plutonium and HEU[4] that have been or may be declared surplus.
- Disposition—convert surplus plutonium and plutonium that may be declared surplus in the future to forms that meet the Spent Fuel Standard,[5] thereby providing evidence of irreversible disarmament and setting a model for proliferation resistance.

2. Long-Term Storage Alternatives and Related Activities

a. No Action. Under the No Action Alternative, all weapons-usable fissile materials would remain at existing storage sites. Maintenance at existing storage facilities would be done as required to ensure safe operation for the balance of the facility's useful life. Sites covered under the No Action Alternative included Hanford, INEL, Pantex, the ORR, SRS, RFETS, and LANL. Although there are no weapons-usable fissile materials within the scope of the S&D PEIS stored currently at Nevada Test Site (NTS), it was also analyzed under No Action to provide an environmental baseline against which impacts of the storage and disposition action alternatives were analyzed.

b. Upgrade at Multiple Sites. Under this alternative for storage, DOE would either modify certain existing facilities or build new facilities, depending on the site's ability to meet standards for nuclear material storage facilities, and would utilize existing site infrastructure to the extent possible. These modified or new facilities would be designed to operate for up to 50 years. Plutonium materials currently stored at Hanford, INEL, Pantex, and SRS would remain at those four sites (in upgraded or new facilities), and HEU would remain at ORR (in upgraded, consolidated facilities). This alternative does not apply to NTS because NTS does not currently store weapons-usable fissile materials.

A sub-alternative of relocating portions of the plutonium inventory (a total of 14.4 metric tons according to DOE's Openness Initiative announcements of December 7, 1993, and February 6, 1996, respectively) from RFETS and LANL to one or more of the four existing plutonium storage sites is analyzed. Storage of surplus materials without strategic reserve and weapons research and development (R&D) materials is also included as a sub-alternative. Within some of the five candidate storage sites under this alternative, there are also multiple storage options.

c. Consolidation of Plutonium. Under this alternative, plutonium materials at existing sites would be removed, and the entire DOE inventory of plutonium would be consolidated at one site, while the HEU inventory would remain at ORR. Again, Hanford, INEL, Pantex and SRS would be candidate sites for plutonium consolidation. In addition, NTS would be a candidate site for this alternative. Consolidation of plutonium at ORR would result in a situation in which inventories of plutonium and HEU were collocated at one site; this alternative was therefore analyzed as one option under the Collocation Alternative (see below). A sub-alternative to account for the separate storage of surplus materials without strategic reserve and weapons R&D materials was also included.

d. Collocation of Plutonium and Highly Enriched Uranium. Under the Collocation Alternative, the entire DOE inventory of plutonium and HEU would be consolidated and collocated at the same site. The six candidate sites would be Hanford, NTS, INEL, Pantex, ORR, and SRS. A sub-alternative for the separate storage of surplus materials without strategic reserve and weapons R&D materials was also included.

3. Plutonium Disposition Alternatives and Related Activities

The disposition technologies analyzed in the S&D PEIS were those that would convert surplus plutonium into a form that would meet the Spent Fuel Standard. For the purpose of environmental impact analyses of the various disposition alternatives, both generic and specific sites were used to provide perspective on these

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[3] The ''Stored Weapons Standard'' for weapons-usable fissile materials storage was initially defined in Management and Disposition of Excess Weapons Plutonium, National Academy of Sciences, 1994. DOE defines the Stored Weapons Standard as follows: The high standards of security and accounting for the storage of intact nuclear weapons should be maintained, to the extent practical, for weapons-usable fissile materials throughout dismantlement, storage, and disposition.

[4] The S&D PEIS covers long-term storage of nonsurplus HEU and storage of surplus HEU pending disposition. Until storage decisions are implemented, surplus HEU that has not gone to disposition will continue to be stored pursuant to, and not to exceed the 10-year interim storage time period evaluated in, the Environmental Assessment for the Proposed Interim Storage of Enriched Uranium Above the Maximum Historical Storage Level at the Y–12 Plant, Oak Ridge, Tennessee (Y–12 EA) (DOE/EA–0929, September 1994) and Finding of No Significant Impact (FONSI).

[5] The ''Spent Fuel Standard'' for disposition was also initially defined in Management and Disposition of Excess Weapons Plutonium, National Academy of Sciences, 1994. DOE defines the Spent Fuel Standard as follows: The surplus weapons-usable plutonium should be made as inaccessible and unattractive for weapons use as the much larger and growing quantity of plutonium that exists in spent nuclear fuel from commercial power reactors.

alternatives. Under each alternative, there are various ways to implement the alternative. These ‘‘variants’’ (such as the can-in-canister[6] approach) are shown in Table 1 to provide a range of available options for consideration.

TABLE 1.—DESCRIPTION OF VARIANTS UNDER PLUTONIUM DISPOSITION ALTERNATIVES

Alternatives analyzed	Possible variants
• Deep Borehole Direct Disposition	• Arrangement of plutonium in different types of emplacement canisters.
• Deep Borehole Immobilized Disposition	• Emplacement of pellet-group mix. • Pumped emplacement of pellet-grout mix. • Plutonium concentration loading, size and shape of ceramic pellets.
• New Vitrification Facilities	• Collocated pit disassembly/conversion, plutonium conversion, and immobilization facilities. • Use of either Cs–137 from capsules or HLW as a radiation barrier. • Wet or dry feed preparation technologies. • An adjunct melter adjacent to the DWPF at SRS, in which borosilicate glass frit with plutonium (without highly radioactive radionuclides) is added to borosilicate glass containing HLW from the DWPF. • A can-in-canister approach at SRS in which cans of plutonium glass (without highly radioactive radionuclides) are plaed in DWPF canisters which are then filled with borosilicate glass containing HLW in the DWPF (see Appendix O of the Final PEIS). • A can-in-canister approach similar to above but using new facilities at sites other than SRS.
• New Ceramic Immobilization Facilities	• Collocated pit disassembly/plutonium conversion, and immobilization facilities. • Use of either Cs–137 from capsules or HLW as a radiation barrier. • Wet or dry feed preparation technologies. • A can-in-canister approach at SRS in which the plutonium is immobilized without highly radioactive radionuclides in a ceramic matrix and then placed in the DWPF canisters that are then filled with borosilicate glass containing HLW (See Appendix O of the Final PEIS). • A can-in-canister approach similar to above but using new facilities at sites other than SRS.
• Electrometallurgical Treatment (glass-bonded zeolite form)	• Immobilize plutonium into metal ingot form. • Locate at DOE sites other than ANL–W at INEL.
• Existing LWR With New MOX Facilities	• Pressurized or Boiling Water Reactors. • Different numbers of reactors. • European MOX fuel fabrication. • Modification/completion of existing facilities for MOX fabrication. • Collocated pit disassembly/conversion, plutonium conversion, and MOX facilities. • Reactors with different core management schemes (plutonium loadings, refueling intervals).
• Partially Completed LWR With New MOX Facilities	• Same as for existing LWR (except that MOX fuel would not be fabricated in Europe).
• Evolutionary LWR With New MOX Facilities	• Same as for partially completed LWR.
• Existing CANDU Reactor With New MOX Facilities	• DIfferent numbers of reactors. • Modification/completion of existing facilities for MOX fabrication. • Collocated pit disassembly/conversion, plutonium conversion, and MOX facilities. • Reactors with different core management schemes (plutonium loadings, refueling intervals).

Note: ANL–W=Argonne National Laboratory-West; Cs–137=cesium-137; HLW=high-level waste; LWR=light water reactor

The first step in plutonium disposition is to remove the surplus plutonium from storage, then process this material in a pit disassembly/conversion facility (for pits) or in a plutonium conversion facility (for non-pit materials). The processing would convert the plutonium material into a form suitable for each of the disposition alternatives described in the following sections. The pit disassembly/conversion facility and the plutonium conversion facility would be built at a DOE site. The six candidate sites for long-term storage were evaluated for the potential environmental impacts of constructing and operating these facilities.

a. No Disposition Action. A ‘‘No Plutonium Disposition’’ action means disposition would not occur, and surplus plutonium-bearing weapon components (pits) and other forms, such as metal and oxide, would remain in storage in accordance with decisions on the long-term storage of weapons-usable fissile materials.

b. Deep Borehole Category. Under this category of alternatives, surplus weapons-usable plutonium would be disposed of in deep boreholes that would be drilled at least 4 kilometers (km) (2.5 miles [mi]) into ancient, geologically stable rock formations beneath the water table. The deep borehole would provide a geologic barrier against potential proliferation. A generic site was evaluated for the construction and operation of a borehole complex where the surplus plutonium would be prepared for emplacement in the borehole. This complex would consist of five major facilities: Processing; drilling; emplacing/sealing; waste management; and support (security, maintenance, and utilities).

(1) Direct Disposition (Borehole). Under the Direct Disposition Alternative, surplus plutonium would be removed from storage, processed as necessary, converted to a form suitable for emplacement, packaged, and placed in a deep borehole. The deep borehole would be sealed to isolate the

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[6] In the can-in-canister variant, cans of plutonium in a glass or ceramic matrix would be placed in a canister. This canister would then be filled with borosilicate glass containing high-level radioactive waste (HLW) or highly radioactive material such as cesium. This variant, at an existing facility (the Defense Waste Processing Facility [DWPF] at SRS), is described in Appendix O of the S&D Final PEIS.

plutonium from the accessible environment. Long-term performance of the deep borehole would depend on the stability of the geologic system. A generic site was used for the borehole complex to analyze the environmental impact of this alternative.

(2) Immobilized Disposition (Borehole). Under the Immobilized Disposition Alternative, the surplus plutonium would be removed from storage, processed, and converted to a suitable form for shipment to a ceramic immobilization facility. The output of this facility would be spherical ceramic pellets containing plutonium, facilitating handling during transportation and emplacement. The ceramic pellets (about 2.54 centimeters [cm] [1 inch {in}] in diameter and containing 1 percent plutonium by weight) would then be placed in drums and shipped to the borehole complex. At the deep borehole site, the ceramic pellets would be mixed with non-plutonium ceramic pellets and fixed with grout during emplacement. The deep borehole would be sealed to isolate the plutonium from the accessible environment. Long-term performance of the deep borehole would depend on the stability of the geologic system.

Although a generic site was used for analyses of the borehole complex in this alternative, the ceramic immobilization facility would be built at a DOE site. Therefore, the six candidate sites for long-term storage were used to evaluate the environmental impacts of the borehole immobilization facility.

c. Immobilization Category. Under this category of alternatives, surplus plutonium would be immobilized to create a chemically stable form for disposal in a geologic repository pursuant to the Nuclear Waste Policy Act (NWPA).[7] The plutonium material would be mixed with or surrounded by high-level waste (HLW) or other radioactive isotopes and immobilized to create a radiation field that could serve as a proliferation deterrent, along with safeguards and security comparable to those of commercial spent nuclear fuel, thereby achieving the Spent Fuel Standard. All immobilized plutonium would be encased in stainless steel canisters and would remain in onsite vault-type storage until a geologic repository pursuant to the NWPA is operational.

(1) Vitrification. Under the Vitrification Alternative, surplus plutonium would be removed from storage, processed, packaged, and transported to the vitrification facility. In this facility, the plutonium would be mixed with glass frit and highly radioactive cesium-137 (Cs-137) or HLW to produce borosilicate glass logs (a slightly different process, using HLW, would be used for the can-in-canister variant, as discussed in Appendix O of the S&D Final PEIS). The Cs-137 isotope could come from the cesium chloride (CsCl) capsules currently stored at Hanford or from existing HLW if the site selected for vitrification already manages HLW. Each glass log produced from the vitrification facility would contain about 84 kilograms (kg) (185 pounds [lb]) of plutonium. The vitrification facility would be built at a DOE site. The six candidate sites for long-term storage were analyzed for this alternative.

(2) Ceramic Immobilization. Under the Ceramic Immobilization Alternative, surplus plutonium would be removed from storage, processed, packaged, and transported to a ceramic immobilization facility. In this facility, the plutonium would be mixed with nonradioactive ceramic materials and Cs-137 or HLW to produce ceramic disks (a slightly different process, using HLW, would be used for the can-in-canister variant, as discussed in Appendix O of the S&D Final PEIS). Each disk would be approximately 30 cm (12 in) in diameter and 10 cm (4 in) thick, and would contain approximately 4 kg (9 lb) of plutonium. The Cs-137 or HLW would be provided as previously described. The ceramic immobilization facility would be built at a DOE site. The six candidate sites for long-term storage were analyzed for this alternative.

(3) Electrometallurgical Treatment. Under the Electrometallurgical Treatment Alternative, surplus plutonium would be removed from storage, processed, packaged, and transported to new or modified facilities for electrometallurgical treatment. This process could immobilize surplus fissile materials into a glass-bonded zeolite (GBZ) form. With the GBZ material, the plutonium would be in the form of a stable, leach-resistant mineral that is incorporated in durable glass materials.[8] Existing electrometallurgical facilities at INEL were used as a representative site for analysis of potential environmental impacts.

d. Reactor Category. Under the reactor alternatives considered in the S&D PEIS, DOE would fabricate surplus plutonium into MOX fuel for use in reactors. The irradiated MOX fuel would reduce the proliferation risks of the plutonium material, and the reactors would also generate electricity. MOX fuel would be used in a once-through fuel cycle, with no reprocessing or subsequent reuse of spent fuel. The spent nuclear fuel generated by the reactors would then be sent to a geologic repository pursuant to the NWPA.

Because the United States does not have a MOX fuel fabrication facility or capability, a new dedicated MOX fuel fabrication facility would be built at a DOE or commercial site.[9] The surplus plutonium from storage would be processed, converted to plutonium dioxide (PuO_2), and transferred to the MOX fuel fabrication facility. In this facility, PuO_2 and uranium dioxide (UO_2) (from existing domestic sources) would be blended and fabricated into MOX pellets, loaded into fuel rods, and assembled into fuel bundles suitable for use in the reactor alternatives under consideration.

(1) Existing Light Water Reactors. Under the Existing Light Water Reactor (LWR) Alternative, the MOX fuel containing surplus plutonium would be fabricated and transported to existing commercial LWRs in the United States, where the MOX fuel would be used instead of conventional UO_2 fuel. The LWRs employed for domestic electric power generation are pressurized water reactors (PWRs) and boiling water reactors (BWRs). Both types of reactors use the heat produced from nuclear fission reactions to generate steam that drives turbines and generates electricity. Three to five reactor units would be needed.[10]

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[7] Also referred to as a permanent, or HLW repository. Pursuant to the Nuclear Waste Policy Act, DOE is currently characterizing the Yucca Mountain Site in Nevada as a potential repository for spent nuclear fuel and HLW. Legislative clarification, or a determination by the Nuclear Regulatory Commission that the immobilized plutonium should be isolated as HLW, may be required before the material could be placed in Yucca Mountain should DOE and the President recommend, and Congress approve, its operation. No Resource Conservation and Recovery Act (RCRA) wastes would be immobilized unless the immobilization would constitute adequate treatment under RCRA. The immobilized product would be consistent with the repository's waste acceptance criteria.

[8] In May 1996, the Department issued a Finding of No Significant Impact (FONSI) (61 Fed. Reg. 25647) and decision to proceed with the limited demonstration of the electrometallurgical treatment process at Argonne National Laboratory-West (ANL–W) at INEL for processing up to 125 spent fuel assemblies from the Experimental Breeder Reactor II (100 drivers and 25 blanket assemblies). Although this alternative could be conducted at other DOE sites, ANL–W is described in the S&D PEIS as the representative site for analysis.

[9] Although a generic commercial site was evaluated in the S&D PEIS, it is not part of the Preferred Alternative or the decisions in this ROD.

[10] It is possible that an existing LWR can be configured to produce tritium, consume plutonium as fuel, and generate revenue through the production of electricity. This configuration is called a multipurpose reactor. Environmental

(2) Partially Completed Light Water Reactors. Under the Partially Completed LWR Alternative, commercial LWRs on which construction has been halted would be completed. The completed reactors would use MOX fuel containing surplus plutonium. The characteristics of these LWRs would be the same as those of the existing LWRs discussed in the Existing LWR Alternative. The Bellefonte Nuclear Plant located along the west bank of the Tennessee River in Alabama was used as a representative site for the environmental analysis of this alternative. Two reactor units (such as those at the Bellefonte Nuclear Plant) would be needed to implement this alternative.

(3) Evolutionary Light Water Reactors. The evolutionary LWRs are improved versions of existing commercial LWRs. Two design approaches were considered in the S&D PEIS. The first is a large PWR or BWR similar to the size of the existing PWR and BWR. The second is a small PWR approximately one-half the size of the large PWR. Two large or four small evolutionary LWRs would be needed to implement this alternative.

Under each design approach for this alternative, evolutionary LWRs would be built at a DOE site. Therefore, the six candidate sites for long-term storage were used to evaluate the environmental impacts of this alternative.

(4) Canadian Deuterium Uranium Reactor. Under the CANDU Reactor Alternative, the MOX fuel containing surplus plutonium would be fabricated in a U.S. facility, then transported for use in one or more commercial heavy water reactors in Canada. The Ontario Hydro Bruce-A Nuclear Generating Station identified by the Government of Canada was used as a representative site for evaluation of this alternative. This station is located on Lake Huron about 300 km (186 mi) northeast of Detroit, Michigan. Environmental analysis of domestic activities up to the U.S./Canadian border is presented in the S&D PEIS. The use of CANDU reactors would be subject to the policies, regulations, and approval of the Federal and Provincial Canadian Governments. Pursuant to Section 123 of the Atomic Energy Act, any export of MOX fuel from the United States to Canada must be made under the agreement for cooperation between the two countries. Spent fuel generated by a CANDU reactor would be disposed under the Canadian spent fuel program.

C. Preferred Alternative

The S&D Final PEIS presented the Department's Preferred Alternative for both storage and disposition. DOE has decided to implement the Preferred Alternative as described in the S&D Final PEIS. Thus, the Preferred Alternative is described in Section V of this ROD, Decisions.

D. Environmental Impacts

Chapter 4 and the appendices of the S&D Final PEIS analyzed the potential environmental impacts of the storage and disposition alternatives in detail. The S&D Final PEIS also evaluated the maximum site impacts that would result at Hanford, INEL, Pantex, and SRS from combining the Preferred Alternative for storage with the Preferred Alternative for disposition. Consistent with the Preferred Alternative, Hanford, INEL, Pantex, and SRS are each a possible location for all or some plutonium disposition activities. The siting, construction, and operation of disposition facilities will be covered in a separate, follow-on EIS. The S&D Final PEIS described the total life cycle impacts that would result from the Preferred Alternative at the DOE sites identified for potential placement of the disposition facilities.

Based on analyses in the S&D Final PEIS, the areas where impacts might be significant are as follows:

- The use of groundwater at the Pantex Plant for storage and disposition facilities could contribute to the overall declining water levels of the Ogallala Aquifer. The projected No Action Alternative water usage at Pantex in the year 2005 reflects a reduction from current usage due to planned downsizing over the next few years. The Preferred Alternative would require a 72-percent increase in the projected No Action Alternative water use; the total amount (428 million liters per year) is considerably less than what is currently being withdrawn (836 million liters per year) at Pantex.
- A set of postulated accidents was used for each plutonium disposition alternative over the life of the campaign to obtain potential radiological impacts at the four DOE sites where disposition facilities could be built. The PEIS analyzes the risk of latent cancer fatalities (reflecting the probability of accident occurrence and the latent cancer fatalities potentially caused by the accident) for accidents that have low probabilities of occurrence and severe consequences, as well as those that have higher probabilities and low consequences. For potential severe accidents, the risk of latent cancer fatalities to the population located within 80 kilometers (50 miles) of the accident for the "front-end" disposition process campaign would range from $4.5\mathrm{x}10^{-16}$ (that is, approximately 1 chance in 2 quadrillion) to $1.7\mathrm{x}10^{-4}$ (approximately 1 chance in 6,000) for the pit disassembly/conversion facility, and from $1.5\mathrm{x}10^{-16}$ to $1.3\mathrm{x}10^{-4}$ for the plutonium conversion facility. This risk would range from $2.8\mathrm{x}10^{-14}$ to $1.8\mathrm{x}10^{-5}$ for the vitrification facility, from $7.0\mathrm{x}10^{-16}$ to $1.9\mathrm{x}10^{-7}$ for the ceramic immobilization facility, and from $4.6\mathrm{x}10^{-16}$ to $4.3\mathrm{x}10^{-4}$ for the MOX fuel fabrication facility. To estimate the change in risk associated with using MOX fuel instead of uranium fuel in existing LWRs, the severe accident scenarios assumed a large population distribution near a generic existing LWR and extreme meteorological conditions for dispersal, leading to large doses that were not necessarily reflective of actual site conditions. The resultant change in risk of cancer fatalities to a generic population located within 80 km (50 mi) of the severe accidents was estimated to range from $-2.0\mathrm{x}10^{-4}$ to $3.0\mathrm{x}10^{-5}$ per year[11], reflecting a postulated risk of using MOX fuel that ranges from seven percent lower to eight percent higher than the risk of using uranium fuel. Under the Preferred Alternative, the estimated risk of cancer fatalities under severe accident conditions using MOX fuel in existing LWRs ranges from 0.01 to 0.098 for an 11-year campaign.
- Under the Preferred Alternative, HEU would continue to be stored at the Y–12 Plant at ORR in existing facilities that would be upgraded to meet requirements for withstanding natural phenomena, including earthquakes and tornadoes. This upgrade would reduce the expected risk for the design basis accidents analyzed in the Y–12 EA (for example, Building 9212) by approximately 80 percent, resulting in a latent cancer fatality risk of 7.4×10^{-6} (approximately 7 in a million) to the maximally exposed individual, 5.7×10^{-8} (approximately 6 in 100

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analysis of the multipurpose reactor is included in Chapter 4 of the Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling (TSR PEIS) (DOE/EIS–0161, October 1995) and Appendix N of the S&D PEIS. In the TSR PEIS ROD (December 1995), the multipurpose reactor was preserved as an option for future consideration. The Fast Flux Test Facility (FFTF) at Hanford has been under consideration for tritium production, and could also use surplus plutonium as reactor fuel if it were shown to be useful for tritium production. This ROD does not preclude use of the FFTF for tritium production or the potential use of surplus plutonium as fuel for the FFTF.

[11] Accidents severe enough to cause a release of plutonium involved combinations of events that are highly unlikely. Estimates and analyses presented in Chapter 4 and summarized in Table 2.5–3 of the PEIS indicate a range of latent cancer fatalities of 5,900 to 7,300 and a risk of 0.016 to 0.15 of a fatality in the population for the 17-year campaign analyzed under the Existing LWR Alternative.

million) to a non-involved worker, and 5.1×10^{-7} (approximately 5 in 10 million) to the 80-km offsite population.

- Under the Preferred Alternative, safe, secure storage would continue for materials at Hanford, INEL, and ORR, pending disposition. Therefore, there would be no transportation impact at these sites until disposition. The storage transportation impact would come from movement of the RFETS materials to Pantex and SRS. If, following the EIS for construction and operation of plutonium disposition facilities, potential plutonium disposition activities were added to Hanford, INEL, Pantex, and SRS, the estimated total health effects for the life of the project from transportation of surplus plutonium (including transportation of those materials from RFETS to Pantex and SRS) would range from 0.193 fatalities for transportation to Pantex, to 1.87 fatalities for transportation to SRS (primarily from normal expected traffic accidents, not from radiological releases). In addition to the disposition activities at DOE sites, there would be transportation of the MOX fuel from the DOE fuel fabrication site to existing LWRs. The location of the LWRs and the destination of the MOX fuel could be either the eastern or western United States. For 4,000 km (2,486 mi) of such transportation, there could be up to an additional 3.61 potential fatalities (primarily from normal expected traffic accidents, not from radiological releases) for the life of the campaign, assuming 100 percent of the surplus plutonium would be used in commercial reactors. The actual amount would be smaller, and therefore potential fatalities would be lower, under the Preferred Alternative.
- At Hanford, INEL, Pantex, and SRS the Preferred Alternative would slightly increase regional employment and income. At RFETS, phaseout of plutonium storage would result in the loss of approximately 2,200 direct jobs. Compared to the total employment in the area, the loss of these jobs and the impacts to the regional economy would not be severe.

DOE has fully considered all of the environmental analyses in the S&D Final PEIS in reaching the decisions set forth in Section V, below.

E. Avoidance/Minimization of Environmental Harm

For the long-term storage of fissile material, there are four sites (Hanford, NTS, INEL, and LANL) where the Preferred Alternative is ‘‘no action’’; that is, no plutonium would be stored at NTS, and at Hanford, INEL, and LANL, DOE would continue storage at existing facilities, using proven nuclear materials safeguards and security procedures, until disposition. These existing facilities would be maintained to ensure their safe operation and compliance with applicable environmental, safety and health requirements. At RFETS, the Preferred Alternative is to phase out storage of weapons-usable fissile materials, thus mitigating environmental impacts at RFETS. There are three sites (Pantex, ORR, and SRS) where the Preferred Alternative is to upgrade existing and planned new facilities. Site-specific mitigation measures for storage at these sites have been described in the S&D Final PEIS, and are summarized as follows:

- At Pantex, to alleviate the effects from using groundwater from the Ogallala Aquifer, the city of Amarillo is considering supplying treated wastewater to Pantex from the Hollywood Road Wastewater Treatment Plant for industrial use; the Department will use such treated wastewater to the extent possible. Radiation doses to individual workers will be kept low by maintaining comprehensive badged monitoring and programs to keep worker exposures ‘‘as low as reasonably achievable’’ (ALARA).
- At ORR, radiation doses to individual workers will be kept low by maintaining comprehensive badged monitoring and ALARA programs, including worker rotations. Upgrades for HEU storage to meet performance requirements will include seismic structural modifications as documented in Natural Phenomena Upgrade of the Downsized/Consolidated Oak Ridge Uranium/Lithium Plant Facilities. These modifications will reduce the risk of accidents to workers and the public.
- At SRS, to minimize soil erosion impacts during construction, storm water management and erosion control measures will be employed. Mitigation measures for potential Native American resources will be identified through consultation with the potentially affected tribes. Radiation doses to individual workers will be kept low by maintaining comprehensive badged monitoring and ALARA programs including worker rotations. The modified Actinide Packaging and Storage Facility (APSF) will be designed and operated in accordance with contemporary DOE Orders and regulations to reduce risks to workers and the public.

From a nonproliferation standpoint, the highest standards for safeguards and security will be employed during transportation, storage, and disposition. With respect to transportation, DOE will coordinate the transport of plutonium and HEU with State officials, consistent with current policy. Although the actual routes will be classified, they will be selected to circumvent populated areas, maximize the use of interstate highways, and avoid bad weather. DOE will continue to coordinate emergency preparedness plans and responses with involved states through a liaison program. The packaging, vehicles, and transport procedures being used are specifically designed and tested to prevent a radiological release under all credible accident scenarios.

For the Preferred Alternative for disposition, site-specific mitigation measures will be addressed in the follow-on, site-specific EIS. In the Nonproliferation and Arms Control Assessment of Weapons-Usable Fissile Material Storage and Plutonium Disposition Alternatives, measures are proposed to reduce the possibility of the theft or loss of material. For both immobilization and MOX fuel fabrication, bulk processing is the point in the disposition process when the material is most vulnerable to covert attempts to steal or divert it. A variety of opportunities for improving safeguards, some of which are already implemented at large, modern facilities, include near real-time accounting, increased automation in the process design, and improved containment and surveillance.

The security risks posed by transportation can be reduced by minimizing the amount of transportation required (for example, putting the plutonium processing and MOX fabrication operations at the same site), minimizing the number of sites to which material has to be shipped, and minimizing the distance between those sites.

F. Environmentally Preferable Alternatives

The environmental analyses in Chapter 4 of the S&D Final PEIS indicate that the environmentally preferable alternative (the alternative with the lowest environmental impacts over the 50 years considered in the PEIS) for storage of weapons-usable fissile materials would be the Preferred Alternative, which consists of No Action at Hanford, NTS, INEL, and LANL pending disposition, phaseout of storage at RFETS, and upgrades that would ultimately reduce environmental vulnerabilities at ORR, SRS, and Pantex.

For disposition of surplus plutonium, the environmentally preferable alternative would be the No Disposition Action alternative, because the plutonium would remain in storage in accordance with decisions on the long-term storage of weapons-usable fissile materials, and there would be no new Federal actions that could impact the environment. For normal operations, analyses show that immobilization would be somewhat preferable to the existing LWR and preferred alternatives, although these alternatives, with the exception of waste generated, would be essentially environmentally comparable.[12]

Severe facility accident considerations indicate that immobilization options would be environmentally preferable to the existing reactor and preferred alternatives, although the likelihood of occurrence of severe accidents and the risk to the public are expected to be fairly low. Although No Disposition Action would be environmentally preferable, it would not satisfy the purpose and need for the Proposed Action, because the stockpile of surplus plutonium would not be reduced, and the Nonproliferation and Export Control Policy would not be implemented.

The hybrid approach (pursuing both reactors/MOX and immobilization) is being chosen over immobilization alone because of the increased flexibility it will provide by ensuring that plutonium disposition can be initiated promptly should one of the approaches ultimately fail or be delayed. Establishing the means for expeditious plutonium disposition will also help provide the basis for an international cooperative effort that can result in reciprocal, irreversible plutonium disposition actions by Russia. (See discussion in sections IV and V, below.)

IV. Non-Environmental Considerations

A. Technical Summary Reports

To assist in the preparation of this ROD, DOE's Office of Fissile Materials Disposition prepared and in July 1996 issued a *Technical Summary Report for Surplus Weapons-Usable Plutonium Disposition and a Technical Summary Report for Long-Term Storage of Weapons-Usable Fissile Materials.* These Technical Summary Reports (TSRs) summarize technical, cost, and schedule data for the storage and disposition alternatives that are considered in the S&D PEIS. After receiving comments on each of the TSRs, DOE issued revised versions of the reports in October and November, 1996, respectively.

1. Storage Technical Summary Report

This report provides technical, cost and schedule information for long-term storage alternatives analyzed in the S&D PEIS. The cost information for each alternative is presented in constant 1996 dollars and also discounted or present value dollars. It identifies both capital costs and life cycle costs. The following costs are in 1996 dollars.

The cost analyses show that the combination (preferred) alternative for the storage of plutonium would provide advantages to the Department with respect to implementing disposition technologies and would be the least expensive compared to other storage alternatives. The cost of the combination (preferred) alternative would be approximately $30 million in investment and $360 million in operating costs from inception until disposition occurs. The cost of the upgrade at multiple sites alternative would be approximately $380 million in investment and $3.2 billion in operating costs for 50 years. The costs for the consolidation alternative could range from approximately $40 million to $360 million in investment and $600 million to $1.1 billion for operating costs for 50 years, depending on the extent to which existing facilities and capabilities can be shared with other programs at the sites.

The schedule analysis shows that the upgraded storage facilities for plutonium under the combination (preferred) alternative could be operational by 2004 at Pantex (Zone 12), and by 2001 at SRS. The upgrade for the storage of HEU could be completed by 2004 (or earlier). RFETS pits could be received at Pantex beginning in 1997 in Zone 4 on a temporary basis until Zone 12 upgrades are completed. The other analyzed alternatives (upgrade and consolidation) would require about six years to complete.

2. Disposition Technical Summary Report

This report provides technical viability, cost, and schedule information for plutonium disposition alternatives and variants analyzed in the S&D PEIS. The variants analyzed in the report are based on pre-conceptual design information in most cases.

a. Technical Viability Estimates. The report indicates that each of the alternatives appears to be technically viable, although each is currently at a different level of technical maturity. There is high confidence that the technologies are sufficiently mature to allow procurement and/or construction of facilities and equipment to meet plutonium disposition technical requirements and to begin disposition in about a decade.[13]

Reactor Alternatives—Light water reactors (LWRs) can be readily converted to enable the use of MOX fuels. Many European LWRs currently operate on MOX fuel cycles. Although some technical risks exist, they are all amenable to engineering resolution. Sufficient existing domestic reactor capacity exists, unless significant delays occur in the disposition mission. CANDU reactors appear to be capable of operating on MOX fuel cycles, but this has never been demonstrated on any industrial scale. Therefore, additional development would be required to achieve the level of maturity for the CANDU reactors that exists for light water reactors. Partially complete and evolutionary LWRs would involve increased technical risk relative to existing LWRs, as well as the need to complete or build (and license) new reactor facilities. The spent MOX fuel waste form that results from reactor disposition of surplus plutonium will have to satisfy waste acceptance criteria for the geologic repository.

Immobilization Alternatives—All vitrification alternatives require additional research and development prior to implementation of immobilization of weapons-usable plutonium. However, a growing experience base exists relating to the vitrification of high-level waste. These existing technologies can be adapted to the plutonium disposition mission, though different equipment designs and glass formulations will generally be necessary due to criticality considerations and chemical differences between plutonium and HLW that may affect the stability of the glass matrix. Vitrification and ceramic immobilization alternatives are similar with regard to the technical maturity of incorporating plutonium in their respective matrices. The technical viability of electrometallurgical treatment has not yet been established for the plutonium disposition mission. The experimental data base for this alternative is limited, and critical questions on waste form performance are not yet resolved. This alternative is considered practical only if the underlying technology is further

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[12] The potential risk of latent cancer fatality for a maximally exposed individual of the public from lifetime accident-free operation under the various alternatives are: 1.2x10^{-9} to 1.2x10^{-7} for boreholes, 1.2x10^{-9} to 1.2x10^{-7} for immobilization (vitrification or ceramic immobilization), 1.3x10^{-6} to 2.6x10^{-6} for existing LWRs, and 9.0x10^{-7} to 1.7x10^{-6} for the Preferred Alternative.

[13] Actual timing would depend on technical demonstrations, follow-on site-specific environmental review, detailed cost estimates, and international agreements.

developed for spent nuclear fuels.[14] All of the immobilization alternatives will require qualification (to meet acceptance criteria) of the waste form for the geologic repository, and may require legislative clarification or NRC rulemaking.

Deep Borehole Alternatives—Uncertainties for the deep borehole alternatives relate to selecting and qualifying a site; additional legislation and regulations, or legislative and regulatory clarification, may be required. The front-end feed processing operations for the deep borehole alternatives are much simpler than for other alternatives because no highly radioactive materials are processed, thus avoiding the need for remote handling operations. Emplacement technologies are comprised of largely low-technology operations which would be adaptations from existing hardware and processes used in the oil and gas industry.

Hybrid Approaches—Two hybrid approaches that combine technologies were considered as illustrative examples, using existing LWR or CANDU reactors in conjunction with a can-in-canister (immobilization) approach. Hybrids provide insurance against technical or institutional hurdles which could arise for a single technology approach for disposition. If any significant roadblock is encountered in any one area of a hybrid, it would be possible to simply divert the feed material to the more viable technology. In the case of a single technology, such roadblocks would be more problematic.

b. Cost Estimates. The following discussion is in constant 1996 dollars unless otherwise stated.

(1) Investment Costs.

- The investment costs for existing reactor variants tends to be about $1 billion; completing or building new reactors increases the investment cost to between $2 billion and $6 billion.
- The investment cost for the immobilization alternatives ranges from approximately $0.6 billion for the can-in-canister variants to approximately $2 billion for new greenfield variants.[15]
- Hybrid alternatives (combining both immobilization and reactor alternatives) require approximately $200 million additional investment over the existing light water reactor stand-alone alternatives.
- Investment costs for the deep borehole alternatives range from about $1.1 billion for direct emplacement to about $1.4 billion for immobilized emplacement.
- Alternatives that utilize existing facilities for plutonium processing, immobilization, or fuel fabrication would realize significant investment cost savings over building new facilities for the same function.
- Large uncertainties in the cost estimates exist, relating to both engineering and institutional factors.
- A significant fraction of the investment cost for an alternative/variant is related to the front-end facilities for the extraction of the plutonium from pits and other plutonium-bearing materials and for other functions that are common to all alternatives.

(2) Life Cycle Costs.

- The life cycle costs for hybrid alternatives are similar to the stand-alone reactor alternatives. For the existing LWR/immobilization hybrid alternative (preferred alternative), the cost is $260 million higher than the stand-alone reactor alternative; for the CANDU/immobilization hybrid alternative, the cost is $70 million higher.
- The combined investment and net operating costs for MOX fuel are higher than for commercial uranium fuel; thus, the cost of MOX fuel cannot compete economically with low-enriched uranium fuel for LWRs or natural uranium fuel for CANDU reactors.
- The can-in-canister approaches are the most attractive variants for immobilization based on cost considerations.
- The deep borehole alternatives are more expensive than the can-in-canister and existing reactor alternatives. The immobilized borehole alternative life cycle cost is $1 billion greater than that for the direct emplacement alternative ($3.6 billion vs. $2.6 billion).
- Large uncertainties in the cost estimates exist, relating to engineering, regulatory, and policy considerations.

c. Schedule Estimates. The key conclusions of the Disposition Technical Summary Report with respect to schedules are as follows:

- Significant schedule uncertainties exist, relating to both engineering and institutional factors.
- Opportunities for compressing or expanding schedules exist.

(1) Reactor Alternatives. • The rate at which MOX fuel is consumed in reactors will depend on the rate that MOX fuel is provided and fabricated, and the rate that plutonium oxide is provided to the MOX fuel fabrication facility.

- The time to attain production scale operation in existing LWRs and CANDU reactors could be about 8–12 years, depending on the need for and source of test assemblies that might be required.
- The time to complete the disposition mission is a function of the number of reactors committed to the mission, among other factors. For the variants considered, the time to complete varies from about 24 to 31 years.

(2) Immobilization Alternatives.

- The time to start the disposition mission ranges from 7 to 13 years, depending on the technology used and whether existing facilities are used.
- The operating campaign for the immobilization alternatives at full-scale operation would be about 10 years; it is possible to compress or expand the operating schedule by several years, if desired, by resizing the immobilization facility designs selected for analysis in this study. The overall mission duration (including research and development, construction, and operation) is expected to be about 18 to 24 years.
- Potential delays for start-up of the immobilization alternatives involve completing process development and demonstration, and qualifying the waste form for a geologic repository.

(3) Deep Borehole Alternatives. • The time to start-up is expected to be 10 years.

- The operating duration of the mission would be about 10 years, although completing all burial operations at the borehole site in 3 years is possible. Therefore, the overall mission duration is estimated to be 20 years with accelerated emplacement reducing the duration by about 7 years.
- The schedule for the deep borehole alternatives would depend in part on selecting and qualifying a site, and obtaining legislative and regulatory clarification as well as any necessary permits.

(4) Hybrid Approaches. • In general, the schedule data that apply to the component technologies apply to the hybrid alternatives as well.

- Confidence in an early start-up and an earlier completion can both be improved with a hybrid approach, relative to stand-alone alternatives.
- Hybrid alternatives provide an inherent back-up technology approach to enhance confidence in attaining schedule goals.

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[14] A recent study by the National Research Council concludes that the electrometallurgical treatment technology is not sufficiently mature to provide a reliable basis for timely plutonium disposition. ‘‘An Evaluation of the Electrometallurgical Approach for Treatment of Excess Weapons Plutonium’’ (National Academy Press, Washington, D.C., 1996).

[15] ‘‘Greenfield’’ means a variant involving a new facility, with no existing plutonium-handling infrastructure.

B. Nonproliferation Assessment

To assist in the development of this ROD, DOE's Office of Arms Control and Nonproliferation, with support from the Office of Fissile Materials Disposition, prepared a report, Nonproliferation and Arms Control Assessment of Weapons-Usable Fissile Material Storage and Plutonium Disposition Alternatives. The report was issued in draft form in October 1996, and following a public comment period, was issued in final form in January 1997. It analyzes the nonproliferation and arms reduction implications of the alternatives for storage of plutonium and HEU, and disposition of excess plutonium. It is based in part on a Proliferation Vulnerability Red Team Report prepared for the Office of Fissile Materials Disposition by Sandia National Laboratory. The assessment describes the benefits and risks associated with each option. Some of the ''options'' and ''alternatives'' discussed in the Nonproliferation Assessment are listed as ''variants'' (such as can-in-canister) in the S&D Final PEIS. The key conclusions of the report, as presented in its Executive Summary, are reproduced below.

1. Storage. • Each of the options under consideration for storage of U.S. weapons-usable fissile materials has the potential to support U.S. nonproliferation and arms reduction goals, if implemented appropriately.

- Each of the storage options could provide high levels of security to prevent theft of nuclear materials, and could provide access to excess materials for international monitoring.
- Making excess plutonium and HEU available for bilateral U.S.-Russian monitoring and International Atomic Energy Agency (IAEA) safeguards, while protecting proliferation-sensitive information, would help demonstrate the U.S. commitment never to return this material to nuclear weapons, providing substantial arms reduction and nonproliferation benefits in the near-term.

2. Disposition of U.S. Excess Plutonium

a. In General. • Each of the options for disposition of excess weapons plutonium that meets the Spent Fuel Standard would, if implemented appropriately, offer major nonproliferation and arms reduction benefits compared to leaving the material in storage in directly weapons-usable form. Taking into account the likely impact on Russian disposition activities, the no-action alternative appears to be by far the least desirable of the plutonium disposition options from a nonproliferation and arms reduction perspective.

- Carrying out disposition of excess U.S. weapons plutonium, using options that ensured effective nonproliferation controls and resulted in forms meeting the Spent Fuel Standard, would:
- reduce the likelihood that current arms reductions would be reversed, by significantly increasing the difficulty, cost, and observability of returning this plutonium to weapons;
- increase international confidence in the arms reduction process, strengthening political support for the nonproliferation regime and providing a base for additional arms reductions, if desired;
- reduce long-term proliferation risks posed by this material by further helping to ensure that weapons-usable material does not fall into the hands of rogue states or terrorist groups; and
- lay the essential foundation for parallel disposition of excess Russian plutonium, reducing the risks that Russia might threaten U.S. security by rebuilding its Cold War nuclear weapons arsenal, or that this material might be stolen for use by potential proliferators.
- Choosing the ''no-action alternative'' of leaving U.S. excess plutonium in storage in weapons-usable form indefinitely, rather than carrying out disposition:
- would represent a clear reversal of the U.S. position seeking to reduce excess stockpiles of weapons-usable materials worldwide;
- would make it impossible to achieve disposition of Russian excess plutonium;
- could undermine international political support for nonproliferation efforts by leaving open the question of whether the United States was maintaining an option for rapid reversal of current arms reductions; and
- could undermine progress in nuclear arms reductions.
- The benefits of placing U.S. excess plutonium under international monitoring and then transforming it into forms that met the Spent Fuel Standard would be greatly increased, and the risks of these steps significantly decreased, if Russia took comparable steps with its own excess plutonium on a parallel track. The two countries need not use the same plutonium disposition technologies, however.
- As the 1994 NAS committee report[16] concluded, options for disposition of U.S. excess weapons plutonium will provide maximum nonproliferation and arms control benefits if they:
- minimize the time during which the excess plutonium is stored in forms readily usable for nuclear weapons;
- preserve material safeguards and security during the disposition process, seeking to maintain to the extent possible the same high standards of security and accounting applied to stored nuclear weapons (the Stored Weapons Standard);
- result in a form from which the plutonium would be as inaccessible and unattractive for weapons use as the larger and growing quantity of plutonium in commercial spent fuel (the Spent Fuel Standard).
- In order to achieve the benefits of plutonium disposition as rapidly as possible, and to minimize the risks and negative signals resulting from leaving the excess plutonium in storage, it is important for disposition options to begin, and to complete the mission as soon as practicable taking into account nonproliferation, environment, safety, and health, and economic constraints. Timing should be a key criterion in judging disposition options. Beginning the disposition quickly is particularly important to establishing the credibility of the process, domestically and internationally.
- Each of the options under consideration for plutonium disposition has its own advantages and disadvantages with respect to nonproliferation and arms control, but none is clearly superior to the others.
- Each of the options under consideration for plutonium disposition can potentially provide high levels of security and safeguards for nuclear materials during the disposition process, mitigating the risk of theft of nuclear materials.
- Each of the options under consideration for plutonium disposition can potentially provide for effective international monitoring of the disposition process.
- Plutonium disposition can only reduce, not eliminate, the security risks posed by the existence of excess plutonium, and will involve some risks of its own:
- Because all plutonium disposition options would take decades to complete, disposition is not a near-term solution to the problem of nuclear theft and smuggling. While disposition will make a long-term contribution, the near-term problem must be addressed through programs to improve security and safeguarding for nuclear materials, and to ensure adequate police, customs, and intelligence capabilities to interdict nuclear smuggling.

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[16] See footnote 3, above.

- All plutonium disposition options under consideration would involve processing and transport of plutonium, which will involve more risk of theft in the short term than if the material had remained in heavily guarded storage, in return for the long-term benefit of converting the material to more proliferation-resistant forms.
- Both the United States and Russia will still retain substantial stockpiles of nuclear weapons and weapons-usable fissile materials even after disposition of the fissile materials currently considered excess is complete. These weapons and materials will continue to pose a security challenge regardless of what is done with excess plutonium.
- None of the disposition options under consideration would make it impossible to recover the plutonium for use in nuclear weapons, or make it impossible to use other plutonium to rebuild a nuclear arsenal. Therefore, disposition will only reduce, not eliminate, the risk of reversal of current nuclear arms reductions.
- A U.S. decision to choose reactor alternatives for plutonium disposition could offer additional arguments and justifications to those advocating plutonium reprocessing and recycle in other countries. This could increase the proliferation risk if it in fact led to significant additional separation and handling of weapons-usable plutonium. On the other hand, if appropriately implemented, plutonium disposition might also offer an opportunity to develop improved procedures and technologies for protecting and safeguarding plutonium, which could reduce proliferation risks and would strengthen U.S. efforts to reduce the stockpiles of separated plutonium in other countries.
- Large-scale bulk processing of plutonium, including processes to convert plutonium pits to oxide and prepare other forms for disposition, as well as fuel fabrication or immobilization processes, represents the stage of the disposition process when material is most vulnerable to covert theft by insiders or covert diversion by the host state. Such bulk processing is required for all options, however; in particular, initial processing of plutonium pits and other forms is among the most proliferation-sensitive stages of the disposition process, but is largely common to all the options. More information about the specific process designs is needed to determine whether there are significant differences between the various immobilization and reactor options in the overall difficulty of providing effective assurance against theft or diversion during the different types of bulk processing involved, and if so, which approach is superior in this respect.
- Transport of plutonium is the point in the disposition process when the material is most vulnerable to overt armed attacks designed to steal plutonium. With sufficient resources devoted to security, however, high levels of protection against such overt attacks can be provided. International, and particularly overseas, shipments would involve greater transportation concerns than domestic shipments.[17]

b. Conclusions Relating to Specific Disposition Options.

- The reactor options, homogeneous immobilization[18] options, and deep borehole immobilized emplacement option can all meet the Spent Fuel Standard. The can-in-canister options are being refined to increase the resistance to separation of the plutonium cans from the surrounding glass, with the goal of meeting the Spent Fuel Standard. The deep borehole direct emplacement option substantially exceeds the Spent Fuel Standard with respect to recovery by sub-national groups, but could be more accessible and attractive for recovery by the host state than spent fuel.
- The reactor options have some advantage over the immobilization options with respect to perceived irreversibility, in that the plutonium would be converted from weapons-grade to reactor-grade, even though it is possible to produce nuclear weapons with both weapons and reactor-grade plutonium. The immobilization and deep borehole options have some advantage over the reactor options in avoiding the perception that they could potentially encourage additional separation and civilian use of plutonium, which itself poses proliferation risks.
- Options that result in accountable ‘‘items’’ (for purposes of international safeguards) whose plutonium content can be accurately measured (such as fuel assemblies or immobilized cans without fission products in the ‘‘can-in-canister’’ option) offer some advantage in accounting to ensure that the output plutonium matches the input plutonium from the process. Other options (such as homogeneous immobilization or immobilized emplacement in deep boreholes) would require greater reliance on containment and surveillance to provide assurance that no material was stolen or diverted—but in some cases could involve simpler processing, easing the task of providing such assurance.
- The principal uncertainty with respect to using excess weapons plutonium as MOX in U.S. LWRs relates to the potential difficulty of gaining political and regulatory approvals for the various operations required.
- Compared to the LWR option, the CANDU option would involve more transport and more safeguarding issues at the reactor sites themselves (because of the small size of the CANDU fuel bundles and the on-line refueling of the CANDU reactors). Demonstrating the use of MOX in CANDU reactors by carrying out this option for excess weapons plutonium disposition could somewhat detract from U.S. efforts to convince nations operating CANDU reactors in regions of proliferation concern not to pursue MOX fuel cycles, but these nations are likely to base their fuel cycle decisions primarily on factors independent of disposition of this material. Disposing of excess weapons plutonium in another country long identified with disarmament could have significant symbolic advantages, particularly if carried out in parallel with Russia. Disposition of Russian plutonium in CANDU reactors, however, would require resolving additional transportation issues and additional questions relating to the likely Russian desire for compensation for the energy value of the plutonium.
- The immobilization options have the potential to be implemented more quickly than the reactor options. They face somewhat less political uncertainty but somewhat more technical uncertainty than the reactor options.
- The likelihood of very long delays in gaining approval for siting and construction of deep borehole sites represents a very serious arms reduction and nonproliferation disadvantage of the borehole option, in either of its variants. While the deep borehole direct-emplacement option requires substantially less bulk processing than the other disposition options, that option may not meet the Spent Fuel Standard for retrievability by the host state, as mentioned above. Any potential

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[17] International shipments would be involved (from the United States to Canada) if the CANDU option were pursued as a result of international agreements among the U.S., Canada, and Russia. Overseas shipments would be involved if European MOX fuel fabrication were utilized in the interim before a domestic MOX fabrication facility were completed. The Preferred Alternative and the decisions in this ROD do not involve European MOX fuel fabrication.

[18] The term ‘‘homogeneous immobilization’’ refers to mixing of solutions of plutonium and either HLW or cesium in liquid form, followed by solidification of the mixture in either glass or ceramic matrices. This contrasts with the ‘‘can-in-canister’’ variant, in which the plutonium and HLW or cesium materials are never actually mixed together.

advantage from the reduced processing is small compared to the large timing uncertainty and the potential retrievability disadvantage.

- Similarly, the electrometallurgical treatment option, because it is less developed than the other immobilization options, involves more uncertainty in when it could be implemented, which represents a significant arms reduction and nonproliferation disadvantage. It does not appear to have major compensating advantages compared to the other immobilization options.
- The ''can-in-canister'' immobilization options have a timing advantage over the homogeneous immobilization options, in that, by potentially relying on existing facilities, they could begin several years sooner. As noted above, however, modified systems intended to allow this option to meet the Spent Fuel Standard are still being designed.

C. Comments on the S&D Final PEIS

After issuing the Final PEIS, DOE received approximately 100 letters from organizations and individuals commenting on the alternatives addressed in the PEIS. Many of these letters expressed opposition to the MOX fuel approach for surplus plutonium disposition. The major concern raised in these letters was the contention that the use of MOX fuel is associated with proliferation risk as well as additional delays, costs, and safety and environmental risks. One of these letters was from a coalition of 14 national organizations recommending that the Department decide to utilize immobilization for the disposition of all surplus plutonium and that MOX be retained for use, if at all, only as an ''insurance policy'' if immobilization should prove infeasible. Several of those 14 organizations also wrote separately making similar points. Conversely, many of the letters provided comments in support of the use of MOX fuel and/or a dual path, while a few expressed opposition to the immobilization alternatives.

Seven of the letters received suggested the use of disposition approaches that were not analyzed in the PEIS. Three of these approaches (dropping plutonium into volcanoes, burying it in the sea at the base of a volcano, and storing it in large granite or marble structures) are similar to options that were either considered (but found to be unreasonable) in a screening process that preceded the PEIS, or were addressed in the PEIS Comment Response Document. These approaches were considered to be potentially damaging to the environment, among other things, and were therefore dismissed as unreasonable. Three other alternatives (plasma technology, binding and neutralizing plutonium with a new organic material, and use in rocket engines) recommended in these letters would require a substantial amount of development and could not be accomplished in the same time frame as alternatives analyzed in the PEIS. One commentor suggested adding the plutonium to the radioactive sludge being stored at Hanford for eventual disposal. The Department views this as unreasonable because of delays and increased costs that would be incurred in the program to manage the wastes in the Hanford tanks. One commentor was opposed to the utilization of Hanford's Fuels and Materials Examination Facility for MOX fuel fabrication and the Fast Flux Test Facility for MOX fuel burning.

All of the issues raised in these letters are covered in the body of the Final PEIS, in the Comment Response Document, the Summary Report of the Screening Process (DOE/MD–0002, March 19, 1995), the Technical Summary Report for Surplus Weapons-Usable Plutonium Disposition, or the Nonproliferation and Arms Control Assessment of Weapons-Usable Fissile Material Storage and Plutonium Disposition Alternatives, which have each been considered in reaching this ROD.

The Department's decision for surplus plutonium disposition is to pursue both the existing LWR (MOX fuel) and immobilization approaches. DOE recognizes that the estimated life-cycle cost of immobilization alone would be less than that of the hybrid approach (pursuing both), but the additional expense would be warranted by the increased flexibility should one of the approaches ultimately fail, and the increased ability to influence Russian plutonium disposition actions. (The lowest cost approach would be the No Disposition Action alternative; however, as noted in section III.F, above, that option would not satisfy the purpose and need for this program.) DOE also recognizes that analyses in the PEIS indicated that, for normal operation, the environmental and health impacts would be somewhat lower for immobilization, although, with the exception of waste generation, impacts for the preferred, immobilization, and existing LWR (MOX) alternatives would be essentially comparable (see prior discussion).

Potential latent cancer fatalities for members of the public under the MOX approach would be significantly higher than under the immobilization approach only under highly unlikely facility accident scenarios; the risk (taking into account accident probabilities) to the public of latent cancer fatalities from accidents would be fairly low for both approaches.

From the nonproliferation standpoint, results of the Nonproliferation and Arms Control Assessment of Weapons-Usable Fissile Material Storage and Plutonium Disposition Alternatives (see section IV.B) indicated that each of the options under consideration for plutonium disposition has its own advantages and disadvantages, and each can potentially provide high levels of security and safeguards for nuclear materials during the disposition process, mitigating the risk of theft of nuclear materials. Initial processing of plutonium pits and other forms is among the most proliferation-sensitive stages of the disposition process, but is largely common to all the options. Although the Assessment also concluded that none of the approaches is clearly superior to the others, both the Nonproliferation Assessment and a letter from the Secretary of Energy Advisory Board Task Force on the Non-proliferation and Arms Control Implications of Weapons-Usable Fissile Materials Disposition Alternatives (included as Appendix B to the Nonproliferation Assessment) concluded that the hybrid approach (both reactors/MOX and immobilization) is preferable because of uncertainties in each approach and because it would minimize potential delays should problems develop with either approach. Numerous comment letters have made similar points.

One such letter was received from five individuals who were the U.S. participants on the U.S.-Russian Independent Scientific Commission on Disposition of Excess Weapons Plutonium. This letter supported the dual-track approach on the grounds that ''ruling out reactors and thus depending solely on vitrification as the only approach to plutonium disposition that might be implementable anytime soon, would have far bigger nonproliferation liabilities then would the two-track approach.'' These commentors argued that designating only immobilization as the preferred approach, with MOX as a back-up, would have essentially all the nonproliferation and arms reduction liabilities of a one-track approach, which would weaken the U.S. position and have severe consequences for the likely success of programs to carry out permanent disposition of weapons plutonium in Russia, and therefore jeopardize the success of programs to carry out U.S. disposition. These commentors stated that without the dual-track approach, the U.S. will lose any leverage it might have over the conditions and safeguards accompanying the use of Russian plutonium in their reactors. They also pointed out that pursuing both the MOX option and immobilization in the U.S. may be the best way to convince Russia, which currently favors converting its own plutonium to MOX fuel, of the value of immobilization for a portion of its excess plutonium. These commentors argued that the dual-track approach would not undermine U.S. nonproliferation policy, would not increase the risk of nuclear theft and terrorism, and would not lead to a new domestic plutonium recycle industry since it would not significantly affect the huge economic barriers to using MOX fuel on a commercial basis.

Two commentors expressed opposition to plutonium recycling (reprocessing), citing the Final Generic Environmental Statement on the Use of Recycle Plutonium in Mixed Oxide Fuel in Light Water Cooled Reactors (GESMO), NUREG–0002, which was issued by the NRC in 1976, and President Carter's decision to ban plutonium recycling. DOE notes that plutonium recycling is not part of the plutonium disposition program or the decisions in this ROD; on the contrary, this ROD includes conditions on the use of MOX fuel that are intended to prevent the use of recycled plutonium.

The use of MOX fuel in existing reactors would be undertaken in a manner that is consistent with the United States' policy objective on the irreversibility of the nuclear disarmament process and the United States' policy discouraging the use of plutonium for civil purposes. To this end, implementing the MOX alternative would include government ownership and control of the MOX fuel fabrication facility at a DOE site, and use of the facility only for the surplus plutonium disposition program. There would be no reprocessing or subsequent reuse of spent MOX fuel. The MOX fuel would be used in a once-through fuel cycle in existing reactors, with appropriate arrangements, including contractual or licensing provisions, limiting use of MOX fuel to surplus plutonium disposition.

One commentor, who opposed MOX fuel use, urged DOE not to use European MOX fuel fabrication capability if the MOX approach is pursued. In this ROD, DOE has not decided to use European MOX fuel fabrication.

V. Decisions

A. Storage of Weapons-Usable Fissile Materials

Consistent with the Preferred Alternative in the S&D Final PEIS, the Department has decided to reduce, over time, the number of locations where the various forms of plutonium are stored, through a combination of storage alternatives in conjunction with a combination of disposition alternatives. DOE will begin implementing this decision by moving surplus plutonium from RFETS as soon as possible, transporting the pits to Pantex beginning in 1997, and non-pit plutonium materials to SRS upon completion of the expanded Actinide Packing and Storage Facility (APSF), anticipated in 2001. Over time, DOE will store this plutonium in upgraded facilities at Pantex and in the expanded APSF. Surplus and non-surplus HEU will be stored in upgraded facilities at ORR. Storage facilities for the surplus HEU will also be modified, as needed, to accommodate international inspection requirements consistent with the President's Nonproliferation and Export Control Policy. Accordingly, DOE has decided to pursue the following actions for storage:

- Phase out storage of all weapons-usable plutonium at RFETS beginning in 1997; move pits to Pantex, and non-pit materials to SRS upon completion of the expanded APSF. At Pantex, DOE will repackage pits from RFETS in Zone 12, then place them in existing storage facilities in Zone 4, pending completion of facility upgrades in Zone 12. At SRS, DOE will expand the planned new APSF, and move separated and stabilized non-pit plutonium materials from RFETS to the expanded APSF upon completion. The small number of pits currently at RFETS that are not in shippable form will be placed in a shippable condition in accordance with existing procedures prior to shipment to Pantex. Additionally, some pits and non-pit plutonium materials from RFETS could be used at SRS, LANL, and Lawrence Livermore National Laboratory (LLNL) for tests and demonstrations of aspects of disposition technologies (see disposition decision, below). All non-pit weapons-usable plutonium materials currently stored at RFETS are surplus.

The Department's decision to remove plutonium from RFETS is based on the cleanup agreement among DOE, EPA, and the State of Colorado for RFETS, the proximity of RFETS to the Denver metropolitan area, and the fact that some of the RFETS plutonium is currently stored in buildings 371 and 376, two of the most vulnerable facilities as defined by and identified in DOE's Plutonium Working Group Report on Environmental, Safety, and Health Vulnerabilities Associated With the Department's Plutonium Storage (DOE/EH–0414, November, 1994).

- Upgrade storage facilities at Zone 12 South (to be completed by 2004) at Pantex to store those surplus pits currently stored at Pantex, and surplus pits from RFETS, pending disposition. Storage facilities at Zone 4 will continue to be used for these pits prior to completion of the upgrade.
- In accordance with the preferred alternative in the Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management (Stockpile Stewardship and Management PEIS), store Strategic Reserve pits at Pantex in other upgraded facilities in Zone 12.

The Department's decision to consolidate pit storage at Pantex places the pits at a central location where most of the pits already reside and where the expertise and infrastructure are already in place to accommodate pit storage.[19] Pantex has more than 40 years of experience with the handling of pits. Zone 12 facilities would be modified for long-term storage of the Pantex plutonium inventory and the small number of pits transferred from RFETS and SRS for a modest cost (about $10 million capital cost). Pursuant to the Final EIS for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components (DOE/EIS–0225), DOE is proposing to continue nuclear weapons stockpile management operations and related activities at the Pantex Plant, including interim storage of up to 20,000 pits.[20] Consequently, the storage of surplus pits at Pantex would offer the opportunity to share trained people and other resources, and a decreased cost could be realized over other sites without similar experience. Using the Pantex Plant for pit storage would also involve the lowest cost and the least new construction relative to other sites.

- Expand the planned APSF at SRS (Upgrade Alternative) to store those surplus, non-pit plutonium materials currently at SRS and surplus non-pit plutonium materials from RFETS, pending disposition (see disposition decision, below). DOE analyzed the

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[19] A small number of research and development pits located at RFETS that have been and will continue to be packaged and returned to LANL and LLNL are outside the scope of the S&D PEIS and this ROD.

[20] The pits that are to be moved to Pantex pursuant to this ROD fall within the 20,000 pit limit.

potential impacts of constructing and operating the APSF in the Final Environmental Impact Statement, Interim Management of Nuclear Materials (DOE/EIS–0220) and announced the decision to build the facility in the associated ROD (60 FR 65300, December 19, 1995). DOE, pursuant to the decisions announced here to store surplus non-pit plutonium at SRS, will likely design and build the APSF and the expanded space to accommodate the RFETS material as one building,[21] which DOE plans to complete in 2001. The RFETS surplus non-pit plutonium materials[22] will be moved to SRS after stabilization is performed at RFETS under corrective actions in response to Defense Nuclear Facilities Safety Board Recommendation 94–1; and after the material is packaged in DOE-approved storage and shipping containers pursuant to existing procedures. The surplus plutonium already on-site at SRS and the movement of separated and stabilized non-pit plutonium from RFETS would result in the storage of a maximum of 10 metric tons of surplus plutonium in the new, expanded APSF at SRS. In addition, shipment of the non-pit plutonium from RFETS to SRS, after stabilization, would only be implemented if the subsequent ROD for a plutonium disposition site (see Section V.B., below) calls for immobilization of plutonium at SRS. Placement of surplus, non-pit plutonium materials in a new storage facility at SRS will allow utilization of existing expertise and plutonium handling capabilities in a location where disposition activities could occur (see disposition decision, below). The decision to store non-pit plutonium from RFETS at SRS places most non-pit material at a plutonium-competent site with the most modern, state-of-the-art storage and processing facilities, and at a site with the only remaining large-scale chemical separation and processing capability in the DOE complex.[23] Pits currently located at SRS will be moved to Pantex for storage consistent with the Preferred Alternative in the Stockpile Stewardship and Management PEIS. There are no strategic non-pit materials currently located at SRS.

- Continue current storage (No Action) of surplus plutonium at Hanford and INEL, pending disposition (or movement to lag storage[24] at disposition facilities when selected).[25] This action will allow surplus plutonium to remain at the sites with existing expertise and plutonium handling capabilities, and where potential disposition activities could occur (see disposition decision, below). There are no non-surplus weapons-usable plutonium materials currently stored at either site.
- Continue current storage (No Action) of plutonium at LANL, pending disposition (or movement to lag storage at the disposition facilities). This plutonium will be stored in stabilized form with the non-surplus plutonium in the upgraded Nuclear Material Storage Facility pursuant to the No Action alternative for the site.
- Take No Action at the NTS. DOE will not introduce plutonium to sites that do not currently have plutonium in storage.
- Upgrade storage facilities at the Y–12 Plant (Y–12) (to be completed by 2004 or earlier) at ORR to store non-surplus HEU and surplus HEU pending disposition. Existing storage facilities at Y–12 will be modified to meet natural phenomena requirements, as documented in Natural Phenomena Upgrade of the Downsized/Consolidated Oak Ridge Uranium/Lithium Plant Facilities (Y/EN–5080, 1994). Storage facilities will be consolidated, and the storage footprint will be reduced, as surplus HEU is dispositioned and blended to low-enriched uranium, pursuant to the ROD for the Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement (61 FR 40619, August 5, 1996). Consistent with the Preferred Alternative in the Stockpile Stewardship and Management PEIS, HEU strategic reserves will be stored at the Y–12 Plant.

B. Plutonium Disposition

Consistent with the Preferred Alternative in the S&D Final PEIS, DOE has decided to pursue a strategy for plutonium disposition that allows for immobilization of surplus weapons plutonium in glass or ceramic forms and burning of the surplus plutonium as mixed oxide fuel (MOX) in existing reactors. The decision to pursue disposition of the surplus plutonium using these approaches is supported by the analyses in the Disposition Technical Summary Report (section IV.A.2 above) and the Nonproliferation Assessment (section IV.B above), as well as the S&D Final PEIS. The results of additional technology development and demonstrations, site-specific environmental review, detailed cost proposals, nonproliferation considerations, and negotiations with Russia and other nations will ultimately determine the timing and extent to which MOX as well as immobilization is deployed. These efforts will provide the basis and flexibility for the United States to initiate disposition efforts either multilaterally or bilaterally through negotiations with other nations, or unilaterally as an example to Russia and other nations.

Pursuant to this decision, the United States policy not to encourage the civil use of plutonium and, accordingly, not to itself engage in plutonium reprocessing for either nuclear power or nuclear explosive purposes, does not change. Although under this decision some plutonium may ultimately be burned in existing reactors, extensive measures will be pursued (see below) to ensure that federal support for this unique disposition mission does not encourage other civil uses of plutonium or plutonium reprocessing. The United States will maintain its commitments regarding the use of plutonium in civil nuclear programs in western Europe and Japan.

The Disposition Technical Summary Report (section IV.A.2 above) concluded that the lowest cost option for plutonium disposition would be immobilization using the can-in-canister variant and existing facilities to the maximum extent possible, with a net life-cycle cost of about $1.8 billion. The Disposition Technical Summary Report also estimated that the net life-cycle cost of the hybrid immobilization/MOX approach would be about $2.2 billion. The additional expense of pursuing the hybrid approach would be warranted by

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[21] Building the APSF in this way, rather than as originally configured plus an expansion, will not increase the potential impacts of constructing and operating the facility beyond those analyzed in the S&D Final PEIS in conjunction with the analyses in the Final Environmental Impact Statement, Interim Management of Nuclear Materials.

[22] This decision does not include residues at RFETS that are less than 50-percent plutonium by weight, or scrub alloys. The management and disposition of those materials has been or is being considered in separate NEPA reviews. See Environmental Assessment for Solid Residue Treatment, Repackaging, and Storage (DOE/EA–1120, April 1996); Notice of Intent to Prepare an EIS on the Management of Certain Plutonium Residues and Scrub Alloy Stored at the Rocky Flats Environmental Technology Site (61 FR 58866, November 19, 1996).

[23] SRS is one of the preferred candidate sites for plutonium disposition facilities, including the potential for the early start of disposition by immobilization using the can-in-canister option at the DWPF.

[24] Lag storage is temporary storage at the applicable disposition facility.

[25] Lawrence Livermore National Laboratory (LLNL) currently stores 0.3 metric tons of plutonium, which are primarily research and development and operational feedstock materials not surplus to government needs. Adequate storage facilities for this material currently exist at LLNL, where it will be stored and used for research and development activities. None of the plutonium stored at LLNL falls within the scope of the disposition alternatives in the S&D Final PEIS or the disposition decisions in this ROD.

the increased flexibility it would provide, as noted in the Nonproliferation Assessment, to ensure that plutonium disposition could be initiated promptly should one of the approaches ultimately fail or be delayed. Establishing the means for expeditious plutonium disposition will also help provide the basis for an international cooperative effort that can result in reciprocal, irreversible plutonium disposition actions by Russia. This disposition strategy signals a strong U.S. commitment to reducing its stockpile of surplus plutonium, thereby effectively meeting the purpose of and need for the Proposed Action.

To accomplish the plutonium disposition mission, DOE will use, to the extent practical, new as well as modified existing buildings and facilities for portions of the disposition mission. DOE will analyze and compare existing and new buildings and facilities, and technology variations, in a subsequent, site-specific EIS. In addition, all disposition facilities will be designed or modified, as needed, to accommodate international inspection requirements consistent with the President's Nonproliferation and Export Control Policy. Accordingly, DOE has decided to pursue the following strategy and supporting actions for plutonium disposition:

- Immobilize plutonium materials using vitrification or ceramic immobilization at either Hanford or SRS, in new or existing facilities. Immobilization could be used for pure or impure forms of plutonium. In the subsequent EIS (referenced above), DOE anticipates that the preferred alternative for vitrification or ceramic immobilization will include the can-in-canister variant, utilizing the existing HLW and the DWPF at SRS (see below). Alternatively, new immobilization facilities could be built at Hanford or SRS. The immobilized material would be disposed of in a geologic repository. Pursuant to appropriate NEPA review, DOE will continue the research and development leading to the demonstration of the can-in-canister variant at the DWPF using surplus plutonium and the development of vitrification and ceramic formulations.
- Convert surplus plutonium materials into mixed oxide (MOX) fuel for use in existing reactors. Pure surplus plutonium materials including pits, pure metal, and oxides could be converted without extensive processing into MOX fuel for use in existing commercial reactors. Other, already separated forms of surplus plutonium would require additional purification. (This purification would not involve reprocessing of spent nuclear fuel.) The Government-produced MOX fuel (from plutonium declared surplus to defense needs) would be used in existing LWRs with a once-through fuel cycle, with no reprocessing or subsequent reuse of the spent fuel. In addition, DOE will explore appropriate contractual limits to ensure that any reactor license modification for use of the MOX fuel is limited to governmental purposes involving the disposition of surplus, weapons-usable plutonium, so as to discourage general civil use of plutonium-based fuel. The spent MOX fuel would be disposed of in a geologic repository. If partially completed LWRs were to be completed by other parties, they would be considered for this mission. The MOX fuel would be fabricated in a domestic, government-owned facility at one of four DOE sites (SRS, Hanford, INEL, or Pantex).

The Department reserves as an option the potential use of some MOX fuel in CANDU reactors in Canada in the event that a multilateral agreement to deploy this option is negotiated among Russia, Canada, and the United States. DOE will engage in a test and demonstration program for CANDU MOX fuel consistent with ongoing and potential future cooperative efforts with Russia and Canada.

The test and demonstration activities could occur at LANL and at sites in Canada, potentially beginning in 1997, and will be based on appropriate NEPA review. Fabrication of MOX fuel for CANDU reactors would occur in a DOE facility, as would be true in the case of domestic LWRs. Strict security and safeguards would be employed in the fabrication and transport of MOX fuel to CANDU reactors, as well as domestic reactors. Whether, and the extent to which, the CANDU option is implemented will depend on multi-national agreements and the results of the test and demonstration activities.

Due to technology, complexity, timing, cost, and other factors that would be involved in purifying certain plutonium materials to make them suitable for potential use in MOX fuel, approximately 30 percent of the total quantity of plutonium that has been or may be declared surplus to defense needs would require extensive purification for use in MOX fuel, and therefore will likely be immobilized. Of the plutonium that is currently surplus, DOE will immobilize at least 8 metric tons that it has determined are not suitable for use in MOX fuel.[26] DOE reserves the option of using the immobilization approach for all of the surplus plutonium.

The timing and extent to which either option is ultimately utilized will depend on the results of international agreements, future technology development and demonstrations, site-specific environmental review, detailed cost proposals, and negotiations with Russia and other nations. In the event both technologies are utilized, because the time required for plutonium disposition using reactors would be longer than that for immobilization, it is probable that some surplus plutonium would be immobilized initially, prior to completion of reactor irradiation for other surplus plutonium.
Implementation of this strategy will involve some or all of the following supporting actions:

- Construct and operate a plutonium vitrification facility or ceramic immobilization facility at either Hanford or SRS. DOE will analyze alternative locations at these two sites for constructing new buildings or using modified existing buildings in subsequent, site-specific NEPA review. SRS has existing facilities (the DWPF) and infrastructure to support an immobilization mission, and at Hanford, DOE has proposed constructing and operating immobilization facilities for the wastes in Hanford tanks.[27] DOE will not create new infrastructure for immobilizing plutonium with HLW or cesium at INEL, NTS, ORR, or Pantex. Due to the substantial timing and cost advantages associated with the can-in-canister option, as discussed in the Technical Summary Report For Surplus Weapons-Usable Plutonium Disposition and summarized in section IV.A.2, above, DOE anticipates that the proposed action for immobilization in the follow-on plutonium disposition EIS will include the use of the can-in-canister option at the DWPF at SRS for immobilizing a portion of the surplus, non-pit plutonium material.[28]

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[26] The S&D Final PEIS, for purposes of analysis of impacts of the preferred alternative (using both reactors and immobilization), assumed that about 30 percent (approximately 17 MT) of the surplus plutonium materials might be immobilized because they are impure. DOE's decision here that immobilization will be used for at least 8 MT currently located at SRS and RFETS is based on DOE's current assessment that that quantity of material is so low in quality that its purification for use in MOX fuel would not be cost-effective. This decision does not preclude immobilizing all of the surplus plutonium, but it does preclude using the MOX/reactor approach for all of the material.

[27] See Final Environmental Impact Statement for the Tank Waste Remediation System, Hanford Site, Richland, Washington (DOE/EIS–0189, August 1996); ROD expected early in 1997.

[28] DOE expects to issue a Notice of Intent to prepare the follow-on EIS shortly following this ROD. Reasonable alternatives for the proposed

- Construct and operate a plutonium conversion facility for non-pit plutonium materials at either Hanford or SRS. DOE will collocate the plutonium conversion facility with the vitrification or ceramic immobilization facility discussed above. In subsequent, site-specific NEPA review, DOE will analyze alternative locations at Hanford and SRS for constructing new buildings or using modified existing buildings for the plutonium conversion facility.
- Construct and operate a pit disassembly/conversion facility at Hanford, INEL, Pantex, or SRS (only one site). DOE will not introduce plutonium to sites that do not currently have plutonium in storage. Therefore, two sites analyzed in the S&D PEIS, NTS and ORR, will not be considered further for plutonium disposition activities. DOE will analyze alternative locations at Hanford, INEL, Pantex, and SRS for constructing new buildings or using modified existing buildings in subsequent, site-specific NEPA review. Based on appropriate NEPA review, DOE anticipates demonstrating the Advanced Recovery and Integrated Extraction System (ARIES) concept at LANL for pit disassembly/conversion beginning in fiscal year 1997.
- Construct and operate a domestic, government-owned, limited-purpose MOX fuel fabrication facility at Hanford, INEL, Pantex, or SRS (only one site). As noted above, NTS and ORR will not be considered further for plutonium disposition activities. In follow-on NEPA review, DOE will analyze alternative locations at Hanford, INEL, Pantex, and SRS, for constructing new buildings or using modified existing buildings. The MOX fuel fabrication facility will serve only the limited mission of fabricating MOX fuel from plutonium declared surplus to U.S. defense needs, with shut-down and decontamination and decommissioning of the facility upon completion of this mission.[29]

DOE's program for surplus plutonium disposition will be subject to the highest standards of safeguards and security for storage, transportation, and processing (particularly during operations that involve the greatest proliferation vulnerability, such as during MOX fuel preparation and transportation), and will include International Atomic Energy Agency verification as appropriate. Transportation of all plutonium-bearing materials under this program, including the transportation of prepared MOX fuel to reactors, will be accomplished using the DOE Transportation Safeguards Division's ‘‘Safe Secure Transports’’ (SSTs), which affords these materials the same level of transportation safety, security, and safeguards as is used for nuclear weapons.

Pursuant to appropriate NEPA review(s), DOE will continue research and development and engage in further testing and demonstrations of plutonium disposition technologies which may include: dissolution of small quantities of plutonium in both glass and ceramic formulation; experiments with immobilization equipment and systems; fabrication of MOX fuel pellets for demonstrations of reactor irradiation at INEL; mechanical milling and mixing of plutonium and uranium feed; and testing of shipping and storage containers for certification, in addition to the testing and demonstrations previously described for the can-in-canister immobilization variant, the ARIES system, and other plutonium processes.

DOE has decided not to pursue several disposition alternatives that were evaluated in the S&D PEIS: two deep borehole alternatives, electrometallurgical treatment, evolutionary reactors, and partially-completed reactors (unless they were completed by others, in which case they would qualify as existing reactors). Although the deep borehole options are technically attractive, the institutional uncertainties associated with siting of borehole facilities make timely implementation of this alternative unlikely. To implement the borehole alternatives, new legislation and regulations, or clarification of existing regulations, may be necessary. DOE has decided not to pursue the electrometallurgical treatment option for immobilization because its technology is less mature than vitrification or ceramic immobilization.[30] DOE has decided not to pursue evolutionary reactors or partially-completed reactors because they offer no advantages over existing reactors for plutonium disposition and would involve higher costs, greater regulatory uncertainties, higher environmental impacts from construction, and less timely commencement of disposition actions.

VI. Conclusion

DOE has decided to implement a program to provide for safe and secure storage of weapons-usable fissile materials and for disposition of weapons-usable plutonium that is declared excess to national security needs (now or in the future), as specified in the Preferred Alternative in the S&D Final PEIS. DOE will consolidate the storage of weapons-usable plutonium by upgrading and expanding existing facilities at the Pantex Plant in Texas and SRS in South Carolina, continuing storage of surplus plutonium currently onsite at Hanford, LANL, and INEL pending disposition, and continuing storage of weapons-usable HEU at DOE's Y–12 Plant in Tennessee, in upgraded and, as surplus HEU is down-blended under the ROD for Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement, consolidated facilities. DOE will provide for disposition of surplus plutonium by pursuing a strategy that allows: (1) Immobilization of surplus plutonium for disposal in a repository pursuant to the Nuclear Waste Policy Act, and (2) fabrication of surplus plutonium into MOX fuel, for use in existing domestic commercial reactors (and potentially CANDU reactors, depending on future agreements with Russia and Canada). The timing and extent to which each of these disposition technologies is deployed will depend upon the results of future technology development and demonstrations, site-specific environmental review, detailed cost proposals, and the results of negotiations with Russia, Canada, and other nations. This programmatic decision is effective upon being made public, in accordance with DOE's regulations implementing NEPA (10 CFR 1021.315). The goals of this program are to support U.S. nuclear weapons nonproliferation policy by reducing global stockpiles of excess fissile materials so that they may never be used in weapons again. This program will demonstrate the United States'' commitment to its nonproliferation goals, as specified in the President's Nonproliferation and Export Control Policy of 1993, and provide an example for other nations, where stockpiles of surplus weapons-usable fissile materials may be less secure from potential theft or diversion than those in the United

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action will be considered in the follow-on disposition EIS.

[29] DOE supports external regulation of its facilities, and in the Report of Department of Energy Working Group on External Regulation (DOE/UF–0001, December 1996), DOE proposed to seek legislation that would generally require NRC licenses for new DOE facilities. Therefore, DOE anticipates seeking an NRC license for the MOX fuel fabrication facility, which would be limited to a license to fabricate MOX fuel from plutonium declared surplus to defense needs. DOE may also seek legislation that would by statute limit the MOX fuel fabrication facility to disposition of surplus plutonium.

[30] An evaluation by the National Research Council in a recent report (see footnote 12, above) concluded that the electrometallurgical treatment process is not sufficiently mature to provide a reliable basis for timely plutonium disposition.

States, to encourage them to take similar actions.

The decision process reflected in this Notice complies with the requirements of the National Environmental Policy Act (42 U.S.C. § 4321 et seq.) and its implementing regulations at 40 CFR Parts 1500–1508 and 10 CFR Part 1021.

Issued in Washington, D.C., January 14, 1997.

Hazel R. O'Leary,

Secretary.

[FR Doc. 97–1355 Filed 1–17–97; 8:45 am]

BILLING CODE 6450–01–P

Energy Information Administration

Agency Information Collection Activities: Proposed Collection; Comment Request

SUMMARY: The Energy Information Administration (EIA) is soliciting comments concerning the proposed three-year extension of existing form DOE–887, ''Department of Energy Customer Surveys.''

DATES: Written comments must be submitted on or before March 24, 1997. If you anticipate that you will be submitting comments, but find it difficult to do so within the period of time allowed by this notice, you should advise the contact listed below of your intention to do so as soon as possible.

ADDRESSES: Send comments to Herbert T. Miller, Office of Statistical Standards, EI–73, Forrestal Building, U.S. Department of Energy, Washington, D.C. 20585, (Phone 202–426–1103, FAX 202-426–1081, or e-mail hmiller@eia.doe.gov).

FOR FURTHER INFORMATION: Requests for additional information should be directed to Herbert Miller at the address listed above.

SUPPLEMENTARY INFORMATION:

I. Background
II. Current Actions
III. Request for Comments

I. Background

In order to fulfill its responsibilities under the Federal Energy Administration Act of 1974 (Pub. L. No. 93–275) and the Department of Energy Organization Act (Pub. L. No. 95–91), the Energy Information Administration is obliged to carry out a central, comprehensive, and unified energy data and information program. As part of this program, EIA collects, evaluates, assembles, analyzes, and disseminates data and information related to energy resource reserves, production, demand, and technology, and related economic and statistical information relevant to the adequacy of energy resources to meet demands in the near and longer term future for the Nation's economic and social needs.

The Energy Information Administration, as part of its continuing effort to reduce paperwork and respondent burden (required by the Paperwork Reduction Act of 1995 (Pub. L. 104–13)), conducts a presurvey consultation program to provide the general public and other Federal agencies with an opportunity to comment on proposed and/or continuing reporting forms. This program helps to ensure that requested data can be provided in the desired format, reporting burden is minimized, reporting forms are clearly understood, and the impact of collection requirements on respondents can be properly assessed. Also, EIA will later seek approval by the Office of Management and Budget (OMB) for the collections under Section 3507(h) of the Paperwork Reduction Act of 1995 (Pub. L. No. 104–13, Title 44, U.S.C. Chapter 35).

On September 11, 1993, the President signed Executive Order No. 12862 aimed at ''* * * ensuring the Federal government provides the highest quality service possible to the American people.'' The Order discusses surveys as a means for determining the kinds and qualities of service desired by Federal Government customers and for determining satisfaction levels for existing services. These voluntary customer surveys will be used to ascertain customer satisfaction with the Department of Energy in terms of services and products. Respondents will be individuals and organizations that are the recipients of the Department's services and products. Previous customer surveys have provided useful information to the Department for assessing how well the Department is delivering its services and products and for making improvements. The results are used internally and summaries are provided to the Office of Management and Budget on an annual basis, and are used to satisfy the requirements and the spirit of Executive Order No. 12862.

II. Current Actions

The request to OMB will be for a three-year extension of the expiration date of approval for DOE to conduct customer surveys. During the past clearance cycle, over 20 customer surveys have been conducted by telephone and mail. (Examples of previously conducted customer surveys are available upon request.) Our planned activities in the next 3 fiscal years reflect our increased emphasis on and expansion of these activities, including an increased use of electronic means for obtaining customer input (CD–ROM and World Wide Web).

III. Request for Comments

Prospective respondents and other interested parties should comment on the actions discussed in item II. The following guidelines are provided to assist in the preparation of responses.

General Issues

A. Is the proposed collection of information necessary, taking into account its accuracy, adequacy, and reliability, and the agency's ability to process the information it collects in a useful and timely fashion?

B. What enhancements can EIA make to the quality, utility, and clarity of the information to be collected?

As a Potential Respondent

A. Average public reporting burden for a customer survey is estimated to be .25 hours per response (8,333 respondents per year x 15 minutes per response = 2,083 hours annually). Burden includes the total time, effort, or financial resources expended to generate, maintain, retain, or disclose or provide the information including: (1) reviewing instructions; (2) developing, acquiring, installing, and utilizing technology and systems for the purposes of collecting, validating, verifying, processing, maintaining, disclosing and providing information; (3) adjusting the existing ways to comply with any previously applicable instructions and requirements; (4) training personnel to respond to a collection of information; (5) searching data sources; (6) completing and reviewing the collection of information; and (7) transmitting, or otherwise disclosing the information.

Please comment on (1) the accuracy of our estimate and (2) how the agency could minimize the burden of the collection of information, including the use of automated collection techniques or other forms of information technology.

B. EIA estimates that respondents will incur no additional costs for reporting other than the hours required to complete the collection. What is the estimated (1) total dollar amount annualized for capital and start-up costs and (2) recurring annual dollar amount of operation and maintenance and purchase of services costs associated with this data collection? The estimates should take into account the costs associated with generating, maintaining, and disclosing or providing the information.

A.2 NOTICE OF INTENT—SURPLUS PLUTONIUM DISPOSITION ENVIRONMENTAL IMPACT STATEMENT

collection on the respondents, including through the use of information technology.

Dated: May 16, 1997.

Gloria Parker,

Director, Information Resources Management Group.

Office of Management

Type of Review: New.

Title: Department of Education Federal Cash Award Certification Statement and Department of Education Federal Cash Quarterly Confirmation Statement.

Frequency: Annually.

Affected Public: Business or other for-profit; Not for Profit institutions; Federal Government; State, Local or Tribal Government, SEAs or LEAs.

Annual Reporting and Recordkeeping Hour Burden:

Responses: 12,000.

Burden Hours: 38,160.

Abstract: The collection of the Federal Cash Award Statement is necessary for the Agency to monitor cash advanced to grantees and to obtain expenditure information for each grant from grantees. Information collection is used to report total outlays to the Office of Management and Budget and the Department of the Treasury and is used to project the Federal government's and the Department's financial condition. This information collection also enables the Department to provide Treasury with outlay information to facilitate Treasury's estimation of future borrowing requirements. Respondents include over 12,000 State, local, college, university, proprietary school and non-profit grantees who draw funds from the Department.

The collection of Federal cash quarterly confirmation statement enables grantees to identify discrepancies in grant authorizations, and funds drawn and funds refunded. Action is required only if a grantee's records do not agree with the information contained on the statement. This information will be used to help grantees report and initiate resolution of discrepancies. Respondents include over 12,000 State, local, college, university, proprietary school and non-profit grantees who draw funds from the Department.

Office of Special Education and Rehabilitative Services

Type of Review: New.

Title: Grantee Reporting Form.

Frequency: Annually.

Affected Public: Business or other for-profit; Not-for-profit institutions; State, local or Tribal Gov't, SEAs or LEAs.

Annual Reporting and Recordkeeping Hour Burden:

Responses: 165.

Burden Hours: 330.

Abstract: Rehabilitation Services Administration (RSA) training grants provide stipends to ''RSA Scholars'' in order to train skilled rehabilitation personnel. Grantees are required to ''track'' scholars, relative to the ''payback'' provision in the Rehabilitation Act. Data collection is reported annually to RSA in order to monitor performance and report progress to Congress.

[FR Doc. 97–13413 Filed 5–21–97; 8:45 am]

BILLING CODE 4000–01–M

DEPARTMENT OF ENERGY

Surplus Plutonium Disposition Environmental Impact Statement

AGENCY: Department of Energy

ACTION: Notice of intent

SUMMARY: The Department of Energy (DOE) announces its intent to prepare an Environmental Impact Statement (EIS) pursuant to the National Environmental Policy Act (NEPA) on the disposition of United States' weapons-usable surplus plutonium. This EIS is tiered from the Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement (Storage and Disposition PEIS) (DOE/EIS–0229), issued in December 1996, and the associated Record of Decision (62 FR 3014), issued on January 14, 1997.

The EIS will examine reasonable alternatives and potential environmental impacts for the proposed siting, construction, and operation of three types of facilities for plutonium disposition. The first is a facility to disassemble and convert pits (a nuclear weapons component) into plutonium oxide suitable for disposition. As explained in the January 1997 Record of Decision, this pit disassembly and conversion facility will be located at either DOE's Hanford Site, Idaho National Engineering and Environmental Laboratory (INEEL), Pantex Plant, or Savannah River Site (SRS). The second is a facility to immobilize surplus plutonium in a glass or ceramic form for disposition in a geologic repository pursuant to the Nuclear Waste Policy Act. This second facility will be located at either Hanford or SRS, and include a collocated capability to convert non-pit plutonium materials into a form suitable for immobilization. The EIS will discuss various technologies for immobilization. The third type of facility would fabricate plutonium oxide into mixed oxide (MOX) fuel. The MOX fuel fabrication facility would be located at either Hanford, INEEL, Pantex or SRS. MOX fuel would be used in existing commercial light water reactors in the United States, with subsequent disposal of the spent fuel in accordance with the Nuclear Waste Policy Act. Some MOX fuel could also be used in Canadian deuterium uranium (CANDU) reactors depending upon negotiation of a future international agreement between Canada, Russia, and the United States. The EIS will also discuss decommissioning and decontamination (D&D) of the three facilities.

This Notice of Intent describes the Department's proposed action, solicits public input, and announces the schedule for the public scoping meetings.

DATES: Comments on the proposed scope of the Surplus Plutonium Disposition EIS (SPD EIS) are invited from the public. To ensure consideration in the draft EIS, written comments should be postmarked by July 18, 1997. Comments received after that date will be considered to the extent practicable. DOE will hold interactive scoping meetings near sites that may be affected by the proposed action to discuss issues and receive oral and written comments on the scope of the EIS. The locations, dates and times for these public meetings are included in the Supplementary Information section of this notice and will be announced by additional appropriate means.

ADDRESSES: Comments and questions concerning the plutonium disposition program can be submitted by calling (answering machine) or faxing them to the toll free number 1–800–820–5156, or by mailing them to: Bert Stevenson, NEPA Compliance Officer, Office of Fissile Materials Disposition, U.S. Department of Energy, Post Office Box 23786, Washington, DC 20026–3786.

Comments may also be submitted electronically by using the Office of Fissile Materials Disposition's web site. The address is http://web.fie.com/fedix/fisl.html.

FOR FURTHER INFORMATION CONTACT: For general information on the DOE NEPA process, please contact: Carol Borgstrom, Director, Office of NEPA Policy and Assistance, U.S. Department of Energy 1000, Independence Avenue, S.W., Washington, DC 20585, 202–586–4600 or 1–800–472–2756.

SUPPLEMENTARY INFORMATION:

Background

The Storage and Disposition Programmatic Environmental Impact Statement (PEIS) analyzed the potential environmental consequences of alternatives for the long-term storage (up to 50 years) of weapons-usable fissile materials and the disposition of surplus plutonium. Surplus plutonium for disposition refers to that weapons-usable plutonium that the President has declared surplus to national security needs, as well as such plutonium that may be declared surplus in the future. As stated in the Record of Decision for the Storage and Disposition PEIS, the Department decided to pursue a hybrid approach that allows immobilization of surplus plutonium in glass or ceramic form and burning of some of the surplus plutonium as MOX fuel in existing, commercial light water reactors in the United States (and potentially in Canadian Deuterium Uranium (CANDU) reactors in Canada depending on future international agreement). The Department decided that the extent to which either or both of these disposition approaches would ultimately be deployed would depend in part upon future NEPA review, although the Department committed to immobilize at least 8 metric tons (tonnes) of currently declared surplus plutonium and reserved the option of immobilizing all surplus weapons plutonium. In the Record of Decision for the Storage and Disposition PEIS, the Department further decided to: (1) locate the immobilization facility (collocated with a plutonium conversion facility) at either Hanford or SRS; (2) locate a potential MOX fuel fabrication facility at either Hanford, INEEL, Pantex, or SRS; (3) locate a pit disassembly and conversion facility at either Hanford, INEEL, Pantex, or SRS; and (4) determine the specific technology for immobilization based in part on this follow-on disposition EIS.

The processes, materials and technologies involved in surplus plutonium disposition are depicted in Figure 1.

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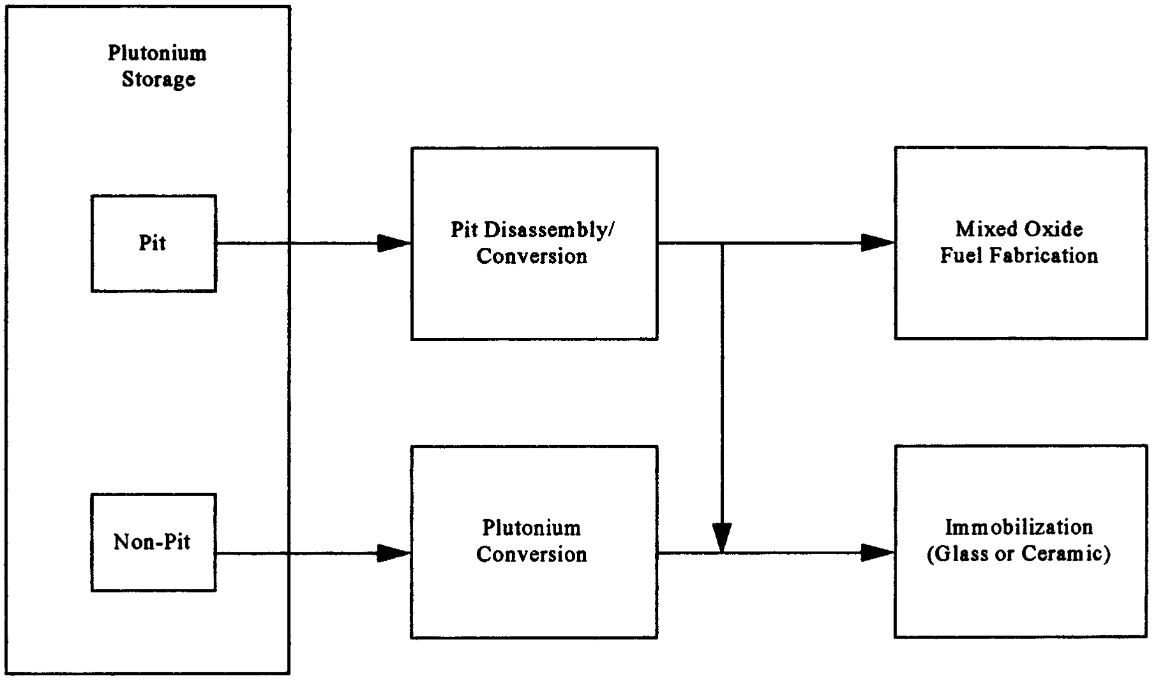

Figure 1. Plutonium Disposition Processes in DOE's Proposed Action

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Proposed Action

The Department proposes to determine whether to continue with both the immobilization and MOX approaches for surplus plutonium disposition and if so, to site, construct, and operate and ultimately D&D three types of facilities for plutonium disposition at one or more of four DOE sites, as follows:

- A collocated non-pit plutonium conversion and immobilization facility at either Hanford, near Richland, Washington, or SRS, near Aiken, South Carolina, with sub-alternatives for the technology and facilities used to form the immobilized plutonium.
- A pit disassembly/conversion facility at either Hanford; SRS; INEEL, near Idaho Falls, Idaho; or the Pantex Plant, near Amarillo, Texas.
- A MOX fuel fabrication facility at either Hanford, INEEL, Pantex, or SRS, with sub-alternatives for fabrication of Lead Test Assemblies for use in fuel qualification demonstrations.

Construction of these facilities would be on previously disturbed land and could include the modification of existing facilities where practicable, to reduce local environmental impacts, reduce costs, and shorten schedules. In the pit disassembly and conversion facility, the Department proposes to disassemble surplus pits and convert the plutonium in them to an unclassified oxide form suitable for disposition. The Department also proposes to convert most non-pit plutonium materials to plutonium oxide at the plutonium conversion facility, which will be collocated with the immobilization facility.

Plutonium Disposition Decisions

The Department expects to make the following decisions based upon the results of this EIS and other information and considerations:

- Whether to construct and operate collocated plutonium conversion and immobilization facilities, and if so, where (including selection of the specific immobilization technology).
- Whether to construct and operate a pit disassembly/conversion facility, and if so, where.
- Whether to construct and operate a MOX fuel fabrication facility, and if so, where (including selection of the site for fabrication of Lead Test Assemblies).

The exact extent to which the MOX approach would ultimately be deployed will depend on a number of factors, in addition to environmental impacts. These are likely to include cost, contract negotiations, and international agreements.

Alternatives

No Action

A No Action alternative will be analyzed (Alternative 1) in the SPD EIS. Implementation of the No Action alternative would mean that disposition would not occur, and surplus weapons-usable plutonium, including pits, metals and oxides, would remain in storage in accordance with the Storage and Disposition PEIS Record of Decision.

Plutonium Disposition Alternatives

The SPD EIS will analyze alternatives for the siting, construction and operation of the three facilities at various candidate sites as described in the Proposed Action. These facilities would be designed so that they could collectively disposition surplus plutonium (existing and future) over their operating lives. Although the exact quantity of plutonium that may be declared surplus over time is not known, for purposes of analysis a nominal 50 tonnes of surplus plutonium will be used for assessing the environmental impacts of plutonium disposition activities at the various candidate sites. Under alternatives involving the ‘‘hybrid’’ (immobilization and MOX) approach selected in the Storage and Disposition Record of Decision, the SPD EIS will analyze the same distribution of surplus plutonium that was analyzed in the Storage and Disposition PEIS, which is fabrication of pits and pure plutonium metal or oxide (approximately 33 tonnes) into MOX fuel, and immobilization of the remaining non-pit plutonium (approximately 17 tonnes). The Record of Decision on the Storage and Disposition PEIS states, ‘‘DOE will immobilize at least eight tonnes of currently declared surplus plutonium materials that DOE has already determined are not suitable for use in MOX fuel.’’ Since the issuance of that decision, the Department has further determined that a total of about 17 tonnes of surplus plutonium is not suitable for use in MOX fuel without extensive processing. Thus, an alternative for fabricating all surplus plutonium into MOX fuel will not be analyzed. However, converting the full 50 tonnes of surplus plutonium into an immobilized form will be analyzed as a reasonable alternative.

Under each disposition approach, DOE could in principle locate one, two, or all three facilities at a candidate site. However, locating one facility at each of three sites would mean conducting disposition activities at three widely separated locations around the country. This would substantially increase transportation cost, unnecessarily increase exposure of workers and the public, and increase transportation risks, without any apparent compensating benefit. Therefore, the Department is proposing to consider only alternatives that locate two or more facilities at one site, with the possibility of one facility at a separate site. Further, certain combinations of facilities and sites are not being considered as reasonable alternatives, because they would also substantially increase transportation cost, unnecessarily increase exposure to workers and the public, and increase transportation risks, without any apparent compensating benefit.

Based on the above considerations and the candidate site selections in the Storage and Disposition Record of Decision, the following alternatives have been developed in addition to the No Action alternative. Table 1 summarizes the alternatives by site. Alternatives 2 through 10 (see Table 1) would involve immobilization of approximately 17 tonnes of low purity (non-pit) plutonium, and fabrication of approximately 33 tonnes of high purity plutonium (pits and plutonium metal) into MOX fuel. The differences among alternatives 2 through 10 are the locations of the proposed facilities. Alternatives 11 and 12 would involve immobilization of all 50 tonnes of plutonium at either Hanford or SRS.

The Department has identified existing facilities that can be modified for use in plutonium disposition at various candidate sites. A summary of the existing and new facilities (shown in the parentheses in Table 1) to be used in the SPD EIS analyses is given in Table 1, where FMEF is the Fuel and Materials Examination Facility, FPF is the Fuel Processing Facility, and DWPF is the Defense Waste Processing Facility.

Lead Test Assemblies

With respect to the MOX alternatives, the Department would qualify MOX fuel forms for use in existing commercial reactors. DOE will analyze two sub-alternatives for the fabrication of the lead test assemblies needed to qualify the fuel. In one sub-alternative, the lead test assemblies would be fabricated in the United States. Fabrication in the United States would involve constructing a pilot capability in conjunction with the fuel fabrication facility. Therefore, the potential sites include the candidate sites for the fuel fabrication facility (i.e., Hanford, INEEL, Pantex, and SRS). The pilot capability could also be located in an existing small facility at the Los Alamos National Laboratory (LANL). The second alternative would be for fabrication in existing European facilities; three potential fabrication sites exist (Belgium, France, and the United Kingdom) that would allow fabrication of the Lead Test Assemblies sooner than with any facility under the United States alternative.

TABLE 1.—DISPOSITION ALTERNATIVES

	Alternative/Site/Disposition Facility			
Alt. No.	Pit disassembly	MOX plant	Plutonium conversion and immobilization	Amounts of plutonium
1	No Action			
2	Hanford (FMEF)	Hanford (FMEF)	Hanford (FMEF)	17t Immobilization / 33t MOX.
3	SRS (New)	SRS (New)	SRS (New, or Bldg 221F, and DWPF)	17t Immobilization / 33t MOX.
4	Pantex (New)	Hanford (FMEF)	Hanford (FMEF)	17t Immobilization / 33t MOX.
5	Pantex (New)	SRS (New)	SRS (New, or Bldg 221F, and DWPF)	17t Immobilization / 33t MOX.
6	Hanford (FMEF)	Hanford (FMEF)	SRS (New, or Bldg 221F, and DWPF)	17t Immobilization / 33t MOX.
7	INEEL (FPF)	INEEL (New)	SRS (New, or Bldg 221F, and DWPF)	17t Immobilization / 33t MOX.
8	INEEL (FPF)	INEEL (New)	Hanford (FMEF)	17t Immobilization / 33t MOX.
9	Pantex (New)	Pantex (New)	SRS (New, or Bldg 221F, and DWPF)	17t Immobilization / 33t MOX.
10	Pantex (New)	Pantex (New)	Hanford (FMEF)	17t Immobilization / 33t MOX.
11	Hanford (FMEF)	N/A	Hanford (FMEF)	50t Immobilization / 0t MOX.
12	SRS (New)	N/A	SRS (New, or Bldg 221F, and DWPF)	50t Immobilization / 0t MOX.

Immobilization Technology

The Record of Decision on the Storage and Disposition PEIS stated, ‘‘Because there are a number of technology variations that could be used for immobilization, DOE will also determine the specific immobilization technology based upon the follow-on EIS * * *’’ (i.e., the SPD EIS). The technologies to be considered are those identified as variants in the Storage and Disposition PEIS.

Preferred Alternative

For immobilization, the Department prefers to use the ‘‘can-in-canister’’ technology at the DWPF at SRS. Under the can-in-canister approach, cans containing plutonium in glass or ceramic form would be placed in DWPF canisters, which would be filled with borosilicate glass containing high-level waste.

Classified Information

The Department plans to prepare the SPD EIS as an unclassified document with a classified appendix. The classified information in the SPD EIS will not be available for public review. However, the classified information will be considered by DOE in reaching a decision on the disposition of surplus plutonium. DOE will provide as much information as possible in unclassified form to assist public understanding and comment.

Research and Development Activities

The Department recently announced its intent to prepare two environmental assessments (EAs) for proposed research and development activities that DOE would conduct prior to completion of the SPD EIS and ROD. One EA will analyze the potential environmental impacts of a proposed pit disassembly and conversion integrated systems test at LANL. In addition, to further the purposes of NEPA, this EA will describe other research and development activities currently on-going at various sites, including work related to immobilization and to MOX fuel fabrication. The other EA will be prepared for the proposed shipment of special MOX fuel to Canada for an experiment involving the use of United States and Russian fuel in a Canadian test reactor, for development of fuel for the CANDU reactors. This EA will analyze the prior and future fabrication and proposed shipment of the fuel pellets needed for the experiment.

Relationships With Other DOE NEPA Activities

In addition to the SPD EIS and the EAs discussed above, the Department is currently conducting NEPA reviews of other activities that have a potential relationship with the SPD EIS. They include:

1. *Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage and Disposal of Radioactive and Hazardous Waste* (DOE/EIS–0200D) (Draft issued: September 22, 1995; 60 FR 49264).
2. *Management of Certain Plutonium Residues and Scrub Alloy Stored at the Rocky Flats Environmental Technology Site EIS* (Notice of Intent to Prepare an Environmental Impact Statement: November 19, 1996; 61 FR 58866).

Invitation To Comment

DOE invites comments on the scope of this EIS from all interested parties, including potentially affected Federal, State, and local agencies, and Indian tribes. Comments can be provided by any of the means listed in the Address Section of this notice and by providing oral and written comments at the scoping meetings.

The Department is requesting, by separate correspondence, that Federal agencies[1] desiring to be designated as cooperating agencies on the SPD EIS inform DOE by July 18, 1997.

Scoping Meetings

Public scoping meetings will be held near each site that may be affected by the proposed action. The interactive scoping meetings will provide the public with the opportunity to present comments, ask questions, and discuss concerns regarding plutonium disposition activities with DOE officials, and for the Department to receive oral and written comments on the scope of the EIS. Written and oral comments will be given equal weight in the scoping process. Input from the scoping meetings along with comments received by other means (phone, mail, fax, website) will be used by the Department in refining the scope of the EIS. The locations and dates for these public meetings are as shown below. All meetings will consist of two sessions (1:00 pm to 4:00 pm and 6:00 pm to 9:00 pm).

Hanford Site:

July 1, 1997
Shilo Inn
50 Comstock
Richland, WA 99352
509–946–4661

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[1] Arms Control and Disarmament Agency; Department of Defense; Department of State; Environmental Protection Agency; and Nuclear Regulatory Commission.

Idaho National Engineering and Environmental Laboratory

June 10, 1997
Shilo Inn
780 Lindsay Boulevard
Idaho Fall, ID 83402
208–523–0088

Pantex Plant

June 12, 1997
Radisson Inn Airport
7909 I–40 East at Lakeside
Amarillo, TX 79104
806–373–3303

Savannah River Site

June 19, 1997
North Augusta Community Center
495 Brookside Avenue
North Augusta, SC 29841
803–441–4290

Advanced registration for the public meetings is requested but not required. Please call 1–800–820–5134 and leave your name and the location of the meeting(s) you plan to attend. This information will be used to determine the size and number of rooms needed for the meeting.

Scoping Meeting Format:

The Department intends to hold a plenary session at the beginning of each scoping meeting in which DOE officials will more fully explain the framework for the plutonium disposition program, the proposed action, preliminary alternatives for accomplishing the proposed action and public participation in the NEPA process. Following the plenary session, the Department intends to discuss relevant issues in more detail, answer questions, and receive comments. Each scoping meeting for the Surplus Plutonium Disposition EIS will have two sessions, with each session lasting approximately three to four hours.

Issued in Washington, DC this 16 day of May, 1997, for the United States Department of Energy.

Peter N. Brush,

Principal Deputy Assistant Secretary, Environment, Safety and Health.

[FR Doc. 97–13494 Filed 5–21–97; 8:45 am]

BILLING CODE 6450–01–P

DEPARTMENT OF ENERGY

Federal Energy Regulatory Commission

[Docket No. RP97–165–003]

Alabama-Tennessee Natural Gas Company; Notice of Compliance Filing

May 16, 1997.

Take notice that on May 12, 1997, Alabama-Tennessee Natural Gas Company (Alabama-Tennessee) tendered for filing the tariff sheets listed in Appendix A to the filing, to be effective June 1, 1997.

Alabama-Tennessee states that the tariff sheets are submitted in compliance with Order No. 587 and the Commission's order issued on May 1, 1997 FERC ¶ 61,117).

Any person desiring to protest said filing should file a protest with the Federal Energy Regulatory Commission, 888 First Street, NE., Washington, DC 20426, in accordance with Section 385.211 of the Commission's Regulations. All such protests must be filed as provided in Section 154.210 of the Commission's Regulations. Protests will be considered by the Commission in determining appropriate action to be taken, but will not serve to make protestants parties to the proceedings. Copies of this filing are on file with the Commission and are available for public inspection.

Lois D. Cashell,

Secretary.

[FR Doc. 97–13441 Filed 5–21–97; 8:45 am]

BILLING CODE 6717–01–M

DEPARTMENT OF ENERGY

Federal Energy Regulatory Commission

[Docket No. ES97–32–000]

Citizens Utilities Company; Notice of Application

May 16, 1997.

Take notice that on May 9, 1997, Citizens Utilities Company (Applicant) filed an application with the Federal Energy Regulatory Commission under § 204 of the Federal Power Act requesting orders (a) extending the effectiveness of the order in Docket No. ES95–34–000 until the close of business on June 30, 1997, and (b) authorizing the issuance, from time to time, of up to 50,000,000 shares of common stock as stock dividends on shares of its outstanding common stock during a two-year period ending July 1, 1999.

Any person desiring to be heard or to protest said application should file a motion to intervene or protest with the Federal Energy Regulatory Commission, 888 1st Street, NE, Washington, D.C. 20426 in accordance with Rules 211 and 214 of the Commission's Rules of Practice and Procedure (18 CFR 385.211 and 385.214). All such motions or protests should be filed on or before May 20, 1997. Protests will be considered by the Commission in determining the appropriate action to be taken, but will not serve to make the protestants parties to the proceeding. Any person wishing to become a party must file a motion to intervene. Copies of this filing are on file with the Commission and are available for public inspection.

Lois D. Cashell,

Secretary.

[FR Doc. 97–13437 Filed 5–21–97; 8:45 am]

BILLING CODE 6717–01–M

DEPARTMENT OF ENERGY

Federal Energy Regulatory Commission

[Docket No. CP96–712–000]

Discovery Gas Transmission LLC; Notice of Site Visit

May 16, 1997.

On May 22, 1997, beginning at 9:30 a.m., the Office of Pipeline Regulation (OPR) staff will conduct a compliance inspection of the onshore facilities of the Discovery Gas Transmission LLC Pipeline Construction Project in Lafourche Parish, Louisiana, beginning at the Larose Gas Processing Plant site (off state highway 24) in Larose.

All parties may attend. Those planning to attend must provide their own transportation (an air boat is required for most of the pipeline route).

For further information, please contact Paul McKee at (202) 208–1088.

Warren C. Edmunds,

Acting Director, Office of Pipeline Regulation.

[FR Doc. 97–13434 Filed 5–21–97; 8:45 am]

BILLING CODE 6717–01–M

DEPARTMENT OF ENERGY

Federal Energy Regulatory Commission

[Docket No. ER97–2846–000]

Florida Power Corporation; Notice of Filing

May 16, 1997.

Take notice that on May 5, 1997, Florida Power Corporation (Florida Power) filed an Application for an Order Approving Market-Based Rates for Sales Outside of Florida. In its Application, Florida Power requests authorization to engage in wholesale, bulk power sales outside of Florida at market-determined prices, including sales not involving Florida Power's generation or transmission. Florida Power requests an effective date of 60 days after this filing, or the date on which the Commission issues an order approving Florida Power's application for market-based rates, whichever is earlier.

A.3 AMENDED NOTICE OF AVAILABILITY—SURPLUS PLUTONIUM DISPOSITION DRAFT ENVIRONMENTAL IMPACT STATEMENT, 45-DAY NEPA REVIEW PERIOD

Dated: July 16, 1998.

Richard D. Wilson,

Acting Assistant Administrator.

[FR Doc. 98–19832 Filed 7–23–98; 8:45 am]

BILLING CODE 6560–50–P

ENVIRONMENTAL PROTECTION AGENCY

[ER–FRL–5494–1]

Environmental Impact Statements and Regulations; Availability of EPA Comments

Availability of EPA comments prepared July 6, 1998 Through July 10, 1998 pursuant to the Environmental Review Process (ERP), under Section 309 of the Clean Air Act and Section 102(2)(c) of the National Environmental Policy Act as amended. Requests for copies of EPA comments can be directed to the Office of Federal Activities AT (202) 564–5076. An explanation of the ratings assigned to draft environmental impact statements (EISs) was published in FR dated April 10, 1998 (63 FR 17856).

Draft EISs

ERP No. D–FRC–J05078–MT Rating EO2, Missouri-Madison Hydroelectric (FERC No. 2188) Project, Issuing a New licence (Relicense) for Nine Dams and Associated Facilities, MT.

Summary: EPA expressed environmental objections regarding FERC's rejection of Section 10 (j) recommendations; inadequacies in the analysis of thermal issues; the potential for impairment to the beneficial uses; and the rejection of some State Clean Water Act 401 conditions. EPA believes FERC should ensure license conditions that require hydropower operations be done in the best practicable manner to minimize harm to beneficial uses. License conditions also need to incorporate thermal success criteria and appropriate language to reopen the license if success criteria are not adequately attained by proposed mitigation. EPA believes additional information is needed to fully assess and mitigate all potential impacts of the management actions.

ERP No. D–IBR–J28020–UT Rating EO2, Narrows Dam and Reservoir Project, Construction of Supplemental Water Supply for Agricultural and Municipal Water Use, Gooseberry Creek, Sanpete and Carbon Counties, UT.

Summary: EPA expressed environmental objections to the proposed project, and stated that it believes additional, less damaging alternatives are available which would reduce the project related impacts. EPA requested additional detail on mitigation, project impacts, and alternatives.

ERP No. D–IBR–K39045–CA Rating EC2, Programmatic EIS—Central Valley Project Improvement Act (CVPIA) of 1992 Implementation, Central Valley, Trinity, Contra Costa, Alameda, Santa Clara and San Benito Counties, CA.

Summary: EPA expressed strong support for the overall intent of CVPIA implementation; alternatives which provide a strong two-pronged commitment to ecosystem restoration and flexible, efficient use of developed water supplies; and use of CVPIA tools to provide efficient management of existing, developed water supplies. EPA requested additional information and explanation on the range of implementation, relationship between PEIS and subsequent rules and regulations, and to the relationship of the PEIS to interim implementation programs and the ''Garamendi process''

ERP No. DR–DOI–K40222–TT Rating EO2, Palau Compact Road Construction, Revision to Major Transportation and Communication Link on the Island of Babeldaob, Implementation, Funding, Republic of Palau, Babeldaob Island, Trust Territory of the Pacific Islands.

Summary: EPA expressed environmental objections because the RDEIS did not provide sufficient documentation that all practicable means have been undertaken by the Corps and the Republic of Palau to avoid and minimize adverse impacts associated with placing dredged or fill material in wetlands and other aquatic resources protected under CWA Section 404.

Final EISs

ERP No. F–AFS–L65285–AK, Chasina Timber Sale, Harvesting Timber and Road Construction, Tongass National Forest, Craig Ranger District, Ketchikan Administrative Area, AK.

Summary: Review of the Final EIS was not deemed necessary. No formal comment letter was sent to the preparing agency.

ERP No. F–AFS–L65300–AK, Canal Hoya Timber Sale, Implementation, Stikine Area, Tongass National Forest, Value Comparison Unit (VCU), AK.

Summary: Review of the Final EIS was not deemed necessary. No formal comment letter was sent to the preparing agency.

Dated: July 21, 1998.

William D. Dickerson,

Director, NEPA Compliance Division, Office of Federal Activities.

[FR Doc. 98–19884 Filed 7–23–98; 8:45 am]

BILLING CODE 6560–50–U

ENVIRONMENTAL PROTECTION AGENCY

[ER–FRL–5493–9]

Environmental Impact Statements; Notice of Availability

Responsible Agency: Office of Federal Activities, General Information (202) 564–7167 OR (202) 564–7153.

Weekly receipt of Environmental Impact Statements

Filed July 13, 1998 Through July 17, 1998

Pursuant to 40 CFR 1506.9

EIS No. 980269, Draft EIS, AFS, ID, Eagle Bird Project Area, Timber Harvesting and Road Construction, Idaho Panhandle National Forests, St. Joe Ranger District, Shoshone County, ID, Due: September 07, 1998, Contact: Cameo Flood (208) 245–4517.

EIS No. 980270, Final EIS, FHW, NC, US 70 Improvements Project, I–40 to the Intersection of US 70 and US 70 Business, Funding and COE Section 404 Permit, Wake and Johnston Counties, NC, Due: August 24, 1998, Contact: Nicholas L. Graf, P.E. (919) 733–7842 ext. 260.

EIS No. 980271, Draft EIS, FHW, IN, US 231 Transportation Project, New Construction from CR–200 N to CR–1150′1, Funding, Right-of-Way Permit and COE Section 404 Permit, Spencer and Dubois Counties, IN, Due: October 15, 1998, Contact: Douglas N. Head (317) 226–7487.

EIS No. 980272, Draft EIS, NOA, MS, Grand Bay National Estuarine Research Reserve (NERR), Designation, To Conduct Research, Educational Project and Construction, East of the City of Biloxi, Jackson County, MS, Due: September 07, 1998, Contact: Stephanie Thornton (301) 713–3125 ext. 110

EIS No. 980273, Draft Supplement, FTA, PR, Tren Urbano Transit Project, Updated Information for the Minillas Extension, Construction and Operation, San Juan Metropolitan Area, Funding, NPDES Permit, US Coast Guard Bridge Permit and COE Section 10 and 404 Permits, PR, Due: September 07, 1998, Contact: Alex McNeil (404) 562–3511.

EIS No. 980274, Final EIS, FRC, NB, Kingsley Dam Project (FERC. No. 1417) and North Platte/Keystone Diversion Dam (FERC. No. 1835) Hydroelectric Project, Application for Licenses, Near the confluence of the North/South Platte Rivers, Keith, Lincoln, Garden, Dawson and Gasper Counties, NB, August 24, 1998, Contact: Frankie Green (202) 501–7704.

EIS No. 980275, Draft EIS, FAA, NC, Charlotte/Douglas International Airport, Construction and Operation, New Runway 17/35 (Future 18L/36R Associated Taxiway Improvements, Master Plan Development, Approval Airport Layout Plan (ALP) and COE Section 404 Permit, Mecklenburg County, NC, Due: September 07, 1998, Contact: Thomas M. Roberts (404) 305–7153.

EIS No. 980276, Draft EIS, BOP, PA, Greater Scranton Area, United States Penitentiary (USP) Construction and Operation, Site Selection, Lackawanna and Wayne Counties, PA, Due: September 8, 1998, Contact: David J. Dorworth (202) 514–6470.

EIS No. 980277, Draft EIS, DOE, ID, Advanced Mixed Waste Treatment Project, Construction and Operation, Site Selected, Idaho National Engineering and Environmental Laboratory (INEEL), Eastern Snake River Plain, ID, Due: September 11, 1998, Contact: John Medema (208) 526–1407.

EIS No. 980278, Final EIS, AFS, ID, North Round Valley Timber Sales and Road Construction, Implementation, Payette National Forest, New Meadows Ranger District, Adams County, ID, Due: August 24, 1998, Contact: Kimberly Brandel (208) 347–0300.

Amended Notices

EIS No. 980171, Draft EIS, COE, TX, Dallas Floodway Extension, Implementation, Trinity River Basin, Flood Damage Reduction and Environmental Restoration, Dallas County, TX, Due: August 14, 1998, Contact: Gene T. Rice, Jr. (817) 978–2110. Published FR 05–15–98—Review Period extended.

EIS No. 980267, Draft EIS, DOE, CA, NM, TX, ID, C, WA, Surplus Plutonium Disposition (DOE/EIS–0283) for Siting, Construction and Operation of three facilities for Plutonium Disposition, Possible Sites Hanford, Idaho National Engineering and Environmental Laboratory, Pantex Plant and Savannah River, CA, ID, NM, SC, TX and WA, Due: September 16, 1998, Contact: G. Bert Stevenson (202) 586–5368. This EIS was inadvertently omitted from the 07–17–98 Federal Register. The official 45 days NEPA review period is calculated from 07–17–98.

Dated: July 21, 1998.

William D. Dickerson,

Director, NEPA Compliance Division, Office of Federal Activities.

[FR Doc. 98–19885 Filed 7–23–98; 8:45 am]

BILLING CODE 6560–50–P

FEDERAL COMMUNICATIONS COMMISSION

Notice of Public Information Collection(s) Submitted to OMB for Review and Approval

July 17, 1998.

SUMMARY: The Federal Communications Commissions, as part of its continuing effort to reduce paperwork burden invites the general public and other Federal agencies to take this opportunity to comment on the following information collection, as required by the Paperwork Reduction Act of 1995, Public Law 104–13. An agency may not conduct or sponsor a collection of information unless it displays a currently valid control number. No person shall be subject to any penalty for failing to comply with a collection of information subject to the Paperwork Reduction Act (PRA) that does not display a valid control number. Comments are requested concerning (a) whether the proposed collection of information is necessary for the proper performance of the functions of the Commission, including whether the information shall have practical utility; (b) the accuracy of the Commission's burden estimate; (c) ways to enhance the quality, utility, and clarity of the information collected; and (d) ways to minimize the burden of the collection of information on the respondents, including the use of automated collection techniques or other forms of information technology.

DATES: Written comments should be submitted on or before August 24, 1998. If you anticipate that you will be submitting comments, but find it difficult to do so within the period of time allowed by this notice, you should advise the contact listed below as soon as possible.

ADDRESSES: Direct all comments to Les Smith, Federal Communications Commissions, Room 234, 1919 M St., N.W., Washington, DC 20554 or via internet to lesmith@fcc.gov.

FOR FURTHER INFORMATION CONTACT: For additional information or copies of the information collections contact Les Smith at 202–418–0217 or via internet at lesmith@fcc.gov.

SUPPLEMENTARY INFORMATION:

OMB Approval Number: 3060–0089.

Title: Application for Land Radio Station Authorization in the Maritime Services.

Form No.: FCC 503.

Type of Review: Revision of a currently approved collection.

Respondents: Individuals or households; Businesses or other for-profit entities; Not-for-profit institutions; State, Local or Tribal Government.

Number of Respondents: 700.

Estimated Time Per Response: 45 minutes.

Frequency of Response: On occasion reporting requirements.

Cost to Respondents: $76,224 ($115 application fee for a new station; $90 application fee to modify an existing land station; postage).

Total Annual Burden: 525 hours.

Needs and Uses: FCC Rules require that applicants file FCC Form 503 when applying for a new station or when modifying an existing land radio station in the Maritime Mobile Service or an Alaska Public Fixed Station. This form is required by the Communications Act of 1934, as amended, International Treaties, and FCC Rules—47 CFR Parts 1.922, 80.19, and 80.29. The data collected are necessary to evaluate a request for station authorization in the Maritime Services or an Alaska Public Fixed Station, to issue licenses, and to update the database to allow proper management of the frequency spectrum. FCC Form 503 is being revised to collect Antenna Structure Registration Number/ or FCC Form 854 File Number, and Internet or E-mail address of the applicant. Due to changes in the antenna clearance procedures, we no longer need to collect certain antenna information, such as the name of the nearest aircraft landing area and the distance and the direction to the nearest runway. The instructions are being edited accordingly.

Federal Communications Commission.

Magalie Roman Salas,

Secretary.

[FR Doc. 98–19715 Filed 7–23–98; 8:45 am]

BILLING CODE 6712–01–P

FEDERAL COMMUNICATIONS COMMISSION

Notice of Public Information Collection(s) Submitted to OMB for Review and Approval

July 18, 1998.

SUMMARY: The Federal Communications Commission, as part of its continuing effort to reduce paperwork burden invites the general public and other Federal agencies to take this opportunity to comment on the following information collection, as required by the Paperwork Reduction Act of 1995, Pub. L. 104–13. An agency may not conduct or sponsor a collection of information unless it displays a currently valid control number. No person shall be subject to any penalty

A.4 AMENDED NOTICE OF AVAILABILITY—SURPLUS PLUTONIUM DISPOSITION DRAFT ENVIRONMENTAL IMPACT STATEMENT, 60-DAY NEPA REVIEW PERIOD

Burden Statement: The annual burden for this collection of information is estimated to average fourteen work weeks of professional effort at $840 per week, and seven work weeks of clerical support at $360 per week for the government. Approximately 210 requests may be made annually with an average of one hour spent on each request by both entities. The total costs are attributed to labor hours and overhead since there is no capital investment required for this collection of information. Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal agency. This includes the time needed to review instruction; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instruction and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection information; and transmit or otherwise disclose the information.

Dated: August 3, 1998.

Robert Perciasepe,

Assistant Administrator for Air and Radiation.

[FR Doc. 98–21210 Filed 8–6–98; 8:45 am]

BILLING CODE 6560–50–P

ENVIRONMENTAL PROTECTION AGENCY

[FRL–6139–8]

Agency Information Collection Activities: Comment Request Up for Renewal

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice.

SUMMARY: In compliance with the Paperwork Reduction Act (44 U.S.C. 3501 *et seq.*), this document announces that EPA is planning to submit the following continuing Information Collection Request (ICR) to the Office of Management and Budget (OMB): EPA Worker Protection Standard for Hazardous Waste Operations and Emergency Response, EPA ICR #1426.03, OMB Control #2050–0105, Expiration 1/31/99. Before submitting ICR to OMB and Budget (OMB) for review and approval, EPA is soliciting comments on specific aspects of the collection as described below.

DATES: Comments must be submitted on or before October 3, 1998.

ADDRESSES: Office of Solid Waste and Emergency Response, 401 M. Street, SW, MS 5101, Washington, DC 20460.

Remit Comments to: Sella M. Burchette, S EPA/ERT, 2890 Woodbridge Ave., Blg 18, MS 101, Edison, NJ 08837–3679.

To obtain a copy at no charge, please contact Sella Burchette at (732) 321–6726/FAX: (732) 321–6724/or electronically at burchette.sella@epamail.epa.gov.

SUPPLEMENTARY INFORMATION:

Affected entities: Entities affected by this action are those State and local employees engaged in hazardous waste operations and emergency response in the 27 States that do not have Occupational Safety and Health Administration (OSHA) approved State plans.

Title: EPA Worker Protection Standard for Hazardous Waste Operations and Emergency Response, EPA ICR #1426.03, OMB Control #2050–0105, Expiration 1–31–99. This is a request for renewal, without change, of a currently approved collection.

Abstract: Section 126 (f) of the Superfund Amendments and Reauthorization Act of 1986 (SARA) require EPA to set worker protection standards for State and local employees engaged in hazardous waste operations and emergency response in the 27 States that do not have Occupational Safety and Health Administration approved State plans. The EPA coverage, required to be identical to the OSHA standards, extends to three categories of employees: those in clean-ups at uncontrolled hazardous waste sites, including corrective actions at Treatment, Storage and Disposal (TSD) facilities regulated under the Resource Conservation and Recovery Act (RCRA); employees working at routine hazardous waste operations at RCRA TSD facilities; and employees involved in emergency response operations without regard to location. This ICR renews the existing mandatory recordkeeping collection of ongoing activities including monitoring of any potential employee exposure at uncontrolled hazardous waste site, maintaining records of employee training, refresher training, medical exams, and reviewing emergency response plans.

An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The OMB control numbers for EPA's regulations are listed in 40 CFR part 9 and 48 CFR Chapter 15.

The EPA would like to solicit comments to:

(i) evaluate whether the proposed collection of information is necessary for the proper performance of the functions of the agency, including whether the information will have practical utility;

(ii) evaluate the accuracy of the agency's estimates of the burden of the proposed collection of information;

(iii) enhance the quality, utility and clarity of the information to be collected; and

(iv) minimize the burden of the collection of information on those who are to respond, including though the use of appropriate automated electronic, mechanical, or other technology collection techniques or other forms of information technology, e.g. permitting electronic submission of responses.

Burden Statement: The annual recordkeeping burden for this collection is estimated to average 10.64 hours per site or event. The estimated number of respondents is approximated at 100 RCRA regulated TSD facilities or uncontrolled hazardous waste sites; 23,900 State and local police departments, fire departments or hazardous materials response teams. The estimated total burden hours on respondents: 255,427. The frequency of collection: continuous maintenance or records.

Send comments regarding these matters, or any other aspect of the information collection, including suggestions for reducing the burden, to the address listed above.

Dated: July 30, 1998.

Larry Reed,

Acting Office Director, Office of Emergency and Remedial Response.

[FR Doc. 98–21211 Filed 8–6–98; 8:45 am]

BILLING CODE 6560–50–P

ENVIRONMENTAL PROTECTION AGENCY

[ER–FRL–5494–3]

Environmental Impact Statements; Notice of Availability

RESPONSIBLE AGENCY: Office of Federal Activities, General Information (202) 564–7167 OR (202) 564–7153.

Weekly receipt of Environmental Impact Statements, Filed July 27, 1998 Through July 31, 1998, Pursuant to 40 CFR 1506.9.

EIS No. 980287, DRAFT EIS, COE, CA, Los Angeles County Drainage Area

(LACDA) Water Conservation and Supply and Santa Fe-Whittier Narrows Dams Feasibility Study, Implementation, Los Angeles County, CA, Due: September 21, 1998, Contact: Ms. Debbie Lamb (213) 452–3798.

EIS No. 980288, FINAL EIS, AFS, CA, Eight Eastside Rivers, Wild and Scenic River Study, Suitability or Nonsuitability, Tahoe National Forest and Lake Tahoe Management Unit, Land and Resource Management Plans, Alpine, El Dorado, Placer, Nevada and Sierra Counties, CA, Due: September 8, 1998, Contact: Phil Horning (530) 478–6210.

EIS No. 980289, FINAL EIS, FHW, TX, Loop 49 Southern Section Construction, TX–155 to TX–110, Funding, Tyler, Smith County, TX, Due: September 8, 1998, Contact: Walter C. Waidelich (512) 916–5988.

EIS No. 980290, DRAFT EIS, NPS, CA, Redwood National and State Parks General Management Plan, Implementation, Humboldt and Del Norte Counties, CA, Due: October 9, 1998, Contact: Alan Schmierer (414) 427–1441.

EIS No. 980291, DRAFT EIS, FHW, MN, TH–23 Reconstruction, MN-TH–22 in Richmond extending through the Cities of Richmond, Cold Spring and Rockville to I–94, Funding, Stearns County, MN, Due: September 22, 1998, Contact: Cheryl Martin (612) 291–6120.

EIS No. 980292, DRAFT EIS, FHW, MO, MO–63 Corridor Project, Transportation Improvement extending from south of the Phelps/Maries County Line and South of Route W near Vida, Funding and COE Section 404 Permit, City of Rolla, Phelps and Maries Counties, MO, Due: October 3, 1998, Contact: Don Neumann (573) 636–7104.

EIS No. 980293, FINAL EIS, FHW, TN, Shelby Avenue/Demonbreum Street Corridor, from I–65 North to I–40 West in Downtown Nashville, Funding, U.S. Coast Guard Permit and COE Section 404 Permit, Davidson County, TN, Due: September 8, 1998, Contact: James E. Scapellato (615) 736–5394.

EIS No. 980294, DRAFT EIS, NOA, MN, Minnesota's Lake Superior Costal Program, Approval and Implementation, St. Louis and Cook Counties, MN, Due: September 21, 1998, Contact: Joseph A. Uravitch (301) 713–3155.

EIS No. 980295, DRAFT EIS, BLM, WY, Carbon Basin Coal Project Area, Coal Lease Application for Elk Mountain/Saddleback Hills, Carbon County, WY, Due: October 6, 1998, Contact: Jon Johnson (307) 775–6116.

EIS No. 980296, FINAL EIS, BLM, AK, Northeast National Petroleum Reserve-Alaska (NPR-A), Integrate Activity Plan, Multiple-Use Management, for Land within the North Slope Borough, AK, Due: September 8, 1998, Contact: Gene Terland (907) 271–3344.

EIS No. 980297, FINAL SUPPLEMENT, AFS, MT, Helena National Forest and Elkhorn Mountain portion of the Deerlodge National Forest Land and Resource Management Plan, Updated Information on Oil and Gas Leasing, Implementation several counties, MT, Due: September 08, 1998, Contact: Tom Andersen (Ext 277) (406) 446–5201.

EIS No. 980298, FINAL EIS, COE, CA, Montezuma Wetlands Project, Use of Cover and Non-cover Dredged Materials to restore Wetland, Implementation, Conditional-Use-Permit, NPDES and COE Section 10 and 404 Permit, Suisum Marsh in Collinsville, Solano County, CA, Due: September 08, 1998, Contact: Liz Varnhagen (415) 977–8451.

EIS No. 980299, FINAL EIS, USA, MD, Aberdeen Proving Ground, Pilot Testing of Neutralization/Biotreatment of Mustard Agent (HD), Design, Construction and Operation, NPDES and COE Section 404 Permit, Harford County, MD, Due: September 08, 1998, Contact: Mr. Matt Hurlburt (410) 612–7027.

EIS No. 980300, DRAFT EIS, COE, AR, Grand Prairie Area Demonstration Project, Implementation, Water Conservation, Groundwater Management and Irrigation Water Supply, Prairie, Arkansas, Monroe and Lonoke Counties, AR, Due: September 21, 1998, Contact: Edward P. Lambert (901) 544–0707.

Amended Notices

EIS No. 980267, DRAFT EIS, DOE, CA, NM, TX, ID, SC, WA, Surplus Plutonium Disposition (DOE/EIS–0283) for Siting, Construction and Operation of three facilities for Plutonium Disposition, Possible Sites Hanford, Idaho National Engineering and Environmental Laboratory, Pantex Plant and Savannah River, CA, ID, NM, SC, TX and WA, Due: September 16, 1998, Contact: G. Bert Stevenson (202) 586–5368. The DOE granted a 60-Day review period for the above project.

EIS No. 980269, DRAFT EIS, AFS, ID, Eagle Bird Project Area, Timber Harvesting and Road Construction, Idaho Panhandle National Forests, St. Joe Ranger District, Shoshone County, ID, Due: September 07, 1998, Contact: Cameo Flood (208) 245–4517. Published FR–07–24–98—Due Date Correction.

Dated: August 4, 1998.

Joseph C. Montgomery,

Environmental Specialist, Office of Federal Activities.

[FR Doc. 98–21235 Filed 8–7–98; 8:45 am]

BILLING CODE 6560–50–U

ENVIRONMENTAL PROTECTION AGENCY

[FRL–6139–5]

Notice of Proposed CERCLA Section 122(h)(1) Administrative Cost Recovery Settlement

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposal of CERCLA section 106 abatement action and section 122(h)(1) administrative cost recovery settlement for the Cecil's Transmission Repair site.

SUMMARY: U.S. EPA proposes to address the potential liability of Buhl and Laura Smith (''Settling Parties'') under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (''CERCLA''), 42 U.S.C. 9601 *et seq.*, by providing for performance of removal actions to abate an imminent and substantial endangerment to the public health, welfare or the environment resulting from the actual or threatened release of hazardous substances at or from the Cecil's Transmission Repair Site (''the Site''), located at 197 and 209 Collier Road, Doylestown, Wayne County, Ohio. U.S. EPA proposes to address the potential liability of the Settling Parties by execution of a CERCLA section 122(h)(1) Administrative Order on Consent (''AOC''), prepared pursuant to 42 U.S.C. 9622(h)(1). The key terms and conditions of the AOC may be briefly summarized as follows: (1) The Settling Parties agree to remove and dispose of all hazardous waste located on the portion of the Site they own, including drums; (2) U.S. EPA provides the Settling Parties a covenant not to sue for recovery of response costs (past and oversight costs) pursuant to section 107(a) of CERCLA, 42 U.S.C. 9607(a), and contribution protection as provided by CERCLA sections 113(f)(2) and 122(h)(4), 42 U.S.C. 9613(f)(2) and 9622(h)(4), conditioned upon satisfactory completion of obligations under the AOC. The Site is not on the NPL, and no further response activities at the Site are anticipated at this time. The total response costs connected with

A.5 NOTICE OF AN AMENDED RECORD OF DECISION FOR THE STORAGE AND DISPOSITION OF WEAPONS-USABLE FISSILE MATERIALS

responsibilities are to (1) evaluate the standards of accreditation applied to applicant foreign medical schools; and (2) determine the comparability of those standards to standards for accreditation applied to United States medical schools.

For Further Information Contact: Bonnie LeBold, Executive Director, National Committee on Foreign Medical Education and Accreditation, 7th and D Streets, S.W., Room 3082, ROB #3, Washington, D.C. 20202–7563. Telephone: (202) 260–3636. Beginning September 28, 1998, you may call to obtain the identity of the countries whose standards are to be evaluated during this meeting.

Dated: August 6, 1998.

David A. Longanecker,

Assistant Secretary for Postsecondary Education.

[FR Doc. 98–21757 Filed 8–12–98; 8:45 am]

BILLING CODE 4000–01–M

DEPARTMENT OF ENERGY

Storage and Disposition of Weapons-Usable Fissile Materials

AGENCY: Department of Energy.

ACTION: Notice of an amended Record of Decision.

SUMMARY: The U.S. Department of Energy (DOE) prepared a final programmatic environmental impact statement, Storage and Disposition of Weapons-Usable Fissile Materials (Storage and Disposition PEIS) (DOE/EIS–0229, December 1996) in accordance with the National Environmental Policy Act (NEPA), Council on Environmental Quality NEPA implementing regulations, and DOE implementing procedures. The Storage and Disposition PEIS, among other things, assesses the potential environmental impacts of alternatives and locations for storing weapons-usable fissile materials (plutonium and highly enriched uranium).

On January 14, 1997, DOE issued a Record of Decision (Storage and Disposition ROD), 62 FR 3014, (January 21, 1997), selecting weapons-usable fissile materials storage and surplus plutonium disposition strategies. For plutonium storage, DOE decided to consolidate part of its weapons-usable plutonium storage by upgrading and expanding existing and planned facilities at the Pantex Plant (Pantex) near Amarillo, Texas and the Savannah River Site (SRS) near Aiken, South Carolina. For plutonium currently stored at the Hanford Site (Hanford) near Richland, Washington, and other DOE sites, DOE decided that surplus weapons-usable plutonium would remain at these sites until disposition (or move to lag storage at a disposition facility). The weapons-usable plutonium stored at the Rocky Flats Environmental Technology Site (RFETS), near Golden, Colorado, would be moved to Pantex and the SRS. However, the plutonium destined for the SRS, i.e., non-pit, weapons-usable surplus plutonium, would be moved only if: (1) the plutonium had been stabilized under corrective actions in response to the Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 94–1 and packaged to meet the DOE storage Standard 3013–96, Criteria for Safe Storage of Plutonium Metals and Oxides, (2) the construction and expansion of the Actinide Packaging and Storage Facility (APSF) at the SRS had been completed, and (3) the SRS had been selected in the upcoming Record of Decision for the Surplus Plutonium Disposition Environmental Impact Statement as the immobilization disposition site for surplus weapons-usable plutonium.

In order to support the early closure of the RFETS and the early deactivation of plutonium storage facilities at the Hanford site, DOE is modifying, contingent upon the satisfaction of certain conditions, some of the decisions made in its Storage and Disposition ROD associated with surplus plutonium storage pending disposition. Namely, DOE will take steps that allow: (1) the accelerated shipment of all non-pit surplus weapons-usable plutonium from the RFETS (about 7 metric tons) to the SRS beginning in about 2000, in advance of completion of the APSF in 2001, and (2) the relocation of all Hanford surplus weapons-usable plutonium (about 4.6 metric tons) to the SRS, between about 2002 and 2005, pending disposition. However, consistent with the Storage and Disposition PEIS ROD, DOE will only implement the movement of RFETS and Hanford non-pit, surplus weapons-usable plutonium inventories to the SRS if the SRS is selected as the immobilization disposition site. DOE is preparing the Surplus Plutonium Disposition Environmental Impact Statement (SPD EIS), draft issued July 1998, as part of the decision making process for determining an immobilization site.[1]

To accommodate the storage of Hanford surplus weapons-usable plutonium, DOE will expand the APSF as planned in the Storage and Disposition ROD. In addition, to accommodate the early receipt and storage of the RFETS surplus plutonium, the Department will prepare additional suitable storage space in Building 105–K (i.e., K–Reactor) in the K–Area at the SRS. Portions of Building 105–K will be modified to provide safe and secure plutonium storage. Safeguards and security features will be upgraded, criticality monitoring devices will be installed, structural features will be inspected and repaired, roof vents will be added, and doors will be modified. Several areas in the facility will be decontaminated and excess equipment will be removed to provide additional floor space.

Modifications will also include dismantling and removing unused process equipment in four building areas: Stack Area, Crane Maintenance Area, Crane Wash Area, and Process Room.

Security systems in the four building areas will be reactivated and upgraded to support using them for plutonium storage. Existing systems including the K-Area security perimeter, security control system and building water/power ventilation support systems will be used. Building modifications will provide for truck loading and unloading, material conformation, shipping accountability measurements, and storage. The Department will also declassify (process the metal to produce unclassified ‘‘buttons’’) some of the RFETS plutonium materials using SRS’s FB-Line (in the F-Area) and after declassification, package this material in the APSF to meet the DOE storage Standard 3013–96, Criteria for Safe Storage of Plutonium Metals and Oxides.

All plutonium materials shipped to SRS will be stable and, except for classified metal and/or parts, will be packaged to meet the requirements of the DOE Standard 3013–96, Criteria for Safe Storage of Plutonium Metals and Oxides, before shipment. All shipments of plutonium to SRS will be by Safe Secure Transport (SST) in accordance with applicable DOE, U.S. Department of Transportation and U.S. Nuclear Regulatory Commission requirements and regulations. Some of the RFETS plutonium material packaged and shipped will be less than 50% plutonium by weight; as a result, there will be approximately 3% more total weight of material and a corresponding increase in the number of shipments than considered in the Storage and Disposition PEIS, although the total amount of plutonium in the material will remain about the same.

Under the previous ROD, a maximum of 10 metric tons of surplus plutonium, including plutonium from RFETS and existing onsite plutonium, would be

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[1] SRS has been identified by DOE as the preferred site for the immobilization disposition facility.

stored at SRS in the APSF, pending disposition, provided that SRS is selected as the immobilization site following completion of the Surplus Plutonium Disposition EIS. Transfer of plutonium from RFETS to SRS would begin when the APSF is completed in 2001.

With this amended ROD, a total of approximately 11.6 metric tons of surplus weapons-usable plutonium from Hanford and RFETS (in addition to existing onsite SRS surplus plutonium, for a total of approximately 14 metric tons of surplus plutonium) could be stored at SRS in the APSF and Building 105–K, pending disposition, provided that SRS is selected as the immobilization site. Transfer of plutonium from RFETS to SRS would begin when the modifications to Building 105–K are completed, i.e., in about 2000; shipments of plutonium from Hanford to SRS would begin in about 2002.

This amended ROD only alters DOE's previous decision (Storage and Disposition ROD) for the storage of non-pit, surplus weapons-usable plutonium currently located at the RFETS and Hanford sites. No changes are being made to other storage decisions or any decisions associated with surplus fissile material disposition.

In accordance with 10 CFR 1021.314, DOE has prepared a Supplement Analysis to determine if these changes require a supplement to the Storage and Disposition PEIS under the Council on Environmental Quality Regulations at 40 CFR 1502.9(c). The Supplement Analysis shows that the new proposed action does not result in a substantial change to environmental concerns evaluated in the Storage and Disposition PEIS. Also, the Supplement Analysis shows that the proposed action does not present significant new circumstances or information relevant to the environmental concerns evaluated in the Storage and Disposition PEIS. Therefore, based on the Supplement Analysis, DOE has determined that a supplement to the Storage and Disposition PEIS is not required, and DOE has decided not to prepare such a supplement.

FOR FURTHER INFORMATION CONTACT: For further information on the long-term storage or the disposition of weapons-usable fissile materials, or to receive a copy of the final Storage and Disposition PEIS, the Storage and Disposition EIS ROD or the Supplement Analysis, contact: G. Bert Stevenson, NEPA Compliance Officer, Office of Fissile Materials Disposition (MD–4), U.S. Department of Energy, 1000 Independence Avenue, SW., 1Washington, DC 20585, (202) 586–5368.

For further information on the DOE NEPA process, contact: Carol M. Borgstrom, Director, Office of NEPA Policy and Assistance (EH–42), U.S. Department of Energy, 1000 Independence Avenue, SW., Washington, DC 20585, (202) 586–4600, or leave a message at (800) 472–2756.

SUPPLEMENTARY INFORMATION:

I. Background

A. Current Storage Program and Original Decision for Surplus Weapons-Usable Plutonium

DOE is currently phasing out the storage of all weapons-usable plutonium at RFETS. The phaseout involves shipping all RFETS pits to Pantex, and shipping all RFETS surplus non-pit, weapons-usable plutonium to the SRS (subject to certain conditions) starting in about 2001. As decided in the January 1997 Storage and Disposition PEIS ROD, the stabilized non-pit, surplus weapons-usable plutonium would not be moved unless and until: expansion of the APSF[2] at the SRS had been completed; the RFETS material had been stabilized and packaged to meet the Criteria for Safe Storage of Plutonium Metals and Oxides for long-term storage under corrective actions in response to the Defense Nuclear Facilities Safety Board Recommendation 94–1; and DOE had decided to immobilize plutonium at the SRS. The Department also decided to continue the current storage of surplus plutonium at Hanford, the Idaho National Engineering and Environmental Laboratory (INEEL), and Los Alamos National Laboratory (LANL) pending disposition (or movement to lag storage); and to pursue a strategy for plutonium disposition that would immobilize surplus weapons-usable plutonium in glass or ceramic forms and would allow the burning of some of the surplus weapons-usable plutonium (mostly from pits) as mixed oxide fuel in existing commercial light-water reactors.

B. Need to Change Storage Program

Recently, DOE has estimated that accelerating the closure of RFETS from 2010 to 2006 could save as much as $1.3 billion. Integral to achieving an accelerated closure of the site would be removal of the non-pit, surplus weapons-usable plutonium to SRS two years earlier than the current plan. Removal of the surplus plutonium at RFETS is only one of several steps to realize the savings. Other steps are proposed or ongoing pursuant to separate NEPA review. DOE also expects that the transfer of non-pit, surplus weapons-useable plutonium from Hanford to Savannah River could save as much as $150 million in upgrade and operating costs for plutonium storage facilities at the Hanford Site. As with the RFETS plutonium, the transfer would not be accomplished unless DOE decided to locate the plutonium immobilization facility at the Savannah River Site. The implementation cost for the proposed action is estimated to be approximately $93 million.

Closing RFETS by 2006 would, among other things, require the removal of non-pit, surplus weapons-usable plutonium metal and oxide from RFETS by 2002. In order to remove all the non-pit, surplus weapons-usable plutonium from RFETS by 2002, DOE would have to begin transferring the material to the SRS by January 2000, prior to completing the construction of the APSF.

DOE has also reevaluated plutonium storage operations at Hanford and determined that transferring all (about 4.6 metric tons) non-pit, surplus weapons-usable plutonium from that site for storage could save the Department as much as $150 million by avoiding upgrade and operating costs for plutonium storage facilities at the Hanford Site. DOE is considering the early transfer of plutonium from Hanford to the SRS as a means of achieving this savings.

These transfers would not occur unless DOE decides to immobilize plutonium at the SRS. A ROD to select the immobilization site is anticipated in early 1999 in the SPD EIS.

C. Proposed Action

The Department of Energy is proposing to accelerate the movement of all (about 7 metric tons) of non-pit, surplus weapons-usable plutonium at the RFETS and to move all (about 4.6 metric tons) of the surplus weapons-usable plutonium at Hanford to the SRS for storage pending disposition. The RFETS plutonium would be shipped to the SRS from about January 2000 through 2002. The Hanford plutonium would be shipped to the SRS from about 2002 through 2005.

The plutonium would not be moved to SRS unless the Department decides to disposition (immobilize) the non-pit,

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[2] The APSF has been designed but not built. Construction is scheduled to start in October 1998 and the facility is scheduled to be in operation by October 2001. Expansion of the APSF refers to increasing the vault capacity of the facility to the current design of 5,000 storage positions (sufficient storage space for current SRS materials and RFETS materials).

surplus weapons-usable plutonium at SRS, after completion of the final Surplus Plutonium Disposition Environmental Impact Statement. In addition, the plutonium would not be shipped until it were stabilized and packaged to meet DOE Standard 3013–96, *Criteria for Safe Storage of Plutonium Metals and Oxides* in response to Defense Nuclear Facilities Safety Board Recommendation 94–1. This proposed action is consistent with DOE's objective, as explained in the ROD for the Storage and Disposition PEIS, to reduce over time the number of locations where plutonium is stored in the DOE complex.

Starting in about January 2000, all non-pit, surplus weapons-usable plutonium (except for classified plutonium) would be shipped to Building 105-K. At Building 105-K, the shipping containers[3] would be unloaded using a battery powered fork-lift truck. Material control and accountability measurements would be made at Building 105-K. The shipping containers would then be loaded onto metal pallets and transferred to a storage location in the building. DOE would not open any of the shipping containers in Building 105-K. While in storage, the containers would be inspected on a regular basis to assure external container integrity.[3] DOE has successfully used (and continues to use) shipping containers for plutonium storage at the SRS. No problems with a loss of material confinement have been experienced to date.

Portions of Building 105-K will be modified to facilitate plutonium storage. Safeguards and security features will be upgraded, criticality monitoring devices will be installed, structural features will be inspected and repaired, and roof vents will be added and doors will be modified. Several areas in the facility will be decontaminated and excess equipment will be removed to provide additional floor space.[4]

Modifications will include dismantling and removing unused process equipment in four building areas: Stack Area, Crane Maintenance Area, Crane Wash Area, and Process Room. These areas total approximately 30,000 square feet, are within the security areas that existed for reactor operations, and are adjacent to a currently active highly enriched uranium storage area. Security systems in the four building areas will be reactivated and upgraded to support using them for plutonium storage. Existing systems including the K-Area security perimeter, security control system and building water/power ventilation support systems will be used. Building modifications will provide for truck loading and unloading, material conformation, shipping accountability measurements, and storage.

Some of the RFETS plutonium is in a classified form, which would restrict the International Atomic Energy Agency (IAEA) from access to the material. DOE intends to make the APSF vault, and potentially Building 105-K, available for IAEA inspection. As a result, the RFETS plutonium needs to be declassified. To accomplish this objective, DOE would transfer the classified RFETS plutonium to F-Area for processing (declassifying) in the FB-Line facility at SRS. In the FB-Line facility, the plutonium would be melted using existing facilities and equipment that are part of the plutonium metal production process for which the FB-Line facility was designed. The declassification work would not be done on a continuous basis, but rather whenever processing capabilities were available. The RFETS plutonium would be fashioned into metal ‘‘buttons’’ that are the traditional FB-Line product. After the ‘‘buttons’’ are fabricated, the material would be transferred to the APSF and packaged to meet the requirements of DOE's plutonium storage standard. Then, the material would be placed in type B shipping containers and transported to Building 105-K for storage. Alternatively, the material could remain in the APSF vault, if space is available to allow for operational flexibility.

Some of the RFETS plutonium materials would be less than 50% plutonium by weight and would involve approximately 3% more total weight of material and a corresponding increase in the number of shipments than considered in the S&D PEIS.

Beginning in about 2002, SRS would begin to receive from Hanford stabilized plutonium packaged to meet DOE's long-term standard for placement in the APSF. Once APSF is operating, DOE could transfer a portion of the RFETS material from Building 105-K to the APSF in order to provide for operational flexibility. The plutonium from RFETS and Hanford would remain in storage at the APSF and Building 105-K pending disposition along with existing SRS surplus plutonium.

The plutonium would be transferred in type B shipping containers by truck using methods and routes described in the Storage and Disposition PEIS (i.e., the Department of Energy's Safe Secure Transport System).

If DOE decides to pursue the No Action alternative for the disposition of surplus plutonium in the SPD EIS Record of Decision, the SRS, RFETS, and Hanford materials would remain in storage at their current sites in accordance with the No Action alternative. If the DOE decides to immobilize surplus plutonium at Hanford, the SRS and RFETS materials would be shipped to Hanford in accordance with the decisions reached in the SPD EIS Record of Decision.

II. NEPA Process for Amending ROD

A. Supplement Analysis

Pursuant to DOE regulations in 10 CFR 1021.314, DOE has prepared a Supplement Analysis, Supplement Analysis for Storing Plutonium in the Actinide Packaging and Storage Facility and Building 105-K at the Savannah River Site (July 1998), to help determine whether a supplement to the Storage and Disposition PEIS is required under the Council on Environmental Quality Regulations, 40 CFR 1502.9(c). The Supplement Analysis compares the potential impacts of the new proposed action to the impacts discussed for the plutonium storage alternatives in the Storage and Disposition PEIS. The Supplement Analysis shows that the new proposed action does not make a substantial change to environmental concerns evaluated in the Storage and Disposition PEIS. Furthermore, the Supplement Analysis shows that there are no new significant circumstances or information relevant to environmental concerns and bearing on the proposed action or its impact.

B. Comparison of Potential Impacts

The facilities involved (i.e, Building 105-K and the APSF) are or will be located in existing industrial areas at the SRS.

- Land Resources, Site Infrastructure, Geology and Soils, Biology Resources and Cultural and Paleontological Resources. There are no aquatic habitats or wetlands in these areas nor are there any threatened or endangered species. None of the affected facilities have been nominated for inclusion in the National Register of Historic Places, and there are no plans for such nominations.

Based on evaluations in the Storage and Disposition PEIS and information

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[3] To support the proposed action, DOE would purchase additional Type 9975 shipping containers, which are Type B containers and would also be used for storage. This would be done so that storing the RFETS materials in shipping containers pending disposition will not impact the Department's supply of Type B shipping containers.

[4] A portion of these activities could be completed as part of maintenance, clean-up, and decontamination activities at SRS that DOE has determined are categorically excluded from further NEPA review.

incorporated in the Supplement Analysis from the Final Environmental Impact Statements on the Interim Management of Nuclear Materials (DOE/EIS–0220, October, 1995)(IMNMS EIS) there would be little or no impact to land resources, site infrastructure, geology and soils, biology resources and cultural and Paleontological resources by the construction, operation and expansion of the APSF. This is equally true for Building 105-K since all storage operations would occur within the existing Building 105-K structure.

- It is expected that declassification of the RFETS material would require 100 Mw hrs/yr of electricity. This work would not require modification to the FB-line's electrical system and is well within the capacity of the facility and the site.
- Packaging and Transportation. The transportation routes to the SRS would be the same as those assumed in the Storage and Disposition PEIS (i.e., overland truck routes on interstate highways and state roads). Transportation operations would not change. DOE estimates that the total inter-site transportation impact associated with transferring plutonium from the RFETS and Hanford to the SRS would be 0.07 potential latent cancer fatalities, which would be approximately the same as for the Preferred Alternative in the Storage and Disposition PEIS.[5] DOE estimates that the intra-site transportation activities could add an additional 0.01 latent cancer fatalities to the worker population.[6]
- Air Quality and Noise. Storage: Accomplishing the proposed action, including the modifications to Building 105-K, would add no significant air quality and noise impacts above the existing site baseline. Therefore, air quality and noise impacts from the plutonium storage aspects of the proposed action would be essentially the same as the air quality and noise impacts from the Preferred Alternative of the Storage and Disposition PEIS (i.e., the Upgrade With RFETS Non-Pit Material alternative).

Declassification/Repackaging: DOE estimates there would be a small increase in non-radiological air emissions for declassification operations (i.e., metal conversion operations in FB-Line) above the non-radiological air emissions estimated for the No Action and the Upgrade alternatives in the Storage and Disposition PEIS. Non-radiological air emissions would be well within State and Federal regulatory limits. Repackaging activities are not expected to involve the use of chemicals, beyond a very small amount of decontamination liquid.

- Water Resources. *Storage:* The maximum impact to water resources, above existing site baseline usage and discharges, expected from plutonium storage aspects of DOE's proposed action would be about the same as presented in the Upgrade With RFETS and LANL Material alternative of the Storage and Disposition PEIS,[7] i.e., there would be a 0.01% increase in water use and a 0.1% increase in waste water discharges. The water impacts from the proposed action would have a negligible effect on site water or waste treatment capacity.

The impacts of radiological liquid discharges from Building 105-K are included as part of the No Action alternative in the Storage and Disposition PEIS. DOE expects there would be no significant increase above the No Action alternative discharge levels since, during normal operations, water is not in contact with plutonium storage containers.

Declassification/Repackaging: DOE estimates declassification operations would cause a small and insignificant increase in water usage beyond the water requirement estimated for other site operations.

Repackaging activities in the APSF are expected to have essentially no impact to water resources beyond the site base line operations presented in the No Action alternative of the Storage and Disposition PEIS.[8] Repackaging operations would not significantly increase the use of water resources beyond that required to operate the industrial systems associated with the APSF, e.g., chillers for air conditioning, sanitary sewer, potable water, etc., because additional water is not used in repackaging operations.

- Socioeconomics. *Storage:* The socioeconomic impact of operating Building 105–K for plutonium storage would be essentially the same as the impact described for the Preferred Alternative of the Storage and Disposition PEIS. The socioeconomic impact of modifying Building 105–K and operating both APSF and Building 105–K would be well within the impacts described for the Consolidation alternative of the Storage and Disposition PEIS.

The socioeconomic impacts at RFETS and Hanford of moving surplus plutonium to SRS were analyzed in the Storage and Disposition PEIS. The analysis concluded that this action would phase out plutonium storage at RFETS and Hanford. Approximately 200 direct job losses at Hanford, in addition to the 2000 at RFETS, would result. Compared to the total employment in those areas, the loss of these jobs and the impacts to the regional economies would not be significant. The proposed action would not change the magnitude of these impacts at RFETS, but cause them to occur sooner.

Declassification/Repackaging: DOE estimates there would be negligible additional socioeconomic effects due to operating the APSF for repackaging of RFETS plutonium or operating FB-Line for declassification purposes because the existing site workforce would be used.

- Public and Occupational Health and Safety (normal operations). *Storage. Public and Non-Involved Workers:* Plutonium storage operations in Building 105–K would not result in any additional air or water radiological impacts (beyond those currently associated with other operations in Building 105–K) because no shipping containers or storage containers would be opened in Building 105–K. Since air and water emissions create impacts that affect the non-involved workers and the public, there would be no significant additional radiological impact to the public or non-involved workers from normal operations in Building 105–K. Therefore, the impact from the proposed action to the public and non-involved workers would be essentially the same as the impact from the Preferred Alternative in the Storage and Disposition PEIS.

Involved Workers: DOE estimated that the potential health impact from 50 years of APSF storage to individual involved workers for the Preferred Alternative in the Storage and Disposition PEIS was a latent cancer fatality risk of $5x10^{-3}$ and that $1.5x10^{-1}$ latent cancer fatalities could occur in the involved worker population. DOE estimates that the potential health impacts from 10 years of operating Building 105–K to store plutonium could result in a risk of latent cancer

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[5] The impact is the sum of the impact of transportation of RFETS non-pit plutonium under the Preferred Alternative in the Storage and Disposition PEIS and the incremental impact for shipping the Hanford plutonium.

[6] In inter-site transportation analyses, non-radiological accidents would be the greatest contributor to fatalities. In the case of intra-site transportation, impacts would be due primarily to radiation doses received from normal transportation operations. Effects from intra-site accidents, if any, would likely be negligible. Historically, certified containers maintain their integrity in accident situations.

[7] Table 4.2.6.4–1 of the Storage and Disposition PEIS.

[8] Table 4.2.6.4–1 of the Storage and Disposition PEIS.

fatality for the average Building 105–K involved worker of $1.5x10^{-3}$ and $2.6x10^{-2}$ latent cancer fatalities in the Building 105–K involved worker population. Since the Storage and Disposition PEIS bases health impacts on 50 years of storage, for comparison purposes, the impacts from 50 years of plutonium storage in the APSF are added to the impacts from 10 years of plutonium storage in Building 105–K. Using this approach, the health impacts from storing plutonium in the APSF and in Building 105–K would be 0.18 latent cancer fatalities in the involved worker population of both facilities.

Health impacts to involved workers for the plutonium storage aspects of the proposed action in this Supplement Analysis (0.18 latent cancer fatalities) would be essentially the same as the health impact estimated in the Preferred Alternative of the Storage and Disposition PEIS (0.15 latent cancer fatalities).

Declassification/Repackaging Radiological Impacts. Public, Non-involved Workers, Involved Workers: For declassification operations the potential health effect from the postulated radiation dose to the maximally exposed member of the public at the Site boundary would be $1.7x10^{-6}$ latent cancer fatalities. The potential health effect from the postulated radiation dose to the population surrounding the SRS and to workers would be 0.068 latent cancer fatalities and 0.078 latent cancer fatalities, respectively, above those predicted in the Preferred Alternative in the Storage and Disposition PEIS.

For repackaging operations (i.e., repackaging all plutonium from the RFETS in the APSF for 2 years) the potential health effect from the postulated radiation dose to the maximally exposed member of the public at the site boundary would be $7.5x10^{-12}$ latent cancer fatalities. The potential health effect from the postulated radiation dose to the population surrounding the SRS and to workers would be $1.5x10^{-7}$ latent cancer fatalities and $2.5x10^{-2}$ latent cancer fatalities, respectively, above those predicted in the Preferred Alternative in the Storage and Disposition PEIS. The impacts from repackaging, only the RFETS plutonium that would be declassified in the FB-Line would be less.

Building 105–K Modification. Public, Non-Involved Workers, Involved Workers: No impacts to non-involved workers or the public would be expected from the decontamination, modification, removal, and construction work because this work is not expected to generate significant air or water emissions. Work activities are confined to the interior of Building 105–K and airborne radioactivity levels are routinely monitored during work. Liquid sources would not be released from the building during normal decontamination, removal, or construction work. The potential health impact to workers, in the form of the risk of latent cancer fatality, would be $4x10^{-4}$ for 18 months of decontamination and construction work and the number of latent cancer fatalities that could be expected in the worker population was estimated to be $2x10^{-2}$. The risks associated with the modification of Building 105–K are approximately ten percent of the risks estimated for storage of the plutonium in the Preferred Alternative of the Storage and Disposition PEIS.

Summary

Public: In the Storage and Disposition PEIS, DOE estimated the potential health impact to the population surrounding the SRS from existing site operations and for the Upgrade Alternative over 50 years was 1.1 latent cancer fatalities. Accomplishing the new proposed action would slightly increase that potential health impact to about 1.2 latent cancer fatalities. Emissions would remain within the limits of the National Emission Standards for Hazardous Air Pollutants permits for the APSF and Building 105–K.

Workers: In the Storage and Disposition PEIS, DOE estimated that the potential health impact to the total site workforce from existing site operations over 50 years would be 5.3 latent cancer fatalities. Accomplishing the proposed action would increase the potential health impact to the site workforce by 0.3 to 5.6 latent cancer fatalities. This new estimate in total site workforce health impact is slightly greater than the health impact of 5.3 latent cancer fatalities estimated for the Preferred Alternative in the Storage and Disposition PEIS and is slightly lower than the health impact of 5.7 latent cancer fatalities that DOE estimated for the Consolidation alternative in the Storage and Disposition PEIS.

Storage Chemical Impacts. There would be no significant impact to the public or workers from hazardous chemicals due to plutonium storage operations in Building 105–K. There are no industrial systems or other operations involved in the plutonium storage operations that would add to existing Building 105–K chemical impacts.

- Waste Management. Modifications to Building 105–K: DOE estimates that decontamination and removal activities which would make Building 105–K available for storage operations would generate 750 cubic meters of low level waste, which is less than 1% of the low-level waste DOE expects to be generated by SRS activities as described in the No Action alternative of the Storage and Disposition PEIS. DOE does not expect to generate any significant quantities of other wastes in order to modify Building 105–K. No high-level radioactive waste would be generated.

Storage: DOE estimated that storing plutonium in the APSF, as described in the Preferred Alternative of the Storage and Disposition PEIS, would not generate any of the following radioactive wastes: high-level, transuranic, mixed transuranic, low-level, mixed low-level or hazardous (other than minor quantities). DOE estimates that storing plutonium in Building 105–K would not significantly change the estimate for the Preferred Alternative in the Storage and Disposition PEIS.

Declassification/Repackaging: DOE estimates that declassifying RFETS plutonium would generate about: 88 m^3 of transuranic waste; 4 m^3 of mixed waste; and 44 m^3 of low-level radioactive waste. No high-level waste is expected. These additional amounts of waste represent a small fraction of these types of waste that are generated at the site by other operations. The site has sufficient capacity to accommodate this increase in waste volume.

- Accidents. *Storage:* For the Building 105–K design basis accidents, DOE estimated that the maximum impact to the population surrounding the SRS could be 0.34 latent cancer fatalities in the unlikely event that plutonium were released to the 105–K Building as a result of corrosion of a storage container. This risk is greater than the risk estimated for storage of plutonium in the Preferred Alternative and other alternatives of the S&D PEIS; however, the risk would be comparable to the same type of accident for the storage of plutonium at SRS in existing storage vaults as analyzed in the Continuing Storage Alternative for the Storage of Plutonium and Uranium in the IMNM EIS. (The IMNM accident analysis showed 0.31 latent cancer fatalities for the population surrounding SRS.) DOE will implement administrative controls (including scheduled surveillances) to limit actions or conditions that might lead to a release of radioactive materials under accident conditions. The risk to the maximally exposed member of the public and non-involved worker would also be greater than the risk for storage of plutonium estimated in the Preferred Alternative and other alternatives of the Storage and Disposition PEIS but would be low (less than $3x10^{-3}$ latent cancer fatalities).

For the postulated beyond design basis accidents, DOE estimated that the maximum impact to the population could be $2.7x10^{-4}$ latent cancer fatalities in the event of a vault fire. This risk is greater than the risk estimated for storage of plutonium in the Preferred Alternative of the Storage and Disposition PEIS, but low. The risks to the maximally exposed public and the non-involved worker would also be greater than the risks for the storage of plutonium estimated in the Preferred Alternative of the Storage and Disposition PEIS but would be extremely small (less than $2x10^{-8}$ latent cancer fatalities). DOE estimated that the involved worker may be subject to injury and, in some cases, fatality as a result of potential beyond design basis accidents.

Declassification/Repackaging: DOE estimates that for declassification operation in the FB-Line, the risk to the public would be $1.2x10^{-3}$ latent cancer fatalities, $2.6x10^{-4}$ latent cancer fatalities to the maximally exposed off-site individual and $4.5x10^{-3}$ latent cancer fatalities/yr to the non-involved worker. These risks are slightly greater than the risks for storage of plutonium estimated in the Upgrade Alternative of the Storage and Disposition PEIS, but are low. For repackaging operations in the APSF, the risks are low and similar to the impacts presented for storage of plutonium in the Preferred Alternative of the Storage and Disposition PEIS (less than $2x10^{-4}$ latent cancer fatalities).

- *Environmental Justice.* For environmental justice impacts to occur, there must be significant and adverse human health or environmental impacts that disproportionately affect minority populations and/or low-income populations. The Supplement Analysis shows that accomplishing the proposed action would be within regulatory limits and the impacts would be very low during routine operations.

The same Supplement Analyses also shows that accidents would not result in a significant risk of adverse human health or environmental impacts to the population who reside within 80 kilometers of the SRS. Therefore, such accidents would not have disproportionately high or adverse risk of impacts on minority or low-income populations.

Based on the analysis in this supplement analysis, no disproportionate, high or adverse impact would be expected on minority or low-income populations.

C. Environmentally Preferable Alternative

The environmental analyses in Chapter 4 of the Storage and Disposition PEIS indicate that the environmentally preferable alternative (the alternative with the lowest environmental impacts over the 50 years considered in the PEIS) for storage of weapons-usable fissile materials would be the Storage and Disposition PEIS Preferred Alternative, which consists of No Action at Hanford, Idaho National Engineering and Environmental Laboratory, Los Alamos National Laboratory, Argonne National Laboratory, and Nevada Test Site (NTS) (no fissile materials are or would be stored at the NTS) pending disposition, phaseout of storage at RFETS, and upgrades at the Oak Ridge Reservation, SRS, and Pantex. The proposed action as modified by this amended decision is still the environmentally preferred alternative.

III. Non-Environmental Considerations

A. Economic Analysis

DOE has estimated that accelerating the closure of RFETS from 2010 to 2006 in accordance with the DOE Closure 2006 Rocky Flats Closure Project Management Plan could save as much as $1.3 billion. Closing RFETS by 2006 would require the removal of non-pit, surplus weapons-usable plutonium metal and oxide from RFETS by 2002. The early removal of the RFETS non-pit, surplus weapons-usable plutonium supports the early deactivation, decontamination, and decommissioning of the RFETS plutonium storage and packaging facilities.

DOE also expects that the transfer of non-pit, surplus weapons-usable plutonium from Hanford to the SRS, could save as much as $150 million in upgrade and operating costs for plutonium storage facilities at the Hanford Site. As with the RFETS plutonium, the transfer would not be accomplished unless DOE decided to locate the plutonium immobilization disposition facility at the SRS.

The implementation cost for the proposed action is estimated to be approximately $93 million.

B. Nonproliferation

From a nonproliferation standpoint, the highest standards for safeguards and security will be employed during transportation and storage. There is no change in this regard from the original PEIS ROD.

IV. Amended Decision

Consistent with the Preferred Alternative in the Storage and Disposition PEIS, and the Supplement Analysis, Storing Plutonium in the Actinide Packaging and Storage Facility and Building 105–K at the Savannah River Site (July 1998), the Department has decided to reduce, over time, the number of locations where the various forms of plutonium are stored, through a combination of storage alternatives in conjunction with a combination of disposition alternatives.

The Department has decided to modify those aspects of the Storage and Disposition ROD (62 FR 3014) concerning the storage of weapons-usable plutonium at RFETS and Hanford, pending disposition. Other aspects of the Storage and Disposition ROD remain unaltered. DOE has decided to:

- Modify an existing building (105–K) at SRS to allow the receipt and storage of RFETS non-pit, surplus weapons-usable plutonium.

If the Department decides to select SRS as the immobilization site in the SPD EIS ROD, then the Department will:

- Ship all RFETS non-pit, surplus weapons-usable plutonium (about 7 MT) to SRS beginning in about 2000 through about 2002;
- Store RFETS non-classified plutonium metal and/or parts in shipping containers in Building 105–K at SRS beginning in about 2000;
- For RFETS classified surplus metal and/or parts, declassify the material in the FB-Line facility and repackage the material in the APSF (after construction of the APSF in about 2001). In the FB-Line, the plutonium will be melted using existing facilities and equipment that are part of the plutonium metal production process for which FB-Line was designed;
- Store the declassified material in Building 105–K in shipping containers or the APSF vault if space is available;
- Ship all Hanford non-pit, surplus weapons-usable plutonium (approximately 4.6 metric tons) from about 2002 through 2005 and store this material in the APSF;
- Before shipment, all plutonium transported from RFETS (except for the classified metal and/or parts) and Hanford will be stabilized[9] and packaged in accordance with DOE Standard-3013–96, Criteria for Safe Storage of Plutonium Metals and Oxides for long-term storage. All shipments of plutonium, including the classified metal and parts, will be by SST in

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[9] Hanford plutonium fuel that is stable would not need to be stabilized.

accordance with applicable DOE, U.S. Department of Transportation and U.S. Nuclear Regulatory Commission requirements and regulations. Plutonium will be packaged in certified Type B accident resistant packages for transport; and

- The RFETS and Hanford Material stored at SRS may be moved between Building 105–K and the APSF to allow for operational flexibility.

Some of the surplus plutonium at RFETS and Hanford, approximately 1 metric ton at each site, is currently under International Atomic Energy Agency (IAEA) safeguards as a component of the United States nonproliferation policy to remove weapons-usable fissile materials from use for defense purposes. DOE has designed the APSF for IAEA safeguards and intends that plutonium stored in the APSF will be available for IAEA safeguards. Surplus plutonium under IAEA safeguards at RFETS and Hanford that may be shipped to the SRS, will remain available for IAEA safeguards in the APSF. Since plutonium that may be stored in Building 105-K will remain in shipping containers and not be accessible for full IAEA safeguards controls (e.g., physical sampling, destructive analyses), DOE is considering, with the IAEA, the application of IAEA verification controls to ensure the plutonium stored in Building 105–K is not diverted for defense purposes. In addition, DOE intends, as indicated in the Storage and Disposition ROD, that DOE's program for surplus plutonium disposition will include IAEA verification as appropriate.

If the DOE decides to pursue the No Action alternative for the disposition of surplus plutonium, the SRS, RFETS, and Hanford materials would remain in storage at their current sites in accordance with the No Action alternative in the Storage and Disposition PEIS ROD. If the DOE decides to immobilize surplus plutonium at Hanford, the SRS and RFETS materials would be shipped to Hanford in accordance with the decisions reached in the SPD EIS ROD.

V. Conclusion

Under the previous ROD, a maximum of 10 metric tons of surplus plutonium, including plutonium from RFETS and existing onsite plutonium, would be stored at SRS in the APSF, pending disposition, provided that SRS is selected as the immobilization site following completion of the SPD EIS. Transfer of plutonium from RFETS to SRS would begin when the APSF is completed in 2001.

With this amended ROD, a total of approximately 11.6 metric tons of surplus plutonium from both Hanford and RFETS (in addition to existing onsite SRS surplus plutonium, for a total of approximately 14 metric tons of surplus plutonium) would be stored at SRS in the APSF and Building 105–K, pending disposition, provided SRS is selected as the immobilization site. Transfer of plutonium from RFETS to SRS would begin when the modifications to Building 105–K are completed, i.e., in about 2000; shipments of plutonium from Hanford to SRS would begin in about 2002.

DOE has decided to implement a revised program to provide for safe and secure storage of weapons-usable fissile materials. DOE will prepare to advance the consolidation of the storage of weapons-usable plutonium by modifying existing facilities at the SRS in South Carolina, and phasing out surplus plutonium storage at RFETS in Colorado and Hanford in Washington. Consistent with the Storage and Disposition PEIS ROD, this Amended ROD supports the Department's objectives to phase out the storage of all weapons-usable plutonium at the RFETS and Hanford as soon as possible and to reduce the number of sites where surplus weapons-usable plutonium is stored.

The decision process reflected in this Notice complies with the requirements of the National Environmental Policy Act (NEPA) (42 U.S.C. 4321 *et seq.*) and its implementing regulations in 40 CFR Parts 1500–1508 and 10 CFR Part 1021.

Issued in Washington, D.C., August 6, 1998.

Laura S. H. Holgate,

Director, Office of Fissile Materials Disposition.

[FR Doc. 98–21744 Filed 8–12–98; 8:45 am]

BILLING CODE 6450–01–P

DEPARTMENT OF ENERGY

Environmental Management Site-Specific Advisory Board, Pantex Plant, Amarillo, Texas

AGENCY: Department of Energy.

ACTION: Notice of open meeting.

SUMMARY: Pursuant to the provisions of the Federal Advisory Committee Act (Pub. L. No. 92–463, 86 Stat. 770) notice is hereby given of the following Advisory Committee meeting: Environmental Management Site-Specific Advisory Board (EM SSAB), Pantex Plant, Amarillo, Texas.

DATE AND TIME: Tuesday, August 25, 1998: 1:30 p.m.–5:30 p.m.

ADDRESSES: Amarillo Association of Realtors, Amarillo, Texas.

FOR FURTHER INFORMATION CONTACT: Jerry S. Johnson, Assistant Area Manager, Department of Energy, Amarillo Area Office, P.O. Box 30030, Amarillo, TX 79120 (806) 477–3125.

SUPPLEMENTARY INFORMATION: *Purpose of the Committee:* The Board provides input to the Department of Energy on Environmental Management strategic decisions that impact future use, risk management, economic development, and budget prioritization activities.

Tentative Agenda

1:30 p.m. Welcome—Agenda Review—Approval of Minutes
1:45 p.m. Co-Chair Comments
2:00 p.m. Immobilization
3:00 p.m. Break
3:15 p.m. Updates—Occurrence Reports—DOE
3:45 p.m. Ex-Officio Reports
4:00 p.m. Low-Level Waste Seminar Update
5:00 p.m. Task Force/Subcommittee Minutes
5:30 p.m. Closing Remarks/Adjourn

Public Participation: The meeting is open to the public, and public comment will be invited throughout the meeting. Written statements may be filed with the Committee either before or after the meeting. Written comments will be accepted at the address above for 15 days after the date of the meeting. Individuals who wish to make oral statements pertaining to agenda items should contact Jerry Johnson's office at the address or telephone number listed above. Requests must be received 5 days prior to the meeting and reasonable provision will be made to include the presentation in the agenda. The Designated Federal Official is empowered to conduct the meeting in a fashion that will facilitate the orderly conduct of business. Each individual wishing to make public comment will be provided a maximum of 5 minutes to present their comments at any time throughout the meeting.

Minutes: The minutes of this meeting will be available for public review and copying at the Pantex Public Reading Rooms located at the Amarillo College Lynn Library and Learning Center, 2201 South Washington, Amarillo, TX phone (806) 371–5400. Hours of operation are from 7:45 am to 10:00 pm, Monday through Thursday; 7:45 am to 5:00 pm on Friday; 8:30 am to 12:00 noon on Saturday; and 2:00 pm to 6:00 pm on Sunday, except for Federal holidays. Additionally, there is a Public Reading Room located at the Carson County Public Library, 401 Main Street,

A.6 NOTICE OF INTENT—SUPPLEMENT TO THE DRAFT SURPLUS PLUTONIUM DISPOSITION ENVIRONMENTAL IMPACT STATEMENT

Dated: March 30, 1999.

Judith Johnson,

Acting Assistant Secretary, Elementary and Secondary Education.

[FR Doc. 99–8394 Filed 4–5–99; 8:45 am]

BILLING CODE 4000–01–P

DEPARTMENT OF ENERGY

Office of Arms Control and Nonproliferation Policy; Proposed Subsequent Arrangement

AGENCY: Department of Energy.

ACTION: Subsequent arrangement.

SUMMARY: This notice is being issued under the authority of Section 131 of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2160). The Department is providing notice of a ''subsequent arrangement'' under the Agreement for Cooperation in the Peaceful Uses of Nuclear Energy Between the United States of America and the European Atomic Energy Community (EURATOM) and the Agreement for Cooperation Between the Government of the United States of America and the Government of Canada Concerning the Civil Uses of Atomic Energy.

This subsequent arrangement concerns the transfer of 90,552,300 grams of natural uranium in the form of hexafluoride from Cameco Corporation in Canada to Urenco Limited in the United Kingdom for toll enrichment. The enrichment will not exceed 20%. The material will then be transferred to Northern States Power in Minneapolis, MN for use in their commercial power reactor.

In accordance with Section 131 of the Atomic Energy Act of 1954, as amended, we have determined that this subsequent arrangement will not be inimical to the common defense and security.

This subsequent arrangement will take effect no sooner than fifteen days after the date of publication of this notice.

Dated: March 30, 1999.

For the Department of Energy.

Edward T. Fei,

Deputy Director, International Policy and Analysis Division, Office of Arms Control and Nonproliferation.

[FR Doc. 99–8451 Filed 4–5–99; 8:45 am]

BILLING CODE 6450–01–P

DEPARTMENT OF ENERGY

Office of Arms Control and Nonproliferation Policy; Proposed Subsequent Arrangement

AGENCY: Department of Energy.

ACTION: Subsequent Arrangement.

SUMMARY: This notice is being issued under the authority of Section 131 of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2160). The Department is providing notice of a ''subsequent arrangement'' under the Agreement for Cooperation in the Peaceful Uses of Nuclear Energy Between the United States of America and the European Atomic Energy Community (EURATOM) and the Agreement for Cooperation Between the Government of the United States of America and the Government of Canada Concerning the Civil Uses of Atomic Energy.

This subsequent arrangement concerns the transfer of 3,078,600 grams of natural uranium in the form of hexafluoride from Cameco Corporation in Canada to Urenco Limited in the United Kingdom for toll enrichment. The enrichment will not exceed 20%. The material will then be transferred to Wolf Creek Nulcear Operation Corporation in Burlington, KS for use in their commercial power reactor.

In accordance with Section 131 of the Atomic Energy Act of 1954, as amended, we have determined that this subsequent arrangement will not be inimical to the common defense and security.

This subsequent arrangement will take effect no sooner than fifteen days after the date of publication of this notice.

Dated: March 30, 1999.

For the Department of Energy.

Edward T. Fei,

Deputy Director, International Policy and Analysis Division Office of Arms Control and Nonproliferation.

[FR Doc. 99–8452 Filed 4–5–99; 8:45 am]

BILLING CODE 6450–01–P

DEPARTMENT OF ENERGY

Supplement to the Draft Surplus Plutonium Disposition Environmental Impact Statement

AGENCY: Department of Energy.

ACTION: Notice of Intent.

SUMMARY: The Department of Energy (DOE) announces its intent to prepare a supplement to the Surplus Plutonium Disposition Draft Environmental Impact Statement (SPD EIS) pursuant to the National Environmental Policy Act (NEPA). The SPD Draft EIS (DOE/EIS–0283D) was issued for public comment in July 1998. The Supplement will update the SPD Draft EIS by examining the potential environmental impacts of using mixed oxide (MOX) fuel in six specific commercial nuclear reactors at three sites for the disposition of surplus weapons-grade plutonium. DOE identified these reactors through a competitive procurement process. The Department is planning to issue the Supplement to the SPD Draft EIS in April 1999. DOE will publish a separate Notice of Availability in the Federal Register at that time. This Notice of Intent describes the content of the Supplement to the SPD Draft EIS, solicits public comment on the Supplement, and announces DOE's intention to conduct a public hearing. Consistent with 40 CFR 1502.9(c)(4) and 10 CFR 1021.314(d), DOE has determined not to conduct scoping for the Supplement.

ADDRESSES: Requests for information concerning the plutonium disposition program can be submitted by calling (answering machine) or faxing them to the toll free number 1–800–820–5156, or by mailing them to: Bert Stevenson, NEPA Compliance Officer, Office of Fissile Materials Disposition, U.S. Department of Energy, Post Office Box 23786, Washington, DC 20026–3786.

FOR FURTHER INFORMATION CONTACT: For general information on the DOE NEPA process, please contact: Carol Borgstrom, Director, Office of NEPA Policy and Assistance, U.S. Department of Energy, 1000 Independence Avenue, S.W., Washington, DC 20585, 202–586–4600 or leave a message at 1–800–472–2756.

Additional information regarding the DOE NEPA process and activities is available on the Internet through the NEPA Home Page at http://www.eh.doe.gov/nepa.

SUPPLEMENTARY INFORMATION:

Background

In October 1994, the Secretary of Energy and the Congress created the Office of Fissile Materials Disposition (MD) within the Department of Energy (DOE) to focus on the elimination of surplus highly enriched uranium (HEU) and plutonium surplus to national defense needs. As one of its major responsibilities, MD is tasked with determining how to disposition surplus weapons—usable plutonium. In January 1997, DOE issued a Record of Decision (ROD) for the Storage and Disposition of Weapons—Usable Fissile Materials Final Programmatic Environmental Impact Statement (S&D PEIS) (DOE/EIS–

0229; December 1996). In that ROD, DOE decided to pursue a strategy that would allow for the possibility of both the immobilization of surplus plutonium and the use of surplus plutonium as mixed oxide (MOX) fuel in existing domestic, commercial reactors. DOE is in the process of completing the Surplus Plutonium Disposition Environmental Impact Statement (SPD Draft EIS) (DOE/EIS–0283D; July 1998) to choose a site(s) for plutonium disposition activities and to determine the technology(ies) that will be used to support this effort.

Related Procurement Action

To support the timely undertaking of the surplus plutonium disposition program, DOE initiated a procurement action to contract for MOX fuel fabrication and reactor irradiation services. The services requested in this procurement process include design, licensing, construction, operation, and eventual deactivation of a MOX facility, as well as irradiation of the MOX fuel in three to eight existing domestic, commercial reactors, should the decision be made by DOE to go forward with the MOX program.

On May 19, 1998, DOE issued a Request for Proposal (RFP) (Solicitation Number DE–RP02–98CH10888) that defined limited activities that may be performed prior to issuance of the SPD EIS ROD. These activities include non-site-specific work primarily associated with the development of the initial conceptual design for the fuel fabrication facility, and plans (paper studies) for outreach, long lead-time procurements, regulatory management, facility quality assurance, safeguards, security, fuel qualifications, and deactivation. No construction would be started on a MOX fuel fabrication facility until the SPD EIS ROD is issued. The MOX facility, if built, would be DOE-owned, licensed by the Nuclear Regulatory Commission, and located at one of four candidate DOE sites. DOE has designated the Savannah River Site as the preferred alternative for the MOX fuel fabrication facility.

Based on a review of proposals received in response to the RFP, DOE determined in January 1999 that one proposal was in the competitive range. Under this proposal, MOX fuel would be fabricated at a DOE site and then irradiated in one of six domestic commercial nuclear reactors.

Environmental Review During Procurement Action

An environmental critique was prepared in accordance with DOE's National Environmental Policy Act (NEPA) regulations at 10 CFR 1021.216. Because an EIS is in progress on this action, DOE required offerors to submit reasonably available environmental data and analyses as a part of their proposals. DOE independently evaluated and verified the accuracy of the data provided by the offeror in the competitive range, and prepared an environmental critique for consideration before the selection was made. The Environmental Critique was used by DOE to determine:

(1) if there are any important environmental issues in the offeror's proposal that may affect the selection process; and

(2) if the potential environmental impacts of the offeror's proposal were bounded by impacts presented in the S&D PEIS and SPD Draft EIS or whether additional analysis was required in the SPD Final EIS.

As required by Section 216, the Environmental Critique included a discussion of the purpose of the procurement; the salient characteristics of the offeror's proposal; any licenses, permits or approvals needed to support the program; and an evaluation of the potential environmental impacts of the offer. The Environmental Critique is a procurement-sensitive document and subject to all associated restrictions. DOE then prepared a synopsis, which summarizes the Environmental Critique and reduces business-sensitive information to a level that will not compromise the procurement process. The Synopsis will be filed with the Environmental Protection Agency and made available to the public.

Contract Award

As a result of the procurement process described above, in March 1999, the Department of Energy contracted with Duke Engineering & Services, COGEMA, Inc., and Stone & Webster to provide mixed oxide fuel fabrication and reactor irradiation services. The team, known as DUKE COGEMA STONE & WEBSTER or DCS, has its corporate headquarters in Charlotte, NC. Subcontractors to DCS include Duke Power Company, Charlotte, NC and Virginia Power Company, Richmond, VA, who will provide the reactor facilities in which mixed oxide fuel will be used upon receipt of Nuclear Regulatory Commission license amendments. Other major subcontractors include Nuclear Fuel Services, Inc., Erwin, TN; Belgonucleaire, Brussels, Belgium; and Framatome Cogema Fuels of Lynchburg, VA. Under the contract, the team will also modify six existing U.S. commercial light water reactors at three sites to irradiate mixed oxide fuel assemblies. These reactors sites are Catawba in York, SC; McGuire in Huntersville, NC; and North Anna in Mineral, VA. The team will be responsible for obtaining a license to operate the fuel fabrication facility and the license modifications for the reactors from the Nuclear Regulatory Commission. Full execution of this contract is contingent on DOE's completion of the SPD EIS, as provided by 40 CFR 1021.216(i).

Supplement to the Surplus Plutonium Disposition Draft Environmental Impact Statement

The purpose of the Supplement to the SPD Draft EIS is to update the Draft by including specific information available as a result of the award of the DCS contract. The Supplement to the SPD Draft EIS will contain background information on the SPD Draft EIS; changes made to the SPD Draft EIS (Section 1.7.2); a description of the reactor sites (Section 3.7); impacts of irradiating mixed oxide fuel in existing light water reactors (Section 4.28); Facility Accidents (Appendix K); Analysis of Environmental Justice (Appendix M); and the Environmental Synopsis (Appendix O).

DOE anticipates that the Supplement to the SPD Draft EIS will be available in April. DOE intends to hold an interactive hearing in Washington, DC in May 1999 to discuss issues and receive oral and written comments on the Supplement to the Draft SPD EIS. The Notice of Availability will provide specific information concerning the date, time and location for the public hearing.

Issued in Washington, DC this 31st day of March 1999, for the United States Department of Energy.

David Michaels,

Assistant Secretary, Environment, Safety and Health.

[FR Doc. 99–8455 Filed 4–5–99; 8:45 am]

BILLING CODE 6450–01–P

DEPARTMENT OF ENERGY

Office of Science; Biological and Environmental Research Advisory Committee

AGENCY: Department of Energy.

ACTION: Notice of open meeting.

SUMMARY: This notice announces a meeting of the Biological and Environmental Research Advisory Committee. Federal Advisory Committee Act (Public Law 92–463, 86 Stat. 770) requires that public notice of

A.7 NOTICE OF AVAILABILITY—SUPPLEMENT TO THE SURPLUS PLUTONIUM DISPOSITION DRAFT ENVIRONMENTAL IMPACT STATEMENT

technological collection techniques or other forms of information technology, e.g., permitting electronic submission of responses.

Burden Statement: The annual public reporting and recordkeeping burden for this collection of information is estimated to average 3.03 hours per response. It is estimated that any individual may respond to synopses or market research questions 5 times per year. EPA anticipates publicizing approximately 260 contract actions per year, and conducting 3790 market research inquiries. Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information.

Dated: May 7, 1999.

Lawrence G. Wyborski,

Acting Manager, Policy Service Center.

[FR Doc. 99–12249 Filed 5–13–99; 8:45 am]

BILLING CODE 6560–50–U

ENVIRONMENTAL PROTECTION AGENCY

[ER–FRL–6242–6]

Environmental Impact Statements and Regulations; Availability of EPA Comments

Availability of EPA comments prepared April 19, 1999 Through April 23, 1999 pursuant to the Environmental Review Process (ERP), under Section 309 of the Clean Air Act and Section 102(2)(c) of the National Environmental Policy Act as amended. Requests for copies of EPA comments can be directed to the Office of FEDERAL ACTIVITIES AT (202) 564–7167.

An explanation of the ratings assigned to draft environmental impact statements (EISs) was published in FR dated April 09, 1999 (64 FR 17362).

Draft EISs

ERP No. D–AFS–L65207–OR Rating *LO, Young'n Timber Sales, Implementation, Willamette National Forest Land and Resource Management Plan, Middle Fork Ranger District, Lane County, OR.

Summary: EPA used a screening tool to conduct a limited review of this action. Based upon the screen, EPA does not foresee having any environmental objections to the proposed project. Therefore, EPA will not be conducting a detailed review.

ERP No. D–AFS–L65304–OR Rating EC2, Moose Subwatershed Timber Harvest and Other Vegetation Management Actions, Central Cascade Adaptive Management (CCAMA), Willamette National Forest, Sweet Home Ranger District, Linn County, OR.

Summary: EPA expressed environmental concerns with the proposed timber harvest due to entry into roadless area and the potential for impact to water quality and recommended that the Forest Service continue to monitor for water quality impacts.

ERP No. D–COE–J36050–ND Rating EO2, Maple River Dam and Reservoir, Construction and Operation, Flood Control, Cass County Joint Water Resource District, Cass County, ND.

Summary: EPA expressed environmental objections to the project on the basis of: (1) the lack of adequate provisions to identify and protect aquatic habitats, (2) exceedances of water quality standards, (3) the uncertainty of the mitigation, restoration and conservation efforts, (4) the lack of information on future flood control activities, (5) future growth and development impacts in the lower watershed area, (6) a cumulative impacts analysis that was limited to water chemistry, (7) a substantial need to address the watershed as a unit.

Final EISs

ERP No. F–AFS–L65255–AK, Control Lake Timber Sale, Implementation, Prince of Wales Island, Tongass National Forest, AK.

Summary: Review of the Final EIS was not deemed necessary. No formal comment letter was sent to the preparing agency.

ERP No. F–BLM–L65294–OR, Beaty Butte Allotment Management Plan, Implementation, Lakeview District, Hart Mountain National Antelope Refuge, Lake and Harney Counties, OR.

Summary: The Final EIS has addressed the issues EPA raised in the draft EIS.

ERP No. FS–COE–G32054–00, Red River Waterway, Louisiana, Texas, Arkansas and Oklahoma and Related Projects, New and Updated Information, Red River Below Denison Dam Levee Rehabilition, Implementation, Hempstead, Lafayette and Miller Counties, AR.

Summary: EPA has no objection to the selection of the preferred alternative described in the FSEIS.

Dated: May 11, 1999.

William D. Dickerson,

Director, Office of Federal Activities.

[FR Doc. 99–12265 Filed 5–13–99; 8:45 am]

BILLING CODE 6560–50–U

ENVIRONMENTAL PROTECTION AGENCY

[ER–FRL–6242–5]

Environmental Impact Statements; Notice of Availability

Responsible Agency: Office of Federal Activities, General Information (202) 564–7167 or (202) 564–7153.

Weekly receipt of Environmental Impact Statements

Filed May 03, 1999 Through May 07, 1999.

Pursuant to 40 CFR 1506.9.

EIS No. 990148, Final Supplement, AFS, CO, Lakewood Raw Water Pipeline for Continued Operation, Maintenance, Reconstruction and/or Replacement, Application for Easement, Roosevelt National Forest, Boulder Ranger District, in the City of Boulder, CO, Due: June 07, 1999, Contact: Jean Thomas (970) 498–1267. The above DOA EIS should have appeared in the 05/07/99 Federal Register. The 30–day Comment Period is Calculated from 05/07/99.

EIS No. 990149, Draft EIS, AFS, MT, Bridger Bowl Ski Area, Permit Renewal and Master Development Plan Update, Implementation, Special Use Permit and COE Section 404 Permit, Gallatin National Forest, in the City of Bozeman, MT, Due: June 28, 1999, Contact: Nancy Halstom (406) 587–6920.

EIS No. 990150, Final EIS, NPS, TX, Lyndon B. Johnson National Historical Park, Package 227, General Management Plan, Implementation, Blanco and Gillespie Counties, TX, Due: June 14, 1999, Contact: Leslie Starhart (830) 868–7128.

EIS No. 990151, Final EIS, FHW, MO, IA, US 61, US 218 and IA–394 Highway Improvements, Construction, Funding, US Army COE Section 404 Permit, Lewis and Clark Counties, MO and Lee and Henry Counties, IA , Due: June 14, 1999, Contact: Donald Neumann (573) 636–7104.

EIS No. 990152, Draft EIS, FTA, VA, Norfolk-Virginia Beach Light Rail Transit System East/West Corridor

Project, Transportation Improvements, Tidewater Transportation District Commission, COE Section 404 Permit, City of Norfolk and City of Virginia Beach, VA, Due: June 28, 1999, Contact: Michael McCollum (215) 656–7100.

EIS No. 990153, Legislative Final EIS, USA, AK, Alaska Army Lands Withdrawal Renewal for Fort Wainwright and Fort Greely West Training Area, Approval of Permits and Licenses, City of Fairbanks, City of North Pole and City of Delta Junction, North Star Borough, AK , Due: June 14, 1999, Contact: Cindy Herdrich (970) 491–5347.

EIS No. 990154, Draft Supplement, DOE, CA, NM, TX, ID, SC, WA, Surplus Plutonium Disposition (DOE/EIS–0283–S) for Siting, New and Revised Information, Construction and Operation of three facilities for Plutonium Disposition, Possible Sites Hanford, Idaho National Engineering and Environmental Laboratory, Pantex Plant and Savannah River, CA, ID, NM, SC, TX and WA, Due: June 28, 1999, Contact: G. Bert Stevenson (202) 586–5368.

EIS No. 990155, Draft EIS, BLM, WY, Wyodak Coal Bed Methane Project, Road Construction, Drilling Operation, Electrical Distribution Line, Powder River Basin, Campbell and Converse Counties, WY, Due: June 28, 1999, Contact: Richard Zander (307) 684–1161.

EIS No. 990156, Final EIS, UAF, ND, Minuteman III Missile System Dismantlement, Intercontinental Ballistic Missile (ICBM) Launch Facilities (LFs) and Missile Alert Facilities (MAFs), Deployment Areas, Grand Forks Air Forces Base, ND , Due: June 14, 1999, Contact: Jonathan D. Farthing (210) 536–3069.

Amended Notices

EIS No. 990103, Draft Supplement, FHW, CA, CA–125 South Route Location, Adoption and Construction, between CA–905 on Otay Mesa to CA–54 in Spring Valley, Updated and Additional Information, Funding and COE Section 404 Permit, San Diego County, CA, Due: May 24, 1999, Contact: C. Glenn Clinton (916) 498–5037. Published FR–04–09–99—Due Date Correction.

EIS No. 990108, Draft Supplement EIS, AFS, ID, Grade-Dukes Timber Sale, Proposal to Harvest and Regenerate Timber, Implementation, Cuddy Mountain Roadless Area, Payette National Forest, Weiser Ranger District, Washington County, Idaho, Due: June 01, 1999, Contact: Dautis Pearson (208) 253–0134. Published FR 04–09–99 Review Period Extended.

EIS No. 990143, Draft EIS, TPT, CA, Presidio of San Francisco General Management Plan, Implementation, New Development and Uses within the Letterman Complex, Golden Gate National Recreation Area, City and County of San Francisco, CA, Due: June 14, 1999, Contact: John Pelka (415) 561–5300. Published FR–04–30–99—Correction to Document Status from a Draft Supplement to Draft.

Dated: May 11, 1999.

William D. Dickerson,

Director, Office of Federal Activities.

[FR Doc. 99–12264 Filed 5–13–99; 8:45 am]

BILLING CODE 6560–50–U

ENVIRONMENTAL PROTECTION AGENCY

[FRL–6342–1]

RIN 2060–AH52

Public Meetings To Discuss Air Quality Modeling and Infrastructure Issues Associated With Alternative-Fueled Vehicles

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice of public meetings.

SUMMARY: The Environmental Protection Agency intends to hold two public workshops to discuss issues associated with alternative fuel vehicles (AFVs) (i.e., vehicles powered by fuels other than gasoline). The first workshop (which EPA will hold May 26, 1999, in Louisville, Kentucky), will focus on issues associated with air quality modeling of AFVs. The purpose of this workshop is to facilitate an exchange of information that will help EPA determine which areas of its modeling, if any, should be enhanced to better estimate the air quality impacts of alternative-fueled vehicles. The second workshop will focus on issues related to infrastructure development and creating a sustainable market for AFVs.

DATES: The first workshop (on modeling and AFVs) will be held on May 26, 1999, in Louisville, Kentucky, following the Department of Energy's National Clean Cities Conference. The date for the second workshop (on infrastructure development and creating a sustainable market for AFVs) will be announced later. Members of the public are invited to attend as observers.

ADDRESSES: Questions about the workshop should be addressed to: Barry Garelick (202–564–9028; garelick.barry@epa.gov) or Christine Hawk (202–564–9672; hawk.christine@epa.gov), 401 M Street, S.W. (6406J), Washington, D.C. (20460). The workshop will be held at the Sellbach Hilton Hotel, 500 4th St, Louisville, Kentucky 40202, 800 333–3399 or 502–585–3200.

FOR FURTHER INFORMATION CONTACT: Barry Garelick (202) 564–9028.

SUPPLEMENTARY INFORMATION: As this Administration has long recognized, one of the keys to moving forward environmentally is moving forward technologically. Progress towards sustainable reductions in emissions from the mobile source sector is inextricably linked to technological advancement. Motor vehicles are significant contributors to ground-level ozone, the principal harmful ingredient in smog. They also emit other pollutants, including particulate matter and air toxics. Motor vehicle emissions contribute to public health problems such as asthma and other respiratory problems, especially in children.

History has shown that the rise in vehicle sales and vehicle miles traveled every year has consistently led to increases in the aggregate emissions from the mobile source sector, despite progress in reducing emissions from gasoline-powered, conventional motor vehicles. This places increasing importance on technological developments, including vehicles powered by fuels other than gasoline. There is particular interest in the creation of vehicles whose emissions do not increase as the vehicle ages. There are a number of types of alternative fuel vehicles (AFVs) in production and under development. In the United States, manufacturers are already selling various types of AFVs, including vehicles powered by electricity, compressed natural gas, methanol, and ethanol. The last year has also seen dramatic developments in hybrid-electric vehicle and fuel cell technology.

Congress and the Administration have already recognized that they have an important role to play regarding AFVs. As part of the 1990 Amendments to the Clean Air Act, Congress included sections promoting increased numbers of clean fuel fleet vehicles. The Clean Fuel Fleet program, which began on September 1, 1998, requires certain nonattainment areas to adopt and implement a program requiring certain centrally-fueled fleets to include a specified percentage of clean-fuel vehicles in their new fleet vehicle purchases. Additionally, Congress passed the Energy Policy Act of 1992 (EPAct), which includes numerous provisions designed to increase the

A.8 JOINT STATEMENT OF PRINCIPLES FOR MANAGEMENT AND DISPOSITION OF PLUTONIUM DESIGNATED AS NO LONGER REQUIRED FOR DEFENSE PURPOSES

AGREEMENT
BETWEEN
THE GOVERNMENT
OF THE UNITED STATES OF AMERICA
AND
THE GOVERNMENT
OF THE RUSSIAN FEDERATION
ON SCIENTIFIC AND TECHNICAL COOPERATION IN THE MANAGEMENT OF PLUTONIUM THAT HAS BEEN WITHDRAWN FROM NUCLEAR MILITARY PROGRAMS

The Government of the United States of America and the Government of the Russian Federation, hereafter referred to as the Parties,

Taking into account:

- The January 14, 1994, Declaration of the Presidents of the United States and the Russian Federation on "Nonproliferation of Weapons of Mass Destruction and the Means of Their Delivery";
- The Declaration of the April 19–20, 1996, Summit on Nuclear Safety and Security in Moscow;
- The Conclusions of the International Meeting of Experts in Paris, on October 28–31, 1996, concerning the safe and efficient management of fissile materials designated as no longer required for defense purposes;
- The statement regarding fissile materials in the June 22, 1997, Final Communiqué of the Denver Summit of the Eight;
- The statement of the President of the United States on March 1, 1995, that 200 tons of fissile material will be withdrawn from the U.S. nuclear stockpile and directing that these materials will never again be used to build a nuclear weapon; and
- The message of the President of the Russian Federation to the participants of the 41st General Conference of the IAEA, September 26, 1997, on step by step removal from nuclear defense programs of up to 500 tonnes of highly enriched uranium and up to 50 tonnes of plutonium released in the process of nuclear disarmament;

Have agreed as follows:

ARTICLE 1

The purposes of this Agreement are to:

a) Provide the scientific and technical basis for decisions on how plutonium, subject to this Agreement, shall be managed; and

b) Establish a framework for continued and expanded scientific and technical cooperation for the accomplishment of the objective in paragraph a.

ARTICLE 2

For purposes of this Agreement:

1. "Plutonium" means plutonium that has been withdrawn from nuclear military programs and is no longer required for defense purposes.

2. "Management of plutonium" means the transformation of plutonium into spent fuel or other forms equally unusable for nuclear weapons or other nuclear explosive devices, and may include conversion of plutonium and its manufacture into MOX fuel, use of MOX fuel in nuclear reactors, and immobilization of plutonium in various forms.

ARTICLE 3

1. The Parties shall:

   a) Continue to cooperate with small-scale tests and demonstrations relating to management of plutonium; and

   b) As soon as is practicable, also proceed to pilot-scale demonstrations of technologies for plutonium management.

2. The principal subject areas for the Parties' cooperative efforts shall be:

   a) Conversion of metallic plutonium into oxide suitable for the manufacture of MOX fuel for nuclear power reactors of various types;

   b) Stabilization of unstable forms of plutonium;

   c) Use of plutonium in the form of MOX fuel in various types of nuclear power reactors;

   d) Immobilization of plutonium, including wastes and hard-to-process forms; and

   e) Disposal of immobilized forms of materials containing plutonium in deep geological formations.

ARTICLE 4

1. The Parties shall designate Executive Agents to carry out the provisions of this Agreement. The Executive Agent for the United States of America shall be the U.S. Department of Energy and the Executive Agent for the Russian Federation shall be the Russian Ministry for Atomic Energy.

2. The Parties shall have the right, consistent with their respective laws and regulations, and following written notification to the other Party, to obtain participation, as necessary, in the implementation of this Agreement, by other agencies, departments, and units of their respective governments.

3. To accomplish the objectives of this Agreement, the Parties shall establish a U.S.-Russian Joint Steering Committee on Plutonium Management, which shall coordinate and agree upon work undertaken under this Agreement. Each Party shall designate its members on the Joint Steering Committee. Decisions of the Joint Steering Committee shall be taken by consensus.

4. The tasks of the Joint Steering Committee shall include:

   a) Development of overall work programs and areas of cooperation within the scope of this Agreement;

   b) Prioritization, coordination, review and approval of the cooperative projects under this Agreement within the resources made available by the Parties;

   c) Resolution of any disputes that may arise with respect to the scientific and technical work performed under this Agreement; and

   d) Such other matters, as the Parties may agree, that are within the scope of this Agreement.

5. When agreement is reached on the performance of joint research, projects, or experiments under this Agreement, detailed procedures for performing the activities involved shall be officially drawn up in the form of implementing arrangements, to be reviewed and approved by the Joint Steering Committee.

ARTICLE 5

Cooperation between the Parties within the framework of this Agreement may include the following:

a) Sharing of scientific and technical information;

b) Development of conceptual approaches;

c) Research, experiments and small-scale demonstrations of technological solutions;

d) Design, construction, and operation of pilot-scale facilities for demonstrating and testing technological solutions obtained as a result of research;

e) Transfer of equipment and non-nuclear materials;

f) Meetings, seminars, conferences, personnel assignments, and workshops for the sharing of information;

g) Feasibility studies; and

h) Such other forms of cooperation within the scope of this Agreement as the Executive Agents may agree upon in writing.

ARTICLE 6

1. In the implementation of this Agreement, only unclassified information shall be exchanged.

2. In order to prevent access to it by people and organizations not participating in the implementation of this Agreement, information provided by the Parties pursuant to, or produced as a result of, this Agreement which is considered sensitive by the Parties is to be held in confidence and must be clearly designated and marked. The Party transmitting the information will designate information as sensitive in accordance with its internal laws and regulations. The Party receiving this information shall assign it a designation that provides a degree of protection at least equivalent to that required by the Party that furnished the information.

3. Sensitive information shall be handled in accordance with the laws and regulations of the Party receiving the information, and shall not be disclosed or transmitted to a third party not participating in implementation of this Agreement without the written consent of the Party transmitting the information. According to the regulations of the United States, such information shall be treated as foreign government information provided in confidence and shall be protected appropriately. According to the norms and regulations of the Russian Federation, such information shall be treated as official information with limited distribution and shall be protected appropriately.

4. The Parties shall assure effective protection and allocation of rights to intellectual property transmitted or created under this Agreement, as set forth in this Article and in the Annex to this Agreement, which forms an integral part of this Agreement.

5. Information transmitted under this Agreement must be used solely in accordance with this Agreement.

6. The number of people having access to sensitive information must be limited to the number necessary to implement this Agreement and other programs associated with this Agreement, and shall be determined by the Parties' Executive Agents.

ARTICLE 7

1. Materials, equipment and technologies, transferred under the terms of this Agreement, shall not be used for the production of nuclear weapons, any nuclear explosive devices, or for research or development of such devices or for the furtherance of any military purpose.

2. Materials, equipment and technologies, transferred under the terms of this Agreement, shall not be exported, re-exported, or transferred from the jurisdiction of the recipient without the written consent of the Parties.

3. Prior to the export under the terms of this Agreement to a third party of any equipment, materials or technologies, the Parties by mutual agreement in writing shall define the conditions in accordance with which such items shall be exported, re-exported, or transferred from the jurisdiction of the third party.

4. The Parties' Executive Agents shall take all measures necessary to ensure adequate physical protection of nuclear materials, equipment, installations, and nuclear technologies in its jurisdiction, and shall apply criteria and levels of physical

protection not lower than those identified in the Convention on the Physical Protection of Nuclear Material and in recommendations of the IAEA.

ARTICLE 8

Equipment, supplies, materials, services and activities provided or acquired by the United States of America, its contractors, subcontractors, and their personnel for the implementation of this Agreement are free technical assistance and are thus exempt from customs duties and taxes. The Russian Federation shall take all necessary measures to exempt this equipment, shipments, materials, services, and work from all taxes, tariffs, customs duties, and levies of the Russian Federation and its instrumentalities.

ARTICLE 9

1. With the exception of claims for damage or injury against individuals arising from their premeditated actions, the Government of the Russian Federation shall bring no claims or other legal proceedings against the Government of the United States of America and its personnel or its contractors, sub-contractors, consultants, suppliers or subsuppliers of equipment or services at any tier and their personnel, in any court or forum, for any damage, including indirect, direct or consequential damage, arising from activities undertaken pursuant to this Agreement, to property owned by the Russian Federation. This paragraph shall not apply to legal actions brought by the Government of the Russian Federation to enforce the provisions of contracts to which it or a Russian national or other legal entity is a party.

2. With the exception of claims for damage or injury against individuals arising from their premeditated actions, the Government of the Russian Federation shall provide for the adequate defense of, shall indemnify, and shall bring no claims or other legal proceedings against the Government of the United States of America and its personnel or its contractors, sub-contractors, consultants, suppliers or subsuppliers of equipment or services at any tier and their personnel, in connection with third-party claims, in any court or forum, for any injury or damage, including indirect, direct, or consequential injury or damage, arising from activities undertaken pursuant to this Agreement, occurring within or outside the territory of the Russian Federation. Nothing in this paragraph shall be construed as acknowledging the jurisdiction of any court or forum over third-party claims to which this paragraph applies, nor shall it be construed as waiving the sovereign immunity of either Party with respect to third-party claims that may be brought against it.

3. The Parties may, as necessary, conduct consultations regarding claims and legal proceedings concerning this Article.

4. The provisions of this Article shall not prevent the Parties from providing compensation in accordance with their national laws.

5. Nothing in this Article shall be interpreted to prevent legal proceedings or claims against nationals of the Russian Federation or permanent residents of the Russian Federation.

ARTICLE 10

1. Joint activities under this Agreement shall be supported by funds and in-kind contributions of equipment, material, and labor provided on a non-reimbursable basis for these purposes by the United States of America and the Russian Federation.

Joint activities may also be supported, in whole or in part, from funds directly from other sources, including non-government funds and funds from the private sector.

2. In all cases, the activities of, and financial support provided by, the United States of America under this Agreement are subject to the availability of appropriated funds. In all cases, the activities of, and financial support provided by, the Russian Federation under this Agreement are subject to the availability of appropriated funds.

ARTICLE 11

In the event that a Party awards contracts for the acquisition of articles and services, including construction, to implement this Agreement, such contracts shall be awarded in accordance with the laws and regulations of that Party.

ARTICLE 12

1. Representatives of the U.S. Department of Energy shall have the right upon reasonable notice to examine and audit the use of any support or assistance provided by the U.S. Government in connection with cooperation under this Agreement during the life of this Agreement and for three years thereafter. Such examinations may be conducted at sites or locations as agreed to by the Parties' Executive Agents.

2. The Parties' Executive Agents shall develop appropriate arrangements for conducting audits and examinations for all work performed within the framework of this Agreement.

ARTICLE 13

All questions regarding the interpretation or application of this Agreement shall be resolved by means of consultation between the Parties.

ARTICLE 14

1. This Agreement shall enter into force on the date of signature, and shall remain in force for five years. The Agreement may be extended for successive five-year periods with the written consent of both Parties after joint review before the end of each five-year period. The Agreement may be amended by written agreement of the Parties.

2. This Agreement may be terminated by either Party by sending written notice through diplomatic channels of its intent to terminate the Agreement, in which case the Agreement shall terminate six months from the date of the notification.

3. In the event that either Party exercises its right to terminate this Agreement, the Parties may agree upon the implementation of existing contracts and projects until their completion, and will settle any outstanding costs by mutual agreement. If this Agreement is terminated or expires, the Parties agree that all sensitive information and intellectual property that was made available in the course of the Agreement shall continue to be treated in conformance with Article 6 of this Agreement, unless other arrangements are made by written agreement of the Parties.

Done at Moscow this twenty-fourth day of July, 1998, in duplicate in the English and Russian languages, both texts being equally authentic.

FOR THE GOVERNMENT OF THE UNITED STATES OF AMERICA:	FOR THE GOVERNMENT OF THE RUSSIAN FEDERATION:
Al Gore	

ANNEX
TO THE
AGREEMENT
BETWEEN
THE GOVERNMENT
OF THE UNITED STATES OF AMERICA
AND
THE GOVERNMENT
OF THE RUSSIAN FEDERATION
ON SCIENTIFIC AND TECHNICAL COOPERATION
IN THE MANAGEMENT OF PLUTONIUM
THAT HAS BEEN WITHDRAWN
FROM NUCLEAR MILITARY PROGRAMS

INTELLECTUAL PROPERTY

Pursuant to Article 6 of this Agreement:

The Parties shall ensure adequate and effective protection of intellectual property created or furnished under this Agreement and relevant implementing agreements. The Parties agree to notify one another in a timely fashion of any inventions or copyrighted works resulting from scientific and technological work performed under this Agreement and to seek protection for such intellectual property in a timely fashion. Rights to such intellectual property shall be allocated as provided in this Annex.

I. Scope

A. This Annex is applicable to all cooperative activities undertaken pursuant to this Agreement, except as otherwise specifically agreed by the Parties or their Executive Agents.

B. For purposes of this Agreement, "intellectual property" shall have the meaning found in Article 2 of the Convention Establishing the World Intellectual Property Organization, done at Stockholm, July 14, 1967.

C. This Annex addresses the allocation of rights and interests between the Parties. Each Party shall ensure that the other Party can obtain the rights to intellectual property allocated in accordance with this Annex, by obtaining those rights from its own participants through contracts, license agreements or other legal documents, if necessary. This Annex does not otherwise alter or prejudice the allocation between a Party and its nationals or other legal entities, which shall be determined by that Party's laws and practices.

D. Disputes concerning intellectual property arising under this Agreement should be resolved through discussions between the concerned participating institutions, or, if necessary, the Parties or their Executive Agents. Upon mutual agreement of the Parties, a dispute shall be submitted to an arbitral tribunal for binding arbitration in accordance with the Agreement and with the applicable rules of international law.

E. Termination or expiration of this Agreement shall not affect rights or obligations under this Annex.

II. Allocation of Rights

A. Each Party shall be entitled to a non-exclusive, irrevocable, royalty-free license in all countries to translate, reproduce, and publicly distribute scientific and technical journal articles, papers, reports, and books directly arising from cooperation under this Agreement. All publicly distributed copies of a copyrighted work prepared under this provision shall indicate the names of the authors of the work unless an author explicitly declines to be named.

B. Rights to all forms of intellectual property, other than those rights described in Paragraph II.A above, shall be allocated as follows:

(1) Visiting researchers shall receive intellectual property rights under the policies of the host institution. In addition, each visiting researcher named as an inventor or author shall be entitled to awards, bonuses, benefits, or any other rewards in accordance with the policies of the host institution.

(2) (a) For intellectual property created during joint research, for example, when the Parties, participating institutions, or participating personnel have agreed in advance on the scope of work, each Party shall be entitled to obtain all rights and interests in its own country. Rights and interests in third countries will be determined in implementing agreements. If research is not designated as "joint research" in the relevant implementing agreement, rights to intellectual property arising from the research will be allocated in accordance with paragraph II.B.(1) above. In addition, each person named as an inventor or author shall be entitled to receive awards in accordance with the policies of the participating institutions.

(b) Notwithstanding paragraph II.B.(2)(a) above, if a type of intellectual property is available under the laws of one Party but not the other Party, the Party whose laws provide for this type of protection shall be entitled to all rights and interests worldwide. Persons named as inventors or authors of the property shall nonetheless be entitled to awards, bonuses, benefits, or any other rewards in accordance with the policies of the participating institution of the Party obtaining rights.

III. Business Confidential Information

In the event that information identified in a timely fashion as business-confidential is furnished or created under this Agreement, each Party and its participants shall protect such information in accordance with applicable laws, regulations, and administrative practices. Information may be identified as "business-confidential" if a person having the information may derive an economic benefit from it or may obtain a competitive advantage over those who do not have it, the information is not generally known or publicly available from other sources, and the owner has not previously made the information available without imposing in a timely manner an obligation to keep it confidential.

СОГЛАШЕНИЕ

между Правительством Соединенных Штатов Америки и Правительством Российской Федерации о научно-техническом сотрудничестве в области обращения с плутонием, изъятым из ядерных военных программ

Правительство Соединенных Штатов Америки и Правительство Российской Федерации, именуемые в дальнейшем Сторонами,

Принимая во внимание:

Заявление Президентов Соединенных Штатов Америки и Российской Федерации от 14 января 1994 года « О нераспространении оружия массового уничтожения и средств его доставки»;

Декларацию встречи на высшем уровне в Москве по ядерной безопасности 19-20 апреля 1996 года;

Заключения Международной встречи экспертов в Париже 28-31 октября 1996 года о безопасном и эффективном обращении с делящимися материалами, определенными как более не требующиеся для военных целей;

Положение, касающееся делящихся материалов, Заключительного Коммюнике Встречи на высшем уровне в Денвере стран Большой Восьмерки от 22 июня 1997 года;

Заявление Президента Соединенных Штатов Америки от 1 марта 1995 года о том, что 200 тонн делящихся материалов будут выведены из ядерного арсенала США и никогда более не будут использованы для создания ядерного оружия; и

Обращение Президента Российской Федерации к участникам 41-ой сессии Генеральной конференции МАГАТЭ 26 сентября 1997 года о поэтапном изъятии из ядерных военных программ до 500 тонн высокообогащенного урана и до 50 тонн плутония, высвобождаемых в процессе ядерного разоружения;

Согласились о нижеследующем:

Статья 1

Целью настоящего Соглашения является:

а). выработка научно-технического обоснования для принятия решения об использовании плутония, являющегося предметом данного Соглашения.

б). определение основных направлений продолжения и расширения научно-технического сотрудничества для выполнения положения параграфа а).

Статья 2

Для целей настоящего Соглашения:

1. Термин «плутоний» означает плутоний, изъятый из ядерных военных программ и более не требуемый для военных целей,
2. Термин «обращение с плутонием» означает перевод плутония в отработавшее топливо или в другие формы, в равной степени не пригодные для использования в ядерном оружии или других ядерных взрывных устройствах и может включать конверсию плутония, производство из плутония смешанного оксидного топлива (МОКС-топлива), использование МОКС-топлива в ядерных реакторах и иммобилизацию плутония в различных формах.

Статья 3

1. Стороны будут:

а) продолжать сотрудничество в области маломасштабных испытаний и демонстраций в области обращения с плутонием; а также

б) так скоро, как это представляется практически возможным, переходить к опытно-промышленным демонстрациям технологий по обращению с плутонием.

2. Основными направлениями сотрудничества Сторон будут:

а) конверсия металлического плутония в оксид, пригодный для изготовления МОКС-топлива для энергетических ядерных реакторов различных типов;

б) стабилизация нестабильных форм плутония;

в) использование плутония в виде МОКС-топлива в энергетических ядерных реакторах различных типов;

г) иммобилизация плутония, включая отходы и трудно перерабатываемые формы; и

д) захоронение иммобилизованных материалов, содержащих плутоний, в глубоких геологических формациях.

Статья 4

1. Для выполнения положений настоящего Соглашения Стороны назначают исполнительные органы. От Соединенных Штатов Америки - Министерство энергетики Соединенных Штатов Америки, в Российской Федерации исполнительным органом является Министерство Российской Федерации по атомной энергии.

2. В соответствии с законодательством и правилами Сторон и после письменного уведомления другой Стороны, каждая Сторона при необходимости имеет право привлекать к осуществлению данного Соглашения другие правительственные агентства, департаменты и организации своей страны.

3. Для выполнения целей настоящего Соглашения Стороны создают российско-американский Объединенный Координационный Комитет по обращению с плутонием, который координирует и согласовывает работы, проводимые в рамках настоящего Соглашения. Каждая Сторона назначает своих представителей в Объединенном Координационном Комитете. Решения Объединенного Координационного Комитета принимаются на основе консенсуса.

4. Задачами Объединенного Координационного Комитета являются:

а) Определение областей сотрудничества и разработка общего плана работ в рамках настоящего Соглашения;

б) Определение приоритетов, координация, рассмотрение и одобрение совместных проектов, осуществляемых в рамках настоящего Соглашения и в пределах ресурсов, предоставленных Сторонами;

в) Разрешение любых споров, которые могут возникнуть в процессе научно-технической работы в рамках настоящего Соглашения; и

г) Рассмотрение иных вопросов по согласию Сторон, находящихся в рамках настоящего Соглашения.

5. При достижении договоренности о проведении совместных исследований, проектов или экспериментов в рамках настоящего Соглашения, детальный план выполнения этих работ официально составляется в виде исполнительных договоренностей, подлежащих рассмотрению и одобрению Объединенным Координационным Комитетом.

Статья 5

Сотрудничество Сторон в рамках настоящего Соглашения может включать следующие направления:

а) Обмен научной и технической информацией;

б) Разработка концептуальных подходов;

в) Исследовательские, экспериментальные работы и маломасштабные демонстрации технологических решений;

г) Проектирование, создание и эксплуатация опытно-промышленных установок с целью демонстрации и проверки технологических решений, полученных в результате исследований;

д) Передачу оборудования и неядерных материалов;

е) Встречи, семинары, конференции, командировки и рабочие совещания с целью обмена информацией;

ж) Технико-экономические обоснования;

з) Другие формы сотрудничества в рамках настоящего Соглашения по совместному согласию исполнительных органов, выраженному в письменном виде.

Статья 6

1.В рамках настоящего Соглашения осуществляется обмен только несекретной информацией.

2. С целью предотвращения доступа лиц и организаций, не участвующих в выполнении настоящего Соглашения, к информации, передаваемой Сторонами в рамках настоящего Соглашения или полученной в результате его осуществления, и считающейся Сторонами конфиденциальной, с этой информацией следует обращаться как с конфиденциальной информацией. Такая информация должна быть четко определена и обозначена. Определение информации в качестве конфиденциальной осуществляется Стороной, передающей информацию, в соответствии с ее законами и правилами. Сторона, принимающая эту информацию, присваивает ей классификацию, обеспечивающую ей такую степень защищенности, которая, по крайней мере, равноценна защищенности, требуемой Стороной, которая предоставила эту информацию.

3.Обращение с конфиденциальной информацией осуществляется в соответствии с законами и правилами Стороны, получающей информацию, причем эта информация не разглашается и не передается третьей стороне, не участвующей в реализации настоящего Соглашения, без письменного согласия Стороны, передавшей информацию. В соответствии с нормами и правилами Соединенных Штатов Америки, с такой информацией обращаются как с информацией, принадлежащей иностранному правительству, переданной конфиденциально. Эта информация обеспечивается соответствующей защитой. В соответствии с нормами и правилами Российской Федерации с этой информацией обращаются как со служебной информацией ограниченного распространения, и эта информация обеспечивается соответствующей защитой.

4.Стороны обеспечивают эффективную защиту интеллектуальной собственности и распределение прав на интеллектуальную собственность, переданную или созданную в рамках настоящего Соглашения, как это указано в настоящей Статье и в Приложении к настоящему Соглашению, которое является неотъемлемой частью настоящего Соглашения.

5.Информация, передаваемая в рамках настоящего Соглашения, должна использоваться исключительно в целях, установленных настоящим Соглашением.

6.Число лиц, имеющих доступ к конфиденциальной информации, должно быть ограничено числом, необходимым для реализации настоящего Соглашения и других связанных с ним программ и определяется исполнительными органами Сторон.

Статья 7

1. Материалы, оборудование и технологии, передаваемые по настоящему Соглашению, не будут использоваться для производства ядерного оружия, любых ядерных взрывных устройств или для исследований или разработки таких устройств, а также для использования в военных целях.

2. Материалы, оборудование и технологии, передаваемые по настоящему Соглашению, не являются предметом экспорта, реэкспорта или передачи из-под юрисдикции получателя без письменного согласия Сторон.

3. До начала экспортных поставок третьей стороне какого-либо оборудования, материалов или технологий в рамках настоящего Соглашения, Стороны по взаимному согласию в письменном виде определяют условия, в соответствии с которыми эти предметы экспорта могут экспортироваться, реэкспортироваться или передаваться из-под юрисдикции третьей стороны.

4. Исполнительные органы Сторон должны предпринимать все необходимые меры для обеспечения соответствующей физической защиты ядерных материалов, оборудования, установок и ядерных технологий, находящихся под их юрисдикцией, а также применяют такие критерии и уровни физической защиты, которые не ниже критериев и уровней,

определенных в Конвенции по физической защите ядерных материалов и в рекомендациях МАГАТЭ.

Статья 8

Оборудование, поставки, материалы, услуги и работы, предоставляемые или приобретаемые Соединенными Штатами Америки, их подрядчиками, субподрядчиками и их персоналом в целях реализации настоящего Соглашения, являются безвозмездной технической помощью, в отношении которых применяется освобождение от уплаты таможенных пошлин и налогов. Российская Федерация предпринимает все необходимые меры для освобождения такого оборудования, поставок, материалов, услуг и работ от всех налогов, тарифов, таможенных пошлин и сборов Российской Федерации и ее органов.

Статья 9

1.За исключением претензий к отдельным лицам за ущерб или телесное повреждение, явившихся результатом их преднамеренных действий, Правительство Российской Федерации не предъявляет претензий и не возбуждает судебных разбирательств в связи с деятельностью, осуществляемой во исполнение настоящего Соглашения, против Правительства Соединенных Штатов Америки и его персонала или его подрядчиков, субподрядчиков, консультантов, поставщиков или субпоставщиков оборудования или услуг на любом уровне и их персонала за любой ущерб, включая косвенный, прямой или вторичный ущерб имуществу, принадлежащему Российской Федерации. Настоящий пункт не применяется к правовым действиям, осуществляемым Правительством Российской Федерации для обеспечения выполнения положений контрактов, стороной которых является оно, российский гражданин или юридическое лицо.

2.За исключением претензий к отдельным лицам за ущерб или телесное повреждение, явившихся результатом их преднамеренных действий, Правительство Российской Федерации обеспечивает надлежащую защиту, освобождает от материальной ответственности, не предъявляет претензий и не возбуждает судебных разбирательств против Правительства Соединенных Штатов Америки и его персонала, подрядчиков, субподрядчиков, консультантов, поставщиков или субпоставщиков оборудования или услуг на любом уровне и их персоналу по претензиям третьих сторон в связи с деятельностью во исполнение настоящего Соглашения в любом суде за телесное повреждение или ущерб, включая косвенное, прямое или вторичное телесное повреждение или ущерб, причиненные в пределах и за пределами территории Российской Федерации. Ничто в настоящем пункте не истолковывается как признание юрисдикции любого суда над претензиями третьих сторон, к которым применяется настоящий пункт, ни как отказ от иммунитета государства любой из Сторон в отношении возможных претензий к ним третьих сторон.

3. Стороны могут в случае необходимости проводить консультации в связи с претензиями и судебными разбирательствами, касающимися настоящей Статьи.

4. Положения настоящей Статьи не исключают возможности предоставления Сторонами компенсации в соответствии с их национальным законодательством.

5. Ничто в настоящей Статье не истолковывается как препятствующее судебным разбирательствам или претензиям к гражданам Российской Федерации или лицам, постоянно проживающим на территории Российской Федерации.

Статья 10

1. Совместная деятельность в рамках данного Соглашения финансируется из фондов, выделенных на эти цели Соединенными Штатами Америки и Российской Федерацией и в виде предоставления ими материалов, оборудования и услуг экспертов на безвозмездной основе. Совместная деятельность также может быть профинансирована частично или полностью непосредственно из других источников, включая неправительственные фонды и частный сектор.

2. Во всех случаях деятельность в рамках настоящего соглашения и ее финансовая поддержка Соединенными Штатами Америки зависит от наличия ассигнованных средств. Во всех случаях деятельность в рамках

настоящего Соглашения и ее финансовая поддержка Российской Федерацией зависит от наличия ассигнованных средств

Статья 11

В случае заключения контракта со Стороной на приобретение предметов и услуг, включая строительство, с целью выполнения настоящего Соглашения, эти контракты заключаются в соответствии с законами и правилами этой Стороны.

Статья 12

1. Представители Министерства энергетики США имеют право при уведомлении в разумные сроки проводить проверки и ревизию использования любой помощи и содействия, представленной Правительством Соединенных Штатов Америки в рамках сотрудничества, предусмотренного настоящим Соглашением, в течение всего срока действия настоящего Соглашения и трех лет по истечении его срока действия. Подобные проверки могут проводиться на территории или местах Сторон, определенных по взаимной договоренности между исполнительными органами Сторон.

3. Исполнительные органы сторон разрабатывают соответствующие процедуры для проведения проверок и ревизий всех работ, выполняемых в рамках настоящего Соглашения.

Статья 13

Все вопросы, относящиеся к толкованию или применению положений данного Соглашения, решаются путем проведения консультаций между Сторонами.

Статья 14

1. Настоящее Соглашение вступает в силу с даты подписания и действует в течение 5 лет. Срок его действия может быть продлен на очередные 5-летние периоды с письменного согласия обеих Сторон после совместного рассмотрения до окончания каждого 5-летнего периода. Настоящее Соглашение может быть изменено по взаимному согласию Сторон в письменном виде.

2. Действие настоящего Соглашения может быть прекращено любой из Сторон путем направления письменного уведомления о таком намерении по дипломатическим каналам. В этом случае настоящее Соглашение прекращает действие по истечении шести месяцев со дня направления уведомления.

3.В случае прекращения действия данного Соглашения по инициативе одной из Сторон, Стороны могут договориться о выполнении существующих контрактов и проектов в полном объеме и по взаимной договоренности урегулировать вопрос о неоплаченных счетах. Стороны согласны, что в случае прекращения или окончания срока действия настоящего Соглашения, обращение со всей конфиденциальной информацией и интеллектуальной собственностью, полученной в ходе осуществления настоящего Соглашения, будет и впредь осуществляться в соответствии со Статьей 6 настоящего Соглашения, если Сторонами не будет достигнуто иных договоренностей в письменной форме.

СОВЕРШЕНО в______________________________199 г., в двух экземплярах, каждый на английском и русском языках, причем оба текста имеют одинаковую силу.

ЗА ПРАВИТЕЛЬСТВО СОЕДИНЕННЫХ ШТАТОВ АМЕРИКИ	**ЗА ПРАВИТЕЛЬСТВО РОССИЙСКОЙ ФЕДЕРАЦИИ**
Al Gore	

ПРИЛОЖЕНИЕ

к Соглашению между Правительством Соединенных Штатов Америки и Правительством Российской Федерации о научно-техническом сотрудничестве в области обращения с плутонием, изъятым из ядерных военных программ

Интеллектуальная собственность

В соответствии со Статьей 6 настоящего Соглашения:

Стороны обеспечивают адекватную и эффективную защиту интеллектуальной собственности, создаваемой или предоставленной в рамках настоящего Соглашения и соответствующих исполнительных соглашений.

Стороны договорились своевременно уведомлять друг друга о всех изобретениях, результатах научно-технической, научно-информационной деятельности и работах, выполняемых в рамках настоящего Соглашения, на которые распространяются авторские права, а также стремиться к своевременной защите объектов интеллектуальной собственности. Распределение прав на такую интеллектуальную собственность осуществляется в соответствии с положениями настоящего Приложения.

I. Область применения

А. Настоящее Приложение распространяется на всю совместную деятельность, осуществляемую в соответствии с Соглашением, если Стороны или их исполнительные органы не договорились иначе.

Б. Для целей настоящего Соглашения "интеллектуальная собственность" имеет значение, определенное в Статье 2 Конвенции, учреждающей Всемирную организацию интеллектуальной собственности, заключенной в Стокгольме 14 июля 1967 г.

В. Настоящее Приложение касается распределения прав и учета интересов Сторон. Каждая Сторона обеспечивает получение другой Стороной прав на интеллектуальную собственность, переданную в соответствии с настоящим Приложением, путем приобретения этих прав от ее собственных участников посредством заключения контрактов, лицензионных договоров или составления при необходимости иных юридических документов. Настоящее Приложение никоим иным образом не изменяет и не наносит ущерба порядку в распределении прав на интеллектуальную собственность между Стороной и ее гражданами или юридическими лицами, который определяется законами и практикой этой Стороны.

Г. Спорные вопросы относительно интеллектуальной собственности, возникающие в рамках настоящего Соглашения, должны разрешаться путем проведения обсуждений между соответствующими участвующими в его выполнении учреждениями либо, если это необходимо, между Сторонами или их исполнительными органами. По взаимному согласию Сторон спорный вопрос передается на рассмотрение арбитражного суда для его разрешения, обязательного для Сторон, в соответствии с Соглашением и применяемыми положениями международного права.

Д. Прекращение или окончание срока действия настоящего Соглашения не влияет на права или обязательства, вытекающие из настоящего Приложения.

II. Распределение прав

А. Каждой Стороне предоставляется неисключительная, безотзывная, безвозмездная лицензия во всех странах на перевод, воспроизведение и публичное распространение научных и технических журнальных статей, докладов, отчетов и книг, непосредственно подготовленных в результате совместной работы в рамках настоящего Соглашения. Во всех публично распространяемых экземплярах охраняемых авторским правом работ, подготовленных в соответствии с настоящим положением, указываются имена их авторов, за исключением тех случаев, когда автор определенно выразил желание остаться анонимным.

Б. Права на все виды интеллектуальной собственности, помимо тех прав, которые изложены выше в параграфе II.А, распределяются следующим образом:

(1) Приглашенные исследователи получают права на интеллектуальную собственность в соответствии с правилами принимающей их организации. В дополнение к этому, каждый приглашенный

исследователь, признанный как изобретатель или автор, имеет право на получение вознаграждений, премий, прибыли или любых иных вознаграждений в соответствии с правилами принимающей организации.

(2) (а) В отношении интеллектуальной собственности, созданной в ходе совместных исследований, если Стороны, участвующие организации или сотрудники предварительно согласовали объем работ, каждой Стороне предоставляются права и выгоды в ее стране. Права и выгоды в третьих странах определяются в исполнительных соглашениях. Если исследовательская работа не определена как “совместные исследования” в соответствующем исполнительном соглашении, то права на интеллектуальную собственность, созданную в рамках такой исследовательской работы, распределяются в соответствии с приведенным выше параграфом II.Б (1). В дополнение к этому, каждое лицо, признанное как изобретатель или автор, имеет право на вознаграждения в соответствии с правилами участвующих организаций.

(б) Несмотря на положения приведенного выше параграфа 2а), если право на какой-либо вид интеллектуальной собственности действительно согласно законодательству государства одной Стороны, но не действительно согласно законодательству государства другой Стороны, то Сторона, законодательство которой обеспечивает такую защиту, получает все права и выгоды во всех странах мира. Тем не менее, лица, признанные как изобретатели или авторы интеллектуальной собственности, имеют право на получение вознаграждений, премий, прибыли или любых иных вознаграждений в соответствии с правилами участвующих организаций.

III. Деловая конфиденциальная информация

В том случае, если в рамках настоящего Соглашения предоставляется или создается информация, своевременно определенная как деловая конфиденциальная, то каждая Сторона и ее участники осуществляют защиту такой информации в соответствии с применимыми законами, правилами и административной практикой. Информация может определяться как “деловая конфиденциальная”, если какое-либо лицо, располагающее информацией, может извлечь из нее экономическую выгоду или получить конкурентные преимущества перед теми, кто такой информацией не обладает, если информация широко не известна либо не доступна из других источников и если владелец ранее не предоставлял эту информацию без своевременного введения обязательства сохранять ее конфиденциальность.

Appendix B
CONTRACTOR DISCLOSURE STATEMENT

NEPA DISCLOSURE STATEMENT FOR PREPARATION OF EIS FOR DOE SURPLUS PLUTONIUM DISPOSITION

The Council on Environmental Quality (CEQ) Regulations at 40 CFR 1506.5(c), which have been adopted by the the U.S. Department of Energy (DOE) (10 CFR 1021), require contractors who will prepare an EIS to execute a disclosure specifying that they have no financial or other interest in the outcome of the project. The term "financial interest or other interest in the outcome of the project" for purposes of this disclosure is defined in the March 23, 1981, guidance "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations," 46 FR 18026-18038 at Question 17a and b.

"Financial or other interest in the outcome of the project" includes "any financial benefit such as a promise of future construction or design work in the project, as well as indirect benefits the contractor is aware of (e.g., if the project would aid proposals sponsored by the firm's other clients)." 46 FR 18026-18038 at 18031.

In accordance with these requirements, the offerer and any proposed subcontractors hereby certify as follows: (check either (a) or (b) to assure of your proposal).

(a) X Offerer and any proposed subcontractors have no financial or other interest in the outcome of the project.

(b) ___ Offerer and any proposed subcontractor have the following financial or other interest in the outcome of the project and hereby agree to divest themselves of such interest prior to award of this contract.

Financial or Other Interests

1.
2.
3.

Certified by:

____
Signature

Casey Koontz
Name

Contract Representative
Title

Science Applications International Corporation
Company

August 14, 1997
Date

Appendix C
Adjunct Melter Vitrification Process

C.1 ADJUNCT MELTER AS AN IMMOBILIZATION TECHNOLOGY VARIANT

The adjunct melter vitrification process was identified in the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement (Storage and Disposition PEIS)* (DOE 1996) as a possible technology variant for immobilizing surplus plutonium. It is a homogenous immobilization approach similar to the new, stand-alone vitrification facility evaluated in the *Storage and Disposition PEIS*, except that the approach would use some existing facilities and infrastructure at the Savannah River Site (SRS).

In the adjunct melter approach, plutonium would be immobilized, using modified facilities in Building 221–F, into a borosilicate glass frit that would be temporarily stored in individual cans. This frit would be mixed in the new adjunct melter facility with high-level waste (HLW) supplied from the Defense Waste Processing Facility (DWPF). The blended feed would be melted and poured into DWPF canisters to produce a radiation field in the final product that would meet the Spent Fuel Standard (UC 1996).

C.2 EVALUATION OF IMMOBILIZATION TECHNOLOGY VARIANTS

The U.S. Department of Energy (DOE) examined six immobilization technology variants to determine the more promising variants for further development. The six variants were divided into two categories—the external radiation barrier approach and internal radiation barrier approach—as follows:

I. External barrier (Can-in-canister variants)	1. Ceramic immobilization in existing facilities 2. Glass immobilization in existing facilities
II. Internal barrier (Homogenous variants)	3. Vitrification in new, stand-alone facilities 4. Vitrification with an adjunct melter in existing (DWPF at SRS) and new facilities 5. Ceramic immobilization in new, stand-alone facilities 6. Electrometallurgical treatment in existing and new facilities

Nine evaluation criteria, similar to those used in the screening of alternatives for analysis in the *Storage and Disposition PEIS*, were used to qualitatively evaluate the six immobilization technology variants:

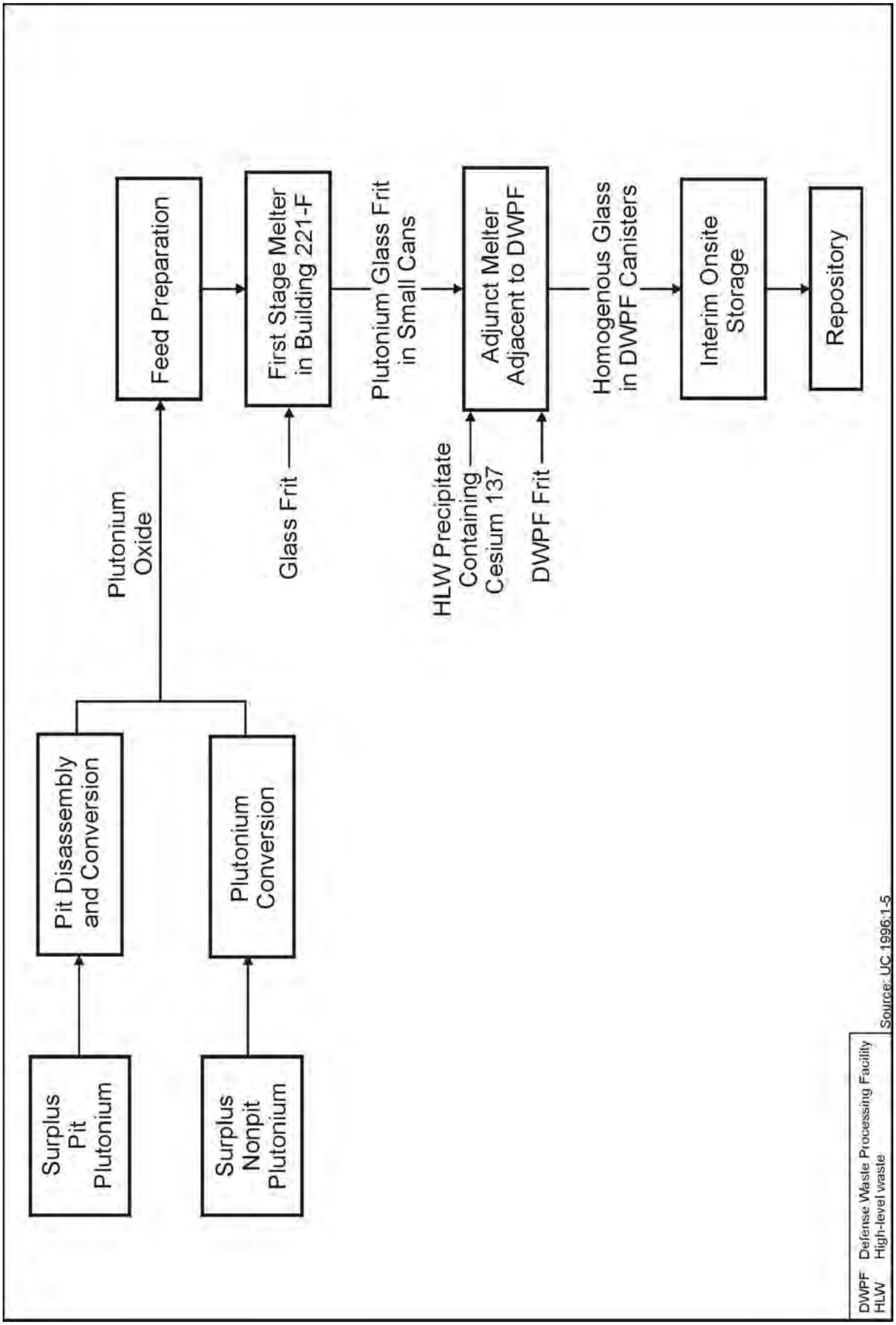
1. Resistance to theft and diversion by unauthorized parties
2. Resistance to retrieval, extraction, and reuse by host nation
3. Technical viability
4. Environmental, safety, and health compliance
5. Cost effectiveness
6. Timeliness
7. Fostering progress and cooperation with Russia and other countries
8. Public and institutional acceptance
9. Additional benefits

The evaluation concluded that the external barrier variants would be superior to the internal barrier variants in terms of timeliness, higher technical viability, much lower costs, and, to a lesser extent, slightly lower environmental and health risks (UC 1997). As a result of this evaluation, the can-in-canister variants (1 and 2) were considered reasonable alternatives for analysis in the *Surplus Plutonium Disposition Environmental Impact Statement* (SPD EIS) and are compared with the homogenous vitrification and ceramic immobilization facilities (3 and 5) evaluated in the *Storage and Disposition PEIS*. DOE decided, in the Record of Decision for the *Storage and Disposition PEIS*, not to pursue the electrometallurgical treatment option (6) because its technology is less mature than vitrification or ceramic immobilization. Although use of the adjunct melter (4) may be viable from a technical standpoint, it would cost twice as much as the can-in-canister approach and would take 1 to 5 years longer to implement. Based on the relative sizes of the facilities, their use of existing facilities and infrastructure, and the processing steps associated with their operation, specific environmental impacts associated with the adjunct melter approach would be expected to result in environmental impacts ranging between those of the new facility (homogenous) variants and the two can-in-canister variants. The adjunct melter's lack of an environmental advantage combined with its timeliness, cost, and technical shortcomings make it less reasonable than the can-in-canister approach. Thus, it is not included as a reasonable alternative for detailed environmental analysis in the SPD EIS. For completeness, a description of the vitrification process using the adjunct melter with DWPF at SRS is provided below.

C.3 ADJUNCT MELTER VITRIFICATION PROCESS

A simplified flow diagram using a new adjunct melter at SRS is shown in Figure C–1. The disposition process would begin with the conversion of feed materials to plutonium oxide at Building 221–F. This oxide would be blended by a dry feed preparation process to prepare a consistent feedstock and fed into a melter along with glass frit to initiate the first stage of vitrification. The first-stage melter would dissolve the plutonium oxide into the borosilicate glass and convert the mixture to a frit containing about 10 percent plutonium by weight. The assumed nominal feed of plutonium over the life of the adjunct melter vitrification process would be 50 t (55 tons) over a 10-year period.

The plutonium glass frit would then be stored in small steel cans and transported as needed to the new adjunct melter facility adjacent to DWPF. Standard DWPF operations receive two main feedlines from the SRS HLW tank farms to be vitrified—a washed tank sludge and an aqueous HLW precipitate that contains highly radioactive cesium 137. In the adjunct melter process, some of the aqueous HLW precipitate would be diverted from the DWPF, via an interarea pipeline, to the adjunct melter facility. At the adjunct melter facility, the plutonium glass frit would be mixed with DWPF frit and the aqueous HLW precipitate in a melter feed tank, and slurry fed to the melter, producing a homogenous glass melt that would then be poured into DWPF canisters. The surplus plutonium contained in the canisters would be dissolved in the glass and uniformly integrated with fission products. The canisters would then be stored on the site awaiting final disposal at a geologic repository pursuant to the Nuclear Waste Policy Act.



Source: UC 1996:1-5

Figure C–1. Adjunct Melter Vitrification Process

C.4 REFERENCES

DOE (U.S. Department of Energy), 1996, *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement*, DOE/EIS-0229, Office of Fissile Materials Disposition, Washington, DC, December.

UC (Regents of the University of California), 1996, *Alternative Technical Summary Report: Vitrification Adjunct Melter to DWPF Variant*, UCRL-ID-122660, L-120217-1, Lawrence Livermore National Laboratory, Livermore, CA, August 26.

UC (Regents of the University of California), 1997, *Immobilization Technology Down-Selection Radiation Barrier Approach*, UCRL-ID-127320, Lawrence Livermore National Laboratory, Livermore, CA, May 23.

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Appendix C

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Appendix E
Facility Data

This appendix presents predesign data on the construction and operations requirements for the proposed surplus plutonium disposition facilities. Tables E–1 through E–24 present data on schedule, construction area requirements, operation area requirements, construction employment requirements, major construction resource requirements, operation employment requirements, and operation resource requirements for each of the four candidate U.S. Department of Energy sites (the Hanford Site [Hanford], Idaho National Engineering and Environmental Laboratory [INEEL], the Pantex Plant [Pantex], and the Savannah River Site [SRS]). For the candidate lead assembly fabrication facilities at Argonne National Laboratory–West, Hanford, Lawrence Livermore National Laboratory, Los Alamos National Laboratory, and SRS, the schedule, operation employment requirements, and operation resource requirements are presented in Tables E–25 through E–28.

The alternatives addressed in the *Surplus Plutonium Disposition Environmental Impact Statement* (SPD EIS) provide options for the collocation of facilities at Hanford in the Fuels and Materials Examination Facility. Resource requirements for the pit conversion facility are the same whether the facility is collocated with the other facilities or is installed alone. There are differences, however, in such requirements for the immobilization and mixed oxide (MOX) facilities as indicated in Tables E–8 through E–24.

E.1 PIT CONVERSION FACILITY

Table E–1. Pit Conversion Facility Schedule

Activity	Calendar Year
Research and development	1995–2002
Integrated-process demonstrations	1998–2002
Facility design	1999–2001
Construction	2001–2003
Permitting and licensing	1999–2004
Startup and operation	2004–2014
Deactivation and stabilization	2015–2017

Note: Schedule dates are approximate based on latest information. Actual timing may cause some activities to start later in the reference year and end sometime past the end year shown here.
Source: UC 1998a–d.

Table E–2. Pit Conversion Facility Construction Area Requirements

Function	Hanford	INEEL	Pantex	SRS
Laydown area, ha (acres) (including spoils, topsoils, etc.)	2 (4.94)	2 (4.94)	2 (4.94)	2 (4.94)
Warehouse area, ha (acres)	0 (0)	0 (0)	0 (0)	0 (0)
Staging area, ha (acres)	0 (0)	0 (0)	0 (0)	0 (0)
Temporary parking, ha (acres)	0 (0)	0 (0)	0 (0)	0 (0)
New roads, km (mi)	0.13 (0.08)	1.3 (0.81)	3.1 (1.93)	1.8 (1.12)

Note: For purposes of the SPD EIS, metric values provided in the data reports were rounded to two significant figures and converted to the English values.
Source: UC 1998a–d.

Table E–3. Pit Conversion Facility Operation Area Requirements

Land-Use Area	Hanford	INEEL	Pantex	SRS
New process facilities, ha (acres)	0 (0)	0 (0)	1.1 (2.72)	1.1 (2.72)
New support facilities, ha (acres)	0.09 (0.22)	0.09 (0.22)	1.5 (3.71)	1.5 (3.71)
Security area, ha (acres)	0 (0)	0 (0)	0 (0)	0 (0)
New parking lots, ha (acres)	0.4 (0.99)	0.4 (0.99)	0.4 (0.99)	0.4 (0.99)

Note: For purposes of the SPD EIS, metric values provided in the data reports were rounded to two significant figures and converted to the English values.
Source: UC 1998a–d.

Table E–4. Pit Conversion Facility Construction Employment Requirements (2001–2003)

Employees	Hanford	INEEL	Pantex	SRS
Craft workers	220	290	853	853
Management and administrative	44	58	171	171
Total employment	264	348	1,024	1,024

Note: Includes construction staff data provided in the data reports.
Source: UC 1998a–d.

Table E–5. Pit Conversion Facility Major Construction Resource Requirements (2001–2003)

Resource Requirements	Hanford	INEEL	Pantex	SRS
Electricity (MWh)	5,100	5,100	5,100	5,100
Fuel, l (gal)	260,000 (68,684)	330,000 (87,176)	990,000 (261,528)	990,000 (261,528)
Water, l (gal)	6,000,000 (1,585,020)	12,000,000 (3,170,040)	36,000,000 (9,510,120)	36,000,000 (9,510,120)
Concrete, m^3 (yd^3)	4,200 (5,494)	5,700 (7,456)	18,000 (23,544)	18,000 (23,544)
Steel, t (tons)	140 (154)	190 (209)	1,900 (2,094)	1,900 (2,094)

Note: For purposes of the SPD EIS, metric values provided in the data reports were rounded to two significant figures and converted to the English values.
Source: UC 1998a–d.

Table E–6. Pit Conversion Facility Annual Employment Operation Requirements

Employees	Hanford	INEEL	Pantex	SRS
Officials and managers	6	6	6	6
Professionals	65	65	65	65
Technicians	179	179	179	179
Office and clerical	14	14	14	14
Craft workers	42	42	42	42
Operatives	22	22	22	22
Laborers	5	5	5	5
Service workers	67	25	67	67
Total employment	400	358	400	400

Source: UC 1998a–d.

Table E–7. Pit Conversion Facility Annual Operation Resource Requirements

Resource Requirements	Hanford	INEEL	Pantex	SRS
Electricity (MWh)	28,000	15,000	16,000	16,000
Coal, t (tons)	NA	2,100 (2,315)	NA	2,400 (2,646)
Natural gas, m^3 (ft^3)	NA	NA	1,300,000 (45,909,500)	NA
Fuel oil,[a] l (gal)	38,000 (10,038)	38,000 (10,038)	38,000 (10,038)	38,000 (10,038)
Water, l (gal)	62,000,000 (16,378,540)	49,000,000 (12,944,330)	48,000,000 (12,680,160)	48,000,000 (12,680,160)
Hydrogen, m^3 (ft^3)	450 (15,892)	450 (15,892)	450 (15,892)	450 (15,892)
Nitrogen, m^3 (ft^3)	2,200 (77,693)	2,200 (77,693)	2,200 (77,693)	2,200 (77,693)
Oxygen, m^3 (ft^3)	330 (11,654)	330 (11,654)	330 (11,654)	330 (11,654)
Argon, m^3 (ft^3)	14,000 (494,410)	14,000 (494,410)	14,000 (494,410)	14,000 (494,410)
Chlorine, m^3 (ft^3)	62 (2,190)	63 (2,225)	62 (2,190)	62 (2,190)
Helium, m^3 (ft^3)	4,800 (169,512)	4,800 (169,512)	4,800 (169,512)	4,800 (169,512)
Sulfuric acid, kg (lb)	570 (1,257)	100 (220)	470 (1,036)	470 (1,036)
Phosphoric acid, kg (lb)	240 (529)	240 (529)	240 (529)	240 (529)
Oils and lubricants, kg (lb)	1,600 (3,527)	1,600 (3,527)	1,600 (3,527)	1,600 (3,527)
Cleaning solvents, kg (lb)	140 (309)	140 (309)	140 (309)	140 (309)
Polyphosphate, kg (lb)	67 (148)	0 (0)	70 (154)	0 (0)
Polyelectrolyte, kg (lb)	240 (529)	240 (529)	240 (529)	240 (529)
Liquid nitrogen, kg (lb)	1,100 (2,425)	1,100 (2,425)	1,100 (2,425)	1,100 (2,425)
Aluminum sulfate, kg (lb)	940 (2,072)	970 (2,138)	960 (2,116)	960 (2,116)
Bentonite, kg (lb)	470 (1,036)	490 (1,080)	480 (1,058)	480 (1,058)

[a] Fuel oil includes gasoline, diesel, and lube oil.

Key: NA, not applicable.

Note: For purposes of the SPD EIS, metric values provided in the data reports were rounded to two significant figures and converted to the English values. Resource requirements less than 50 kg/yr (110 lb/yr) are not listed.

Source: UC 1998a–d.

E.2 IMMOBILIZATION FACILITY

Table E–8. Ceramic or Glass Immobilization Facility Schedule

Activity	Calendar Year
Research and development	1995–2002
Integrated-process demonstrations	1997–2003
Design and construction	1999–2005
Permitting and licensing	1999–2005
Startup and operation	2005–2016
Deactivation and stabilization	2016–2019

Note: Schedule dates are approximate based on latest information. Actual timing may cause some activities to start later in the reference year and end sometime past the end year shown here.
Source: UC 1999a–d.

Table E–9. Ceramic or Glass Immobilization Facility Construction Area Requirements

	Hanford			SRS
		Collocation		
Function	Alone	with PDCF	with MOX	New
Laydown area, ha (acres) (including spoils, topsoils, etc.)	1.8 (4.45)	4.5 (11.1)	4.5 (11.1)	9.7 (24.0)
Warehouse area, ha (acres)	2.6 (6.4)	2.6 (6.4)	2.6 (6.4)	2.6 (6.4)
Staging area, ha (acres)	0 (0)	0 (0)	0 (0)	0 (0)
Temporary parking, ha (acres)	0 (0)	0 (0)	0 (0)	0 (0)
Waste storage area, ha (acres)	0.1 (0.25)	0.1 (0.25)	0.1 (0.25)	0.1 (0.25)
New roads, km (mi)	0 (0)	0.25 (0.16)	0.3 (0.19)	0.6 (0.37)

Key: MOX, mixed oxide fuel fabrication facility; PDCF, pit disassembly and conversion facility.
Note: For purposes of the SPD EIS, metric values provided in the data reports were rounded to two significant figures and converted to the English values.
Source: UC 1999a–d.

Table E–10. Ceramic or Glass Immobilization Facility Operation Area Requirements

	Hanford			SRS
		Collocation		
Land-Use Area	**Alone**	**with PDCF**	**with MOX**	**New**
New process facilities, ha (acres)	0 (0)	0 (0)	0 (0)	0.55 (1.36)
New support facilities, ha (acres)	0 (0)	0.23 (0.57)	0.34 (0.84)	0.16 (0.40)
Security area, ha (acres)	0 (0)	0 (0)	0 (0)	0 (0)
New parking, ha (acres)	0 (0)	0.6 (1.5)	0.72 (1.8)	2 (4.94)

Key: MOX, mixed oxide fuel fabrication facility; PDCF, pit disassembly and conversion facility.
Note: For purposes of the SPD EIS, metric values provided in the data reports were rounded to two significant figures and converted to the English values.
Source: UC 1999a–d.

Table E–11. Ceramic or Glass Immobilization Facility Construction Employment Requirements (2001–2005)

	Hanford			SRS
		Collocation		
Employees	**Alone**	**with PDCF**	**with MOX**	**New**
Craft workers	1,049	1,063	1,306	2,564
Management and administrative	174	176	218	428
Total employment	1,223	1,239	1,524	2,992

Key: MOX, mixed oxide fuel fabrication facility; PDCF, pit disassembly and conversion facility.
Source: UC 1999a–d.

Table E–12. Ceramic or Glass Immobilization Facility Major Construction Resource Requirements (2001–2005)

	Hanford			SRS
		Collocation		
Resource Requirements	**Alone**	**with PDCF**	**with MOX**	**New**
Electricity (MWh)	91,000	74,000	77,000	32,000
Fuel, 1 (gal)	290,000 (76,609)	750,000 (198,128)	960,000 (253,603)	4,700,000 (1,241,599)
Coal, t (tons)	NA	NA	NA	1,800 (1,984)
Water, 1 (gal)	220,000,000 (58,117,400)	230,000,000 (60,759,100)	250,000,000 (66,042,500)	330,000,000 (87,176,100)
Concrete, m^3 (yd^3)	1,900 (2,485)	17,000 (22,236)	22,000 (28,776)	77,000 (100,716)
Steel, t (tons)	420 (463)	3,100 (3,417)	4,000 (4,409)	25,000 (27,558)

Key: MOX, mixed oxide fuel fabrication facility; NA, not applicable; PDCF, pit disassembly and conversion facility.
Note: For purposes of the SPD EIS, metric values provided in the data reports were rounded to two significant figures and converted to the English values.
Source: UC 1999a–d.

Table E–13. Ceramic or Glass Immobilization Facility Annual Employment Operation Requirements

	Hanford					SRS	
			Collocation				
	Alone		with PDCF		with MOX	New	
Employees	**17 t**	**50 t**	**17 t**	**50 t**	**17 t**	**17 t**	**50 t**
Officials and managers	14	14	16	16	16	14	14
Professionals	29	29	33	33	33	29	29
Technicians	188	220	200	232	200	196	212
Office and clerical	12	12	15	15	15	12	12
Craft workers	32	32	36	36	36	32	32
Service workers	60	60	80	80	80	52	52
Total employment	335	367	380	412	380	335	351

Key: MOX, mixed oxide fuel fabrication facility; PDCF, pit disassembly and conversion facility.
Source: UC 1999a–d.

Table E–14. Immobilization Facility Annual Operation Resource Requirements at Hanford

	Ceramic		Glass	
Resource Requirements	**17 t**	**50 t**	**17 t**	**50 t**
Electricity (MWh)	28,000	29,000	28,000	29,000
Coal, t (tons)	NA	NA	NA	NA
Natural gas, m^3 (ft^3)	NA	NA	NA	NA
Fuel oil,[a] l (gal)	69,000 (18,228)	69,000 (18,228)	69,000 (18,228)	69,000 (18,228)
Water, l (gal)	58,000,000 (15,321,860)	62,000,000 (16,378,540)	55,000,000 (14,529,350)	60,000,000 (15,850,200)
Hydrogen, m^3 (ft^3)	290 (10,241)	320 (11,301)	290 (10,241)	320 (11,301)
Oxygen, m^3 (ft^3)	350 (12,360)	400 (14,126)	350 (12,360)	400 (14,126)
Nitrogen,[b] m^3 (ft^3)	990,000 (34,961,850)	1,400,000 (49,441,000)	990,000 (34,961,850)	1,400,000 (49,441,000)
Argon,[b] m^3 (ft^3)	200,000 (7,063,000)	330,000 (11,653,950)	130,000 (4,590,950)	130,000 (4,590,950)
Helium,[b] m^3 (ft^3)	8,600 (303,709)	10,000 (353,150)	8,600 (303,709)	10,000 (353,150)
[Text deleted.]				
Process water, l (gal)	110 (29)	110 (29)	110 (29)	110 (29)
Precursor, kg (lb)	11,000 (24,251)	31,000 (68,343)	NA	NA
Binder, kg (lb)	350 (772)	960 (2,116)	NA	NA
[Text deleted.]				
Frit, kg (lb)	NA	NA	29,000 (63,933)	55,000 (121,253)
Stainless steel canisters, kg (lb)	50,000 (110,230)	140,000 (308,644)	62,000 (136,685)	170,000 (374,782)
Absorbents, kg (lb)	1,100 (2,425)	1,100 (2,425)	1,100 (2,425)	1,100 (2,425)
Hydraulic fluid, l (gal)	400 (106)	400 (106)	400 (106)	400 (106)
Oil,[c] l (gal)	1,400 (370)	1,400 (370)	1,400 (370)	1,400 (370)
Sodium hypochlorite, kg (lb)	57 (126)	57 (126)	57 (126)	57 (126)
Polyphosphate, kg (lb)	84 (185)	84 (185)	84 (185)	84 (185)
Corrosion inhibitor, kg (lb)	100 (220)	100 (220)	100 (220)	100 (220)

[a] Fuel oil includes gasoline, diesel, and oil.

[b] Includes process and nonprocess chemicals.

[c] Includes cutting oil and lubricating oil.

Key: NA, not applicable.

Note: For purposes of the SPD EIS, metric values provided in the data reports were rounded to two significant figures and converted to the English values. Resource requirements less than 50 kg/yr (110 lb/yr) are not listed, except for lubricants.

Source: UC 1999a, 1999b.

Table E–15. Immobilization Facility Annual Operation Resource Requirements Collocated With Pit Conversion Facility at Hanford

	Ceramic		Glass	
Resource Requirements	**17 t**	**50 t**	**17 t**	**50 t**
Electricity (MWh)	23,000	24,000	23,000	24,000
Coal, t (tons)	NA	NA	NA	NA
Natural gas, m^3 (ft^3)	NA	NA	NA	NA
Fuel oil,[a] l (gal)	100,000 (26,417)	100,000 (26,417)	100,000 (26,417)	100,000 (26,417)
Water, l (gal)	68,000,000 (17,963,560)	72,000,000 (19,020,240)	68,000,000 (17,963,560)	72,000,000 (19,020,240)
Hydrogen, m^3 (ft^3)	290 (10,241)	320 (11,301)	290 (10,241)	320 (11,301)
Oxygen, m^3 (ft^3)	350 (12,360)	400 (14,126)	350 (12,360)	400 (14,126)
Nitrogen,[b] m^3 (ft^3)	990,000 (34,961,850)	1,400,000 (49,441,000)	990,000 (34,961,850)	1,400,000 (49,441,000)
Argon,[b] m^3 (ft^3)	200,000 (7,063,000)	330,000 (11,653,950)	130,000 (4,590,950)	130,000 (4,590,950)
Helium,[b] m^3 (ft^3)	8,600 (303,709)	10,000 (353,150)	8,600 (303,709)	10,000 (353,150)
[Text deleted.]				
Process water, l (gal)	110 (29)	110 (29)	110 (29)	110 (29)
Precursor, kg (lb)	11,000 (24,251)	31,000 (68,343)	NA	NA
Binder, kg (lb)	350 (772)	960 (2,116)	NA	NA
[Text deleted.]				
Frit, kg (lb)	NA	NA	29,000 (63,933)	55,000 (121,253)
Stainless steel canisters, kg (lb)	50,000 (110,230)	140,000 (308,644)	62,000 (136,685)	170,000 (374,782)
Absorbents, kg (lb)	1,100 (2,425)	1,100 (2,425)	1,100 (2,425)	1,100 (2,425)
Hydraulic fluid, l (gal)	400 (106)	400 (106)	400 (106)	400 (106)
Oil,[c] l (gal)	1,400 (370)	1,400 (370)	1,400 (370)	1,400 (370)
Sodium hypochlorite, kg (lb)	74 (163)	74 (163)	74 (63)	74 (63)
Polyphosphate, kg (lb)	110 (243)	110 (243)	110 (243)	110 (243)
Corrosion inhibitor, kg (lb)	130 (287)	130 (287)	130 (287)	130 (287)

[a] Fuel oil includes gasoline, diesel, and oil.

[b] Includes process and nonprocess chemicals.

[c] Includes cutting oil and lubricating oil.

Key: NA, not applicable.

Note: For purposes of the SPD EIS, metric values provided in the data reports were rounded to two significant figures and converted to the English values. Resource requirements less than 50 kg/yr (110 lb/yr) are not listed, except for lubricants.

Source: UC 1999a, 1999b.

Table E–16. Immobilization Facility Annual Operation Resource Requirements Collocated With MOX Facility at Hanford

	17 t	
Resource Requirements	**Ceramic**	**Glass**
Electricity (MWh)	24,000	24,000
Coal, t (tons)	NA	NA
Natural gas, m^3 (ft^3)	NA	NA
Fuel oil,[a] l (gal)	100,000 (26,417)	100,000 (26,417)
Water, l (gal)	70,000,000 (18,491,900)	70,000,000 (18,491,900)
Hydrogen, m^3 (ft^3)	290 (10,241)	290 (10,241)
Oxygen, m^3 (ft^3)	350 (12,360)	350 (12,360)
Nitrogen,[b] m^3 (ft^3)	990,000 (34,961,850)	990,000 (34,961,850)
Argon,[b] m^3 (ft^3)	200,000 (7,063,000)	130,000 (4,590,950)
Helium,[b] m^3 (ft^3)	8,600 (303,709)	8,600 (303,709)
[Text deleted.]		
Process water, l (gal)	110 (29)	110 (29)
Precursor, kg (lb)	11,000 (24,251)	NA
Binder, kg (lb)	350 (772)	NA
[Text deleted.]		
Frit, kg (lb)	NA	29,000 (63,933)
Stainless steel canisters, kg (lb)	50,000 (110,230)	62,000 (136,685)
Absorbents, kg (lb)	1,100 (2,425)	1,100 (2,425)
Hydraulic fluid, l (gal)	400 (106)	400 (106)
Oil,[c] l (gal)	1,400 (370)	1,400 (370)
Sodium hypochlorite, kg (lb)	81 (179)	81 (179)
Polyphosphate, kg (lb)	120 (265)	120 (265)
Corrosion inhibitor, kg (lb)	140 (309)	140 (309)

[a] Fuel oil includes gasoline, diesel, and oil.
[b] Includes process and nonprocess chemicals.
[c] Includes cutting oil and lubricating oil.

Key: NA, not applicable.

Note: For purposes of the SPD EIS, metric values provided in the data reports were rounded to two significant figures and converted to the English values. Resource requirements less than 50 kg/yr (110 lb/yr) are not listed, except for lubricants.

Source: UC 1999a, 1999b.

Table E–17. Immobilization Facility Annual Operation Resource Requirements at SRS

	Ceramic		**Glass**	
Resource Requirements	**17 t**	**50 t**	**17 t**	**50 t**
Electricity (MWh)	23,000	24,000	23,000	23,000
Coal, t (tons)	1,200 (1,323)	1,200 (1,323)	1,200 (1,323)	1,200 (1,323)
Natural gas, m^3 (ft^3)	NA	NA	NA	NA
Fuel oil,[a] l (gal)	69,000 (18,228)	69,000 (18,228)	69,000 (18,228)	69,000 (18,228)
Water, l (gal)	100,000,000 (26,417,000)	110,000,000 (29,058,700)	100,000,000 (26,417,000)	110,000,000 (29,058,700)
Hydrogen, m^3 (ft^3)	290 (10,241)	320 (11,301)	290 (10,241)	320 (11,301)
Oxygen, m^3 (ft^3)	350 (12,360)	400 (14,126)	350 (2,360)	400 (14,126)
Nitrogen,[b] m^3 (ft^3)	990,000 (34,961,850)	1,400,000 (49,441,000)	990,000 (34,961,850)	1,400,000 (49,441,000)
Argon,[b] m^3 (ft^3)	200,000 (7,063,000)	330,000 (11,653,950)	130,000 (4,590,950)	130,000 (4,590,950)
Helium,[b] m^3 (ft^3)	8,600 (303,709)	10,000 (353,150)	8,600 (303,709)	10,000 (353,150)
[Text deleted.]				
Process water, l (gal)	110 (29)	110 (29)	110 (29)	110 (29)
Precursor, kg (lb)	11,000 (24,251)	31,000 (68,343)	NA	NA
Binder, kg (lb)	350 (772)	960 (2,116)	NA	NA
[Text deleted.]				
Frit, kg (lb)	NA	NA	29,000 (63,933)	55,000 (121,253)
Stainless steel canisters, kg (lb)	50,000 (110,230)	140,000 (308,644)	62,000 (136,685)	174,000 (383,600)
Absorbents, kg (lb)	1,100 (2,425)	1,100 (2,425)	1,100 (2,425)	1,100 (2,425)
Hydraulic fluid, l (gal)	400 (106)	400 (106)	400 (106)	400 (106)
Oil,[c] l (gal)	1,400 (370)	1,400 (370)	1,400 (370)	1,400 (370)
Sodium hypochlorite, kg (lb)	130 (287)	130 (287)	130 (287)	130 (287)
Polyphosphate, kg (lb)	190 (419)	190 (419)	190 (419)	190 (419)
Corrosion inhibitor, kg (lb)	230 (507)	230 (507)	230 (507)	230 (507)

[a] Fuel oil includes gasoline, diesel, and oil.

[b] Includes process and nonprocess chemicals.

[c] Includes cutting oil and lubricating oil.

Key: NA, not applicable.

Note: For purposes of the SPD EIS, metric values provided in the data reports were rounded to two significant figures and converted to the English values. Resource requirements less than 50 kg/yr (110 lb/yr) are not listed, except for lubricants.

Source: UC 1999c, 1999d.

E.3 MOX FACILITY

Table E–18. MOX Facility Schedule

Activity	Calendar Year
MOX team selection and contract negotiation	1999
Design	2000–2001
Permitting and licensing	2000–2006
Construction	2002–2004
Cold startup	2005
Hot startup	2006
Operation	2006–2015
Deactivation and stabilization	2015–2019 (nominal 3 years)

Note: Schedule dates are approximate based on latest information. Actual timing may cause some activities to start later in the reference year and end sometime past the end year shown here.
Source: UC 1998e–h.

Table E–19. MOX Facility Construction Area Requirements

	Hanford				
Function	FMEF	New	INEEL	Pantex	SRS
Laydown area, ha (acres) (including spoils, topsoils, etc.)	2 (4.94)	2 (4.94)	2 (4.94)	2 (4.94)	2 (4.94)
Warehouse area, ha (acres)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Staging area, ha (acres)	0.65 (1.61)	0.65 (1.61)	0.65 (1.61)	0.65 (1.61)	0.65 (1.61)
Temporary parking, ha (acres)	2 (4.94)	2 (4.94)	2 (4.94)	2 (4.94)	2 (4.94)
Waste storage area, ha (acres)	1 (2.47)	1 (2.47)	1 (2.47)	1 (2.47)	1 (2.47)
New roads, km (mi)	1 (0.62)	1 (0.62)	1 (0.62)	2 (1.24)	2 (1.24)

Key: FMEF, Fuels and Materials Examination Facility.
Note: For purposes of the SPD EIS, metric values provided in the data reports were rounded to two significant figures and converted to the English values.
Source: UC 1998e–h.

Table E–20. MOX Facility Operation Area Requirements

	Hanford				
Land-Use Area	FMEF	New	INEEL	Pantex	SRS
New process facilities, ha (acres)	0 (0)	1.0 (2.47)	1.0 (2.47)	1.0 (2.47)	1.0 (2.47)
New support facilities, ha (acres)	0.47 (1.16)	0.24 (0.59)	0.24 (0.59)	0.24 (0.59)	0.24 (0.59)
Security area, ha (acres)	3 (7.41)	3 (7.41)	3 (7.41)	3 (7.41)	3 (7.41)
New parking, ha (acres)	2 (4.94)	2(4.94)	2 (4.94)	2 (4.94)	2 (4.94)

Key: FMEF, Fuels and Materials Examination Facility.
Note: For purposes of the SPD EIS, metric values provided in the data reports were rounded to two significant figures and converted to the English values.
Source: DOE 1999; UC 1998e–h.

Table E–21. MOX Facility Construction Employment Requirements (2002–2004)

	Hanford				
Employees	**FMEF**	**New**	**INEEL**	**Pantex**	**SRS**
Craft workers	1,263	1,471	1,471	1,471	1,471
Management and administrative	641	679	679	679	679
Total employment	1,904	2,150	2,150	2,150	2,150

Key: FMEF, Fuels and Materials Examination Facility.

Note: Total employment includes construction workers during cold and hot startup years.

Source: DOE 1999; ORNL 1998.

Table E–22. MOX Facility Major Construction Resource Requirements (2002–2004)

	Hanford				
Resource Requirements	**FMEF**	**New**	**INEEL**	**Pantex**	**SRS**
Electricity (MWh)	74,000	6,000	6,000	6,000	6,000
[Text deleted.]					
Fuel, l (gal)	330,000 (87,176)	1,000,000 (264,170)	1,000,000 (264,170)	1,000,000 (264,170)	1,000,000 (264,170)
Water, l (gal)	50,000,000 (13,208,500)	69,000,000 (18,227,730)	69,000,000 (18,227,730)	69,000,000 (18,227,730)	69,000,000 (18,227,730)
Concrete, m^3 (yd^3)	6,300 (8,240)	15,000 (19,620)	15,000 (19,620)	15,000 (19,620)	15,000 (19,620)
Steel, t (tons)	2,400 (2,646)	6,100 (6,724)	6,100 (6,724)	6,100 (6,724)	6,100 (6,724)

[Text deleted.]

Key: FMEF, Fuels and Materials Examination Facility.

Note: For purposes of the SPD EIS, metric values provided in the data reports were rounded to two significant figures and converted to the English values. Resource requirements less than 50 kg/yr (110 lb/yr) are not listed.

Source: DOE 1999; ORNL 1998.

Table E–23. MOX Facility Annual Employment Operation Requirements

	Hanford				
Employees	**FMEF**	**New**	**INEEL**	**Pantex**	**SRS**
Office managers and professionals	86	86	86	86	86
Technicians, operatives, laborers, and service workers	268	268	268	268	268
Office and clerical	12	12	12	12	12
Craft workers	19	19	19	19	19
Total employment	385	385	385	385	385

Key: FMEF, Fuels and Materials Examination Facility.

Note: Total employment during normal operations, after cold and hot startup years.

Source: DOE 1999; ORNL 1998; UC 1998e–h.

Table E–24. MOX Facility Annual Operation Resource Requirements

	Hanford				
Resource Requirements	**FMEF**	**New**	**INEEL**	**Pantex**	**SRS**
Electricity (MWh)	46,000	46,000	30,000	30,000	30,000
Coal, t (tons)	NA	NA	2,100 (2,315)	NA	890 (983)
Natural gas, m^3 (ft^3)	NA	NA	NA	1,100,000 (38,846,500)	NA
Fuel oil,[a] l (gal)	63,000 (16,643)	63,000 (16,643)	63,000 (16,643)	63,000 (16,643)	63,000 (16,643)
Water, l (gal)	68,000,000 (17,963,560)	68,000,000 (17,963,560)	68,000,000 (17,963,560)	68,000,000 (17,963,560)	68,000,000 (17,963,560)
Hydrogen, m^3 (ft^3)	23,000 (812,245)	23,000 (812,245)	23,000 (812,245)	23,000 (812,245)	23,000 (812,245)
Nitrogen, m^3 (ft^3)	10,000,000 (353,150,000)	10,000,000 (353,150,000)	10,000,000 (353,150,000)	10,000,000 (353,150,000)	10,000,000 (353,150,000)
Oxygen, m^3 (ft^3)	74 (2,613)	74 (2,613)	74 (2,613)	74 (2,613)	74 (2,613)
Argon, m^3 (ft^3)	500,000 (17,657,500)	500,000 (17,657,500)	500,000 (17,657,500)	500,000 (17,657,500)	500,000 (17,657,500)
Helium, m^3 (ft^3)	21,000 (741,615)	21,000 (741,615)	21,000 (741,615)	21,000 (741,615)	21,000 (741,615)
Phosphoric acid, kg (lb)	100 (220)	100 (220)	100 (220)	100 (220)	100 (220)
Sodium nitrate, kg (lb)	500 (1,102)	500 (1,102)	500 (1,102)	500 (1,102)	500 (1,102)
Sodium hydroxide, kg (lb)	76 (168)	76 (168)	76 (168)	76 (168)	76 (168)
Ethylene glycol, kg (lb)	300 (661)	300 (661)	300 (661)	300 (661)	300 (661)
Lubricant zinc stearate, kg (lb)	300 (661)	300 (661)	300 (661)	300 (661)	300 (661)
[Text deleted.]					
Nitric acid, m^3 (ft^3)	180 (6,357)	180 (6,357)	180 (6,357)	180 (6,357)	180 (6,357)
Silver nitrate kg (lb)	140 (309)	140 (309)	140 (309)	140 (309)	140 (309)
Solvent, l (gal)	15 (3.97)	15 (3.97)	15 (3.97)	15 (3.97)	15 (3.97)
[Text deleted.]					
Hydroxylamine nitrate, kg (lb)	660 (1,455)	660 (1,455)	660 (1,455)	660 (1,455)	660 (1,455)
[Text deleted.]					
Oxalic acid dihydrate, kg (lb)	7,000 (15,432)	7,000 (15,432)	7,000 (15,432)	7,000 (15,432)	7,000 (15,432)
Reillex HPG resin (wet basis), kg (lb)	160 (353)	160 (353)	160 (353)	160 (353)	160 (353)

[a] Fuel oil includes gasoline and oil.

Key: FMEF, Fuels and Materials Examination Facility; NA, not applicable.

Note: For purposes of the SPD EIS, metric values provided in the data reports were rounded to two significant figures and converted to the English values.

Source: DOE 1999; ORNL 1998; UC 1998e–h.

E.4 LEAD ASSEMBLY FABRICATION FACILITY

Table E–25. Lead Assembly Fabrication Facility Schedule

Activity	Calendar Year
Equipment procured	2000–2001
Facility design	1999–2001
Facility permitting	2000–2002
Facility modification	2001–2002
Lead assembly fabrication (operation)	2003–2006
Deactivation and stabilization	2010–2013

Note: Schedule dates are approximate based on latest information. Actual timing may cause some activities to start later in the reference year and end sometime past the end year shown here.
Source: O'Connor et al. 1998a–e.

Table E–26. Lead Assembly Fabrication Annual Employment Operation Requirements

Employees	Number of Employees
Officials and managers	1
Professionals	4
Technicians	31
Office and clerical	2
Craft workers	5
Operatives	8
Service workers	9
Total employment	60

Source: O'Connor et al. 1998a–e.

Table E–27. Lead Assembly Fabrication Construction Resource Requirements

Resource Requirement	ANL–W	Hanford	LLNL	LANL	SRS
Electricity (MWh)	NR	NR	NR	NR	2,800
Fuel oil,[a] l (gal)	NR	NR	NR	NR	45,000 (11,888)
Water, l (gal)	NR	NR	NR	NR	15,000,000 (3,962,550)
Industrial gases, m^3 (ft^3)	NR	NR	NR	NR	57 (2,013)
Concrete, m^3 (yd^3)	NR	NR	NR	NR	19 (25)
Steel, t (tons)	NR	NR	NR	NR	45 (50)

[a] Fuel oil includes gasoline, diesel, and oil.
Key: ANL–W, Argonne National Laboratory–West; LANL, Los Alamos National Laboratory; LLNL, Lawrence Livermore National Laboratory; NR, not reported.
Note: ANL–W, Hanford, LLNL, and LANL require minor modifications to existing buildings; therefore, no significant construction resource requirements are expected.
Source: O'Connor et al. 1998a–e.

Table E–28. Lead Assembly Fabrication Annual Operation Resource Requirements

Resource Requirement	ANL–W	Hanford	LLNL	LANL	SRS
Electricity (MWh)	720	1,200	720	720	720
Coal, t (tons)	NA	NA	NA	NA	60 (66)
Natural gas, m^3 (ft^3)	NA	NA	55,000 (1,942,325)	55,000 (1,942,325)	NA
Fuel oil,[a] l (gal)	61,000 (16,114)	12,000 (3,170)	12,000 (3,170)	12,000 (3,170)	12,000 (3,170)
Water, l (gal)	1,600,000 (422,672)	1,600,000 (422,672)	1,600,000 (422,672)	1,600,000 (422,672)	1,600,000 (422,672)
Argon, m^3 (ft^3)	16,000 (565,040)	16,000 (565,040)	16,000 (565,040)	16,000 (565,040)	16,000 (565,040)
Helium, m^3 (ft^3)	10 (353)	10 (353)	10 (353)	10 (353)	10 (353)
Hydrogen, m^3 (ft^3)	1,000 (35,315)	1,000 (35,315)	1,000 (35,315)	1,000 (35,315)	1,000 (35,315)
Nitrogen, m^3 (ft^3)	5,300 (187,170)	5,300 (187,170)	5,300 (187,170)	5,300 (187,170)	5,300 (187,170)
Oxygen, m^3 (ft^3)	5,000 (176,575)	5,000 (176,575)	5,000 (176,575)	5,000 (176,575)	5,000 (176,575)
Sodium nitrate, kg (lb)	85 (187)	85 (187)	85 (187)	85 (187)	85 (187)
Alcohol, l (gal)	230 (61)	230 (61)	230 (61)	230 (61)	230 (61)
General cleaning fluids, l (gal)	230 (61)	230 (61)	230 (61)	230 (61)	230 (61)

[a] Fuel oil includes gasoline, diesel, and oil.

Key: ANL–W, Argonne National Laboratory–West; LANL, Los Alamos National Laboratory; LLNL, Lawrence Livermore National Laboratory; NA, not applicable.

Note: For purposes of the SPD EIS, metric values provided in the data reports were rounded to two significant figures and converted to the English values. Resource requirements less than 50 kg/yr (110 lb/yr) are not listed.

Source: O'Connor et al. 1998a–e.

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Appendix F
Impact Assessment Methods

This appendix briefly describes the methods used to evaluate the potential direct, indirect, and cumulative effects of the alternatives for surplus plutonium disposition. The same methodologies were also applied to the assessment of impacts at each of the proposed lead assembly and postirradiation examination sites. Included are impact assessment methods for air quality and noise, geology and soils, water resources, ecological resources, cultural and paleontological resources, land use and visual resources, infrastructure, waste management, socioeconomics, human health risk and hazardous chemicals, facility accidents, transportation, environmental justice, and cumulative impacts. Each section is organized so that first the affected resource is described and then the impact assessment method is presented. Detailed descriptions of the methods for facility accident and transportation impact analyses are presented as Appendixes K and L, respectively.

Although impacts were generally described as either major or minor, this assignment was made in different ways, depending on the resource. For air quality, for example, estimated pollutant emissions from the proposed surplus plutonium disposition facilities were compared with the appropriate regulatory standards or guidelines. For human health risk, estimated radionuclide exposure to humans from the proposed facilities were compared with applicable dose limits. Comparison with regulatory standards is a commonly used method for benchmarking environmental impact and is done here to provide perspective on the magnitude of identified impacts.

Other indicators of impact were also established to focus the analysis on impacts that could be major. The analysis of waste management impacts, for example, focused on alternatives where additional waste generation would be a large percentage of current site waste generation, although a major impact was suggested only where waste generation would exceed the capacity of existing waste management facilities. Cumulative impacts were also evaluated with a view to ensuring that actions with minor impacts individually could not have major impacts collectively.

Impacts in all resource areas were analyzed consistently; that is, the impact values were estimated using a consistent set of input variables and computations. Moreover, efforts were made to ensure that calculations in all areas used accepted protocols and up-to-date models. Finally, like presentations were developed to facilitate the comparison of alternatives.

The impact assessment methods used to evaluate the effects of irradiating mixed oxide (MOX) fuel at the proposed domestic, commercial reactor sites (see Section 4.28) are generally the same as those applied to assess the impacts of the surplus plutonium disposition alternatives at each of the candidate U.S. Department of Energy (DOE) sites. Where there is a difference in the impact assessment method, the nature of the deviation and a discussion of the impact assessment methods used for the reactor sites are provided. Otherwise, if no specific exception is noted, the impact assessment methods applied to the candidate DOE sites were also applied to the proposed reactor sites.

F.1 AIR QUALITY AND NOISE

F.1.1 Description of Affected Resources

F.1.1.1 Air Quality

Air pollution refers to any substance in the air that could harm human or animal populations, vegetation, or structures, or that unreasonably interferes with the comfortable enjoyment of life and property. For purposes of the *Surplus Plutonium Disposition Environmental Impact Statement* (SPD EIS), only outdoor air pollutants were addressed. They may be in the form of solid particles, liquid droplets, gases, or a combination of these forms. Generally, they can be categorized as primary pollutants (those emitted directly from identifiable sources) and secondary pollutants (those produced in the air by interaction between two or more primary pollutants or by reaction with normal atmospheric constituents, which may be influenced by sunlight). Air pollutants are transported, dispersed, or concentrated by meteorological and topographical conditions. Thus, air quality is affected by air pollutant emission characteristics, meteorology, and topography.

Ambient air quality in a given location can be described by comparing the concentrations of various pollutants in the atmosphere with the appropriate standards. Ambient air quality standards have been established by Federal and State agencies, allowing an adequate margin of safety for protection of public health and welfare from the adverse effects of pollutants in the ambient air. Pollutant concentrations higher than the corresponding standards are considered unhealthy; those below such standards, acceptable.

The pollutants of concern are primarily those for which Federal and State ambient air quality standards have been established, including criteria air pollutants, hazardous air pollutants, and other toxic air compounds. Criteria air pollutants are those listed in 40 CFR 50, *National Primary and Secondary Ambient Air Quality Standards* (EPA 1997a). Hazardous air pollutants and other toxic compounds are those listed in Title I of the 1990 Clean Air Act (CAA) as amended, those regulated by the National Emissions Standards for Hazardous Air Pollutants (NESHAPs), and those that have been proposed or adopted for regulation by the respective State or are listed in State guidelines. Also of concern are air pollutant emissions that may contribute to the depletion of stratospheric ozone or global warming. Construction activities, particularly those that involve modification of existing facilities, may be subject to certain NESHAPs requirements, for example, the reporting, training, and work practice requirements for asbestos renovation (EPA 1997b). Provisions of other NESHAPs requirements, such as those for benzene (EPA 1997c), would likely not apply because the amounts stored and used for construction and operation of these facilities would be small. Provisions of NESHAPs for radionuclides are discussed in Chapter 5 and Appendix F.10.

Areas with air quality better than the National Ambient Air Quality Standards (NAAQS) for criteria air pollutants are designated as being in attainment; areas with air quality worse than the NAAQS for such pollutants, as nonattainment areas. Areas may be designated as unclassified when sufficient data for attainment status designation are lacking. Attainment status designations are assigned by county, metropolitan statistical area, consolidated metropolitan statistical area, or portions thereof. Air Quality Control Regions designated by the U.S. Environmental Protection Agency (EPA) are listed in 40 CFR 81, *Designation of Areas for Air Quality Planning Purposes*.

For locations that are in an attainment area for criteria air pollutants, prevention of significant deterioration (PSD) regulations limit pollutant emissions from new sources and establish allowable increments of pollutant concentrations. Three PSD classifications are specified with the criteria established in the CAA amendments. Class I areas include national wilderness areas, memorial parks larger than 2,020 ha (5,000 acres), and national parks larger than 2,430 ha (6,000 acres), and areas that have been redesignated as Class I. Class II areas are all areas not designated as Class I. No Class III areas have been designated.

Designation as a nonattainment area for criteria air pollutants triggers control requirements designated to achieve attainment status by specified dates. In addition, facilities that constitute major new emission sources cannot be constructed in a nonattainment area without permits that impose stringent pollution control requirements to ensure progress toward compliance.

The region of influence (ROI) for air quality is that area around a site potentially affected by air pollutant emissions caused by the surplus plutonium disposition alternatives. The air quality impact area normally evaluated is the area in which concentrations of criteria air pollutants would increase more than a significant amount in a Class II area. Significance varies according to the averaging period: 2,000 $\mu g/m^3$ for 1 hr for carbon monoxide; 25 $\mu g/m^3$ for 3 hr for sulfur dioxide; 5 $\mu g/m^3$ for 24 hr for sulfur dioxide and particulate matter with an aerodynamic diameter less than or equal to 10 microns (PM_{10}); and 1 $\mu g/m^3$ annually for sulfur dioxide, PM_{10}, and nitrogen dioxide (EPA 1997d). Generally, this covers a few kilometers downwind from the source. For sources within 100 km (62 mi) of a Class I area, the air quality impact area evaluated would include the Class I area if the average 24-hr increase in concentration were greater than 1$\mu g/m^3$. The size of the ROI depends on emission source characteristics, pollutant types, emission rates, and meteorological and topographical conditions. For purposes of this analysis, where most of the sites are large, impacts were evaluated at the site boundary, along roads within the sites to which the public has access, and anywhere else the contributions to pollutant concentrations could exceed the established significance levels.

Baseline air quality is typically described in terms of pollutant concentrations modeled for existing sources at each site and background air pollutant concentrations measured near the sites. For this analysis, concentrations for existing sources were obtained from existing source documents or by modeling recent emissions data. Data from the *Storage and Disposition PEIS* (DOE 1996a) were incorporated where appropriate.

The maximum concentrations of toxic air pollutants at or beyond the site boundary were compared with Federal and State regulations or limits. To determine human health risk (see Appendix F.10), modeling outputs on chemical concentrations in air were weighed against chemical-specific toxicity values. Emissions of radionuclides to the air (see Appendix F.10) were evaluated in terms of a total dosage standard.

F.1.1.2 Noise

Sound results from the compression and expansion of air or some other medium when an impulse is transmitted through it. Sound requires a source of energy and a medium for transmitting the sound wave. Propagation of sound is affected by various factors, including meteorology, topography, and barriers. Noise is undesirable sound that interferes or interacts negatively with the human or natural environment. Noise may disrupt normal activities (e.g., hearing, sleep), damage hearing, or diminish the quality of the environment.

Sound-level measurements used to evaluate the effects of nonimpulsive sound on humans are compensated by an A-weighting scale that accounts for the hearing response characteristics (i.e., frequency) of the human ear. Sound levels are expressed in decibels, or in the case of A-weighted measurements, decibels A-weighted. The EPA has developed noise-level guidelines for different land-use classifications. Some States and localities have established noise control regulations or zoning ordinances that specify acceptable noise levels by land-use category.

Noise from facility operations and associated traffic could affect human and animal populations. Because most nontraffic noise associated with construction and operation of the proposed facilities would be distant from offsite noise-sensitive receptors, the contribution to offsite noise levels should be small. Impacts associated with transportation access routes, including noise from increased traffic, could result in small increases in noise along these routes. The ROI for each of the sites includes the site and surrounding areas, including transportation corridors, where proposed activities might increase noise levels. Transportation corridors most likely to experience increased noise levels are those roads within a few miles of the site boundary that carry most of the site's employee and shipping traffic.

Sound-level data representative of site environs were obtained from existing reports and from calculations of the sound levels typical of prevailing traffic volumes along the transportation corridors. The acoustic environment was further described in terms of existing noise sources for each site.

F.1.2 Description of Impact Assessment

F.1.2.1 Air Quality

Potential air quality impacts of pollutant emissions from construction and normal operations were evaluated for each alternative (see Table F–1). That assessment included a comparison of effects of each alternative with applicable Federal and State ambient air quality standards and concentration limits. The more stringent standards, EPA or State, served as the assessment criteria. Criteria for hazardous and toxic air pollutants include those listed in Title III of the 1990 CAA Amendments, NESHAPs, and standards and guidelines adopted by the respective states. The State ambient standards are the same as or more stringent than the Federal ambient standards. The Federal primary ambient standards define levels of air quality that EPA "judges are necessary with an adequate margin of safety, to protect the public health" (EPA 1997a). The Federal secondary ambient standards define levels of air quality that EPA "judges are necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant" (EPA 1997a). The surplus plutonium disposition incremental change in concentrations of pollutants was compared with the PSD Class II allowable increments. Impacts on Class I PSD areas were evaluated where there was a Class I area within 100 km (62 mi) of the site.

Operational air pollutant emissions data for each alternative (other than No Action) were based on engineering design reports; construction emissions data for each alternative, on engineering design reports, emission factors for construction equipment listed in *Compilation of Air Pollutant Emission Factors: Mobile Sources* (EPA 1991:vol. II, 7-1–7-7), and emission factors for fugitive dust from construction listed in *Compilation of Air Pollutant Emission Factors* (EPA 1996a:13.2-1; 13.2-2; 13.2.2-1–13.2.2-8; 13.2.3-1–13.2.3-7; 13.2.4-1–13.2.4-9; 13.2.5-1–13.2.5-21). Traffic emissions were estimated using EPA's MOBILE5b and PART 5 emissions calculation models.

For each alternative, contributions to offsite air pollutant concentrations were modeled on the basis of guidance presented in the *Guideline on Air Quality Models* (EPA 1997e). The EPA-recommended Industrial Source Complex Model, Version 3 (ISC3), was selected as the most appropriate model to perform the air dispersion modeling, because it is designed to support the EPA regulatory modeling program and is capable of handling multiple sources and source types. The short-term version of ISC3, ISCST3, was used to calculate concentrations with averaging times of 1 to 24 hours and annual average concentrations. Concentrations for the No Action Alternative were based on information provided in the *Storage and Disposition PEIS* (DOE 1996a).

For each reactor site proposed for irradiation of MOX fuel, the contributions to offsite air pollutant concentrations were modeled using the EPA long-term version of the ISC3 model, ISCLT3, for annual average concentrations, and the SCREEN3 model, for short-term average concentrations. Emissions were based on information provided by Duke Engineering and Services, COGEMA Inc., and Stone and Webster as summarized in the *MOX Fuel Fabrication Facility and Nuclear Power Reactor Data Report* (DOE 1999).

The modeling analysis incorporated conservative assumptions, which tend to overestimate the pollutant concentrations. The "highest-high" concentration for each pollutant and averaging time was selected for comparison with the applicable assessment criterion, instead of the less conservative EPA-recommended "highest-high" and "highest second-highest" concentration for long-term and short-term averaging times, respectively. The concentrations evaluated were the maximum occurring at or beyond the site boundary or a public access road, and included the contribution of the alternative and that of existing onsite sources. Available monitoring data, which reflect both onsite and offsite sources, were also taken into consideration. Concentrations of the criteria air pollutants, hazardous air pollutants, and toxic air compounds were presented for each alternative. Construction equipment activity emissions were evaluated as a volume source for each

Table F–1. Impact Assessment Protocol for Air Quality and Noise

Resource	Required Data: Affected Environment	Required Data: Facility Design	Measure of Impact
Air quality			
Criteria air pollutants and other regulated pollutants[a]	Ambient concentration ($\mu g/m^3$) of air pollutants, and concentrations of pollutants from existing sources at site	Emission (kg/yr) of air pollutants from facility and facility construction or modification; source characteristics (e.g., stack height and diameter, exit temperature and velocity); shipments and workforce estimates	Contribution of proposed alternative to concentrations of each pollutant at or beyond site boundary; total concentration of each pollutant at or beyond site boundary; percent of applicable standard
Toxic/hazardous air pollutants[b]	Ambient concentrations ($\mu g/m^3$) of toxic air pollutants; concentrations of pollutants from existing sources at site	Emission rate (kg/yr) of toxic air pollutants from facility; source characteristics (e.g., stack height and diameter, exit temperature and velocity)	Contribution of proposed alternative to concentrations of each pollutant at or beyond the site boundary; total concentration of each pollutant at or beyond site boundary; percent of applicable standard
Noise	Sound levels at sensitive offsite receptors (e.g., at nearby residences, along major access routes); sound levels at noise-sensitive wildlife habitat (nearby threatened and endangered wildlife habitat)	Descriptions of major construction and operation sources; shipment and workforce estimates	Increase in day/night average sound level at sensitive receptors

[a] Carbon monoxide; hydrogen fluoride; lead; nitrogen oxides; ozone; particulate matter with an aerodynamic diameter less than or equal to 10 μg; sulfur dioxide; total suspended particulates.

[b] Title III pollutants, pollutants regulated under the National Emissions Standard for Hazardous Air Pollutants, and other State-regulated pollutants.

alternative using the ISC3 model. The total concentration, including the contribution from each alternative and the percent of the applicable standard, were presented. This percentage reflects the variability of the No Action concentrations, the standards and guidelines among sites and the differences among the alternatives.

The effects of traffic related to construction and operation for each alternative were evaluated by calculating the emissions of criteria pollutants from worker vehicles and shipping activities.

One year of sequential hourly onsite meteorological data from the sites and upper-air data for appropriate locations from the National Climactic Data Center were used in the air quality modeling. For consistency, the data were for the same year considered in the *Storage and Disposition PEIS* (DOE 1996a).

Additional assumptions were incorporated in the air quality modeling at each site. For example, to model emissions from a generic process stack for MOX fuel fabrication, a single source within the facility was used, assuming a stack height of 8 m (26 ft), a stack diameter of 0.3 m (1 ft), a stack exit temperature equal to the ambient temperature, and a stack exit velocity of 0.03 m/s (0.1 ft/s). Where they could be obtained, however, actual stack locations and stack parameters were used to model pollutant concentrations.

The analysis tends to overestimate pollutant concentrations, since the location of the maximum site boundary concentrations due to surplus plutonium disposition facilities was assumed to be the same as the location of maximum concentrations of other pollutant sources at the site.

Ozone is typically formed as a secondary pollutant in the ambient air (troposphere). It is formed from such primary pollutants as nitrogen oxides and volatile organic compounds, which emanate from vehicular (mobile), natural, and other stationary sources. It is not emitted directly as a pollutant from the sites. Although ozone may thus be regarded appropriately as a regional issue, specific ozone precursors, notably nitrogen dioxide and volatile organic compounds, were analyzed as applicable to the alternatives under consideration.

The CAA, as amended, required that Federal actions conform to the host State's "State Implementation Plan." A State Implementation Plan provides for the implementation, maintenance, and enforcement of NAAQS for the six criteria pollutants: sulfur dioxide; PM_{10}; carbon monoxide; ozone; nitrogen dioxide; and lead. Its purpose is to eliminate or reduce the severity and number of violations of NAAQS and to expedite the attainment of these standards. No department, agency, or instrumentality of the Federal Government shall engage in or support in any way (i.e., provide financial assistance for, license or permit, or approve) any activity that does not conform to an applicable implementation plan. The final rule for *Determining Conformity of General Federal Actions to State or Federal Implementation Plans* (EPA 1993) took effect on January 31, 1994. Hanford, Pantex, the Idaho National Engineering and Environmental Laboratory, the Savannah River Site, and Los Alamos National Laboratory are within areas currently designated as attainment for criteria air pollutants. Therefore, the surplus plutonium disposition alternatives being considered at these sites are not affected by the provisions of the conformity rule. Rocky Flats Environmental Technology Site (RFETS) is in an area designated nonattainment for ozone, PM_{10}, and carbon monoxide. Lawrence Livermore National Laboratory is in an area designated nonattaining for ozone. Applicability of the conformity rule to the RFETS is discussed in Section 4.2.1.7 on No Action.

Emissions of potential stratospheric ozone-depleting compounds such as chlorofluorocarbons were not evaluated because no emissions of these pollutants were identified in the engineering design reports.

Emissions of pollutants that are potential contributors to global warming (e.g., carbon dioxide, nitrous oxide chlorofluorocarbons, and methane) were evaluated using emission data in the engineering design reports. These emissions were compared with annual releases of these pollutants from other sources (EPA 1997f).

F.1.2.2 Noise

Also addressed in the SPD EIS assessment were the onsite and offsite acoustic impacts of construction and operation of the proposed facilities (see Table F–1). That analysis drew from available information (e.g., engineering design reports) on the types of noise sources and the locations of the proposed facilities relative to the site boundary and noise-sensitive locations. Its focus was the degree of change in noise levels at sensitive receptors (e.g., residences near the site boundary and along access routes, and schools along access routes) with respect to ambient conditions. (A change in noise level of less than 3 decibels is generally not detectable by the human ear. An increase of 10 decibels is roughly equivalent to a doubling of the perceived sound.) Most nontraffic noise sources associated with construction and operation of the surplus plutonium disposition facilities are far enough from offsite noise-sensitive receptors that the contribution to offsite noise levels should be small. Projections of traffic noise during construction and operations were based on the employment and shipment projections provided in the engineering design reports.

F.2 GEOLOGY AND SOILS

F.2.1 Description of Affected Resources

Geologic resources include consolidated and unconsolidated earth materials, including mineral assets such as ore and aggregate materials, and fossil fuels such as coal, oil, and natural gas. Geologic conditions include hazards such as earthquakes, faults, volcanoes, landslides, and land subsidence. Soil resources include the loose surface materials of the earth in which plants grow, usually consisting of mineral particles from disintegrating rock, organic matter, and soluble salts.

The ROI for geology and soils includes all areas subject to disturbance by construction and operation of surplus plutonium disposition facilities, and those areas beneath these facilities that would remain inaccessible for the life of the facilities.

Geology and soils were considered with respect to natural conditions that could affect the alternative, as well as those portions of the resource that could be affected by the alternative. Geology and soil conditions that could affect the integrity and safety of the surplus plutonium disposition alternatives include large-scale geologic hazards and attributes of the soil beneath the proposed facility. Geology and soil resources that could be affected by the surplus plutonium disposition alternatives include economically valuable mineral resources and prime farmland soils.

F.2.2 Description of Impact Assessment

Facility construction and operations for the surplus plutonium disposition alternatives were considered from the perspective of impacts on specific geologic resources and soil attributes. Construction impacts would predominate in effects on geologic and soil resources; hence, key factors in the analysis were the land area to be disturbed during construction and occupied during operations (see Table F–2). The main objective was avoidance of the siting of facilities over unstable soils (i.e., soils prone to liquefaction, shrink-swell, or erosion).

Table F–2. Impact Assessment Protocol for Geology and Soils

	Required Data		
Resource	**Affected Environment**	**Facility Design**	**Measure of Impact**
Soil attributes	Presence of any unstable soils at proposed facility location	Location of proposed facility on the site	Location of facility on unstable soils
Valuable mineral and energy resources	Presence of any valuable mineral or energy resources at proposed facility location	Location of proposed facility on the site	Destruction or rendering inaccessible of valuable mineral or energy resources
Prime farmland soils	Presence of prime farmland soils at proposed facility location	Location of proposed facility on the site	Conversion of prime farmland soils to nonagricultural use

Included in the geology and soil impact analysis was consideration of the risks to the proposed facilities of large-scale geologic hazards such as faulting and earthquakes, lava extrusions and other volcanic activity, landslides, sinkholes, and salt dissolution (i.e., conditions that tend to affect broad expanses of land). In the *Storage and Disposition PEIS* (DOE 1996a:4-45–47, 4-148–150, 4-204–206, 4-309–311), hazards from the large-scale geologic conditions at each candidate site were assessed for proposed long-term storage facilities. The supporting data and findings of that analysis, which focused on the presence of the hazard and the distance of the facilities from it, were reviewed and accepted as generally applicable to the surplus plutonium disposition facilities and therefore are incorporated by reference. Efforts were also made to determine if locating the surplus plutonium disposition facilities at a specific site could destroy, or preclude the use of, valuable mineral or energy resources.

Pursuant to the Farmland Protection Policy Act (FPPA) (7 USC 4201 et seq.), and the regulations (7 CFR 658) promulgated as result thereof, the presence of prime farmland was also evaluated. This act requires agencies to make FPPA evaluations part of the National Environmental Policy Act (NEPA) process, the main purpose being to reduce the conversion of farmland to nonagricultural uses by Federal projects and programs. Prime farmland, as defined in 7 CFR 657, is land that contains the best combination of physical and chemical characteristics for producing crops. It includes cropland, pasture land, rangeland, and forest land. Potential prime farmlands not acquired prior to June 22, 1982, the effective date of the FPPA, are exempt from its provisions (DOE 1996b:4-22).

F.3 WATER RESOURCES

F.3.1 Description of Affected Resources

Water resources are the surface and subsurface waters that are suitable for human consumption, agricultural purposes, or irrigation or industrial/commercial purposes, and that could be impacted by the proposed action. This analysis involved the review of engineering estimates of expected water use and effluent discharges from proposed construction, operation, maintenance, and decontamination and decommissioning (D&D) of the proposed facilities, and ultimately the impacts of the activities on the local surface water and groundwater.

F.3.2 Description of Impact Assessment

The water resources evaluation for the SPD EIS tiers from the corresponding analysis presented in the *Storage and Disposition PEIS* (DOE 1996a). Its purpose was to evaluate the differences in the impacts where changes would be incurred in the assumed water usage to accommodate the facilities involved in the planned disposition activities. Determination of the impacts of the alternatives on water resources (see Table F–3) consisted of a comparison of field-generated data with regulatory standards, design parameters commonly used in the water and wastewater design industry, and accepted industry standards.

Certain assumptions were integral to this analysis: (1) that all water and sewage treatment facilities would be approved by the appropriate permitting authority, and thus that the impacts of project-specific withdrawals from the water treatment plants and effluent discharges from the sewage treatment plant would be in accordance with established standards; (2) that the sewage treatment facilities would meet the effluent limitations imposed by their respective National Pollutant Discharge Elimination System (NPDES) permits; and (3) that any storm-water runoff from construction or operation activities would be handled in accordance with the regulations of the appropriate permitting authority. It was also assumed that, during construction, siltation fencing or other erosion control devices would be used to mitigate short-term adverse impacts from siltation, and that, as appropriate, storm-water holding ponds would be constructed to lessen the impacts of rainfall events on the receiving streams.

Table F–3. Impact Assessment Protocol for Water Resources[a]

	Required Data		
Resource	**Affected Environment**	**Facility Design**	**Measure of Impact**
Surface water quality	Surface waters near the facilities in terms of stream classifications and changes in water quality	Anticipated effluent quantity and quality	Noncompliance of surface water quality with relevant standards of Clean Water Act or with State regulations
Groundwater quality	Groundwater near the facilities in terms of classification, presence of designated sole source aquifers, and changes in quality of groundwater	Quantity and quality of anticipated withdrawals from, or discharges to, groundwater	Concentrations of contaminants in groundwater exceeding standards established in accordance with Safe Drinking Water Act or State regulations
Surface water availability	Surface waters near the facilities, including average flow; 7-day, 10-year low flow; and numbers of downstream users	Volume of withdrawals from, and discharges to, surface waters	Changes in availability to downstream users of water for drinking, irrigation, or animal feeding[b]
Groundwater availability	Groundwater near the facilities, including numbers of all groundwater users, existing water rights for major water users, and contractual agreements for water supply use within impacted area	Volume of withdrawals and discharges to groundwater	Changes in availability of groundwater for human consumption, irrigation, or animal feeding
Flooding impacts	Locations of 100- and 500-year floodplains	Facility location on the site	Construction of facilities in a floodplain[c]

[a] For flows above the design capacity of existing water and sewage treatment systems.
[b] An impact is assumed if withdrawals exceed 10 percent of the 7-day, 10-year low flow of the receiving stream.
[c] A floodplain assessment is a prerequisite to construction on a floodplain.

Further assumptions regarding water resources impacts were based in part on results of the analysis. The first step in the analysis was to determine whether any revisions in project water and wastewater flows had occurred between the time of the *Storage and Disposition PEIS* (DOE 1996a) and the collection of data for the SPD EIS. If no revisions were necessary, and if no evidence of an impact on water resources was presented in the *Storage and Disposition PEIS* (DOE 1996a), then it was assumed that no such impact would be incurred. If the analysis reflected a revision downward in the assumed water use for a proposed activity, and there was no impact for that activity in the *Storage and Disposition PEIS* (DOE 1996a), then no impact was attributed to that activity. If the analysis reflected an increase in water use, then an evaluation of the design capacity of the water and wastewater treatment facilities was made to determine whether their design capacity would be exceeded by the additional flows. If the combined flow (i.e., the existing flow plus those from the proposed activities) were less than the design capacity of the water and sewage treatment plants, then it was assumed that there would be no impact on water availability for local users or on the receiving stream from sewage treatment plant effluent discharges. If the flows from the proposed facilities were found to exceed the design capacity of the existing water or sewage treatment facilities, then the following extensive analyses of the impact of these flows were conducted.

Surface Water Availability. The analysis of the potential impacts on water availability entailed comparing the rate of surface water use for the specific alternative, the associated effluent discharges, and the use and classification of water in downstream waterways. For facilities intending to use surface water, an evaluation was made of the total use and the 7-day, 10-year low-flow conditions of the receiving stream. Discharges of effluent back into the receiving stream were included in the evaluation. If net losses were found to exceed 10 percent of the 7-day, 10-year low flow, an impact was assumed. Where groundwater was the source of water, discharges to surface water were interpreted as adding to the flow in the receiving stream. If the increases exceeded 200 percent of the 7-day, 10-year low flow, then an impact was assumed.

Surface Water Quality. The evaluation of the surface water quality impacts focused on the quality and quantity of the effluent to be discharged and the quality of the receiving stream upstream and downstream from the proposed facilities. The evaluation of effluent quality featured review of the expected design parameters, such as the design average and maximum flows, as well as the effluent parameters reflected in the existing or expected NPDES permit. Those parameters include biochemical oxygen demand, total suspended solids, metals, coliform bacteria, organic and inorganic chemicals, radionuclides, and any other parameters that affect the local environment. Water quality management practices were reviewed to ensure that NPDES permit limitations would be met. Factors that currently degrade water quality were also identified.

During construction, the receiving stream could be affected by construction site runoff and sedimentation. Such impacts relate to the amount of land disturbed, the type of soil at the site, the topography, and weather conditions. They would be minimized by application of standard management practices for storm-water and erosion control.

During operations, receiving waters could be affected by increased runoff from parking lots, buildings, or other cleared areas. Storm water from these areas could be contaminated with materials deposited by airborne pollutants, automobile exhaust and residues, and process effluents. Impacts of storm-water discharges could be highly specific, and mitigation would depend on management practices, the design of holding facilities, the topography, and adjacent land use. Data from the existing water quality database were compared with expected flows from the new facilities to determine the relative impacts on the quality of the water in the receiving stream.

Groundwater Availability. Effects of the proposed action on groundwater supplies were determined by analyzing potential withdrawal rates for the construction and operation phases of the action. Estimates of withdrawal from the affected aquifers were provided. Additionally, instances in which groundwater use could exceed a large portion of the locally developed groundwater supplies were identified.

Groundwater Quality. Potential groundwater quality impacts associated with effluent discharges during the construction and operation phases were examined. The groundwater quality projections were then weighed against Federal and State groundwater quality standards, effluent limitations, and drinking water standards to determine the impacts of each alternative. Also evaluated were the effects of construction and operation activities on the movement of existing groundwater contamination plumes, and the consequences thereof for groundwater use in the area.

Floodplain Impacts. Once the regional 100- and 500-year floodplains were identified from maps and other existing documents, the likely impacts of proposed surplus plutonium disposition facility construction and operation activities were analyzed. For any facilities proposed for location in a floodplain, a floodplain assessment would be prepared, as necessary. Where possible, the surplus plutonium disposition facilities were sited to ensure compliance with Executive Order 11988, *Floodplain Management*, and 10 CFR 1022, *Compliance With Floodplain/Wetlands Environmental Review Requirements*.

F.4 ECOLOGICAL RESOURCES

F.4.1 Description of Affected Resources

Ecological resources include terrestrial and aquatic resources (plants and animals), wetlands, and threatened and endangered species that could be affected by proposed construction and operations at the proposed surplus plutonium disposition sites. In accordance with the *Storage and Disposition PEIS* (DOE 1996a), the ROI for habitat impacts from facility construction and operations is the area within a 1.6-km (1-mi) radius of the proposed facilities.

F.4.2 Description of Impact Assessment

The proposed alternatives would involve, at a minimum, land disturbance during modifications to existing facilities and may require site clearing for construction of new facilities (see Table F–4). Accordingly, ecological impacts were assessed in terms of potential disturbances or loss of nonsensitive terrestrial and aquatic habitats and the potential effects on nearby sensitive habitats. For purposes of the SPD EIS, sensitive habitats include those areas occupied by threatened and endangered species, State-protected species, and wetlands.

Table F–4. Impact Assessment Protocol for Ecological Resources

	Required Data		
Resource	**Affected Environment**	**Facility Design**	**Measure of Impact**
Nonsensitive terrestrial and aquatic habitats	Vegetation and wildlife within a 1.6-km (1-mi) radius of proposed facility locations	Area disturbed by construction of proposed facility	Decrease in acreage of undisturbed local and regional nonsensitive habitats
Sensitive terrestrial and aquatic habitats, including wetlands	Sensitive species habitats within a 1.6-km (1-mi) radius of proposed facility locations	Area disturbed by construction of proposed facility	Decrease in extent of sensitive habitats in ROI Determination by USFWS and State agencies that facility construction could disturb sensitive habitats

Key: ROI, region of influence; USFWS, U.S. Fish and Wildlife Service.

F.4.2.1 Nonsensitive Habitat Impacts

During the construction phase, ecological resources could be affected through disturbance or loss of habitat resulting from site clearing, land disturbance, human intrusion, and noise. Terrestrial resources could be directly affected through changes in vegetative cover important to individual animals of certain species with limited home ranges, such as small mammals and songbirds. Likely impacts include increased direct mortality and susceptibility to predation. Activities associated with the construction and operation of facilities (e.g., human intrusion and noise) could also compel the migration of the wildlife to adjacent areas with similar habitat. If the receiving areas were already supporting the maximum sustainable wildlife, competition for limited resources and habitat degradation could be fatal to some species. Therefore, the analysis of impacts on terrestrial wildlife was based largely on the extent of plant community loss or modification.

Construction or modification of facilities, and the operation thereof, could directly affect aquatic resources through increased runoff and sedimentation, increased flows, and the introduction of thermal and chemical changes to the water. However, various mitigation techniques should minimize construction impacts, and discharges of contaminants to surface waters from routine operations are expected to be limited by engineering control practices. Therefore, impacts are expected to be minimal.

F.4.2.2 Sensitive Habitat Impacts

Impacts on threatened and endangered species, State-protected species, and their habitats during construction of the proposed surplus plutonium disposition facilities were determined in a manner similar to that for nonsensitive habitats. A list of sensitive species that could be present at each site was compiled. Informal consultations were initiated with the appropriate U.S. Fish and Wildlife Service (USFWS) offices and State-equivalent agencies as part of the impacts assessment for sensitive species. Plans were developed for preconstruction surveys, as necessary, to determine the presence of any Federal- or State-listed species within the ROI. Those plans call for consulting the USFWS and various State agencies to confirm that potential impacts on sensitive habitats are acceptable or can be mitigated.

Most construction impacts on wetlands are related to the displacement of wetlands by filling, draining, or dredging activities. Operational impacts thereon could result from effluents, surface water or groundwater withdrawals, or the creation of new wetlands. Loss of wetlands resulting from construction and operation of the surplus plutonium disposition facilities was addressed by comparing data on the location and areal extent of wetlands in the ROI with the land area requirements for the proposed facilities.

F.5 CULTURAL AND PALEONTOLOGICAL RESOURCES

F.5.1 Description of Affected Resources

Cultural resources are the indications of human occupation and use of the landscape as defined and protected by a series of Federal laws, regulations, and guidelines. For the SPD EIS, the potential impacts of proposed surplus plutonium disposition activities were assessed separately for each of the three general categories of cultural resources: prehistoric, historic, and Native American. Paleontological resources are the physical remains, impressions, or traces of plants or animals from a former geological age, and may be sources of information on paleoenvironments and the evolutionary development of plants and animals. Although not governed by the same historic preservation laws as cultural resources, they could be affected by the proposed surplus plutonium disposition activities in much the same manner.

Prehistoric resources are physical remains of human activities that predate written records; they generally consist of artifacts that may alone or collectively yield otherwise inaccessible information about the past. Historic resources consist of physical remains that postdate the emergence of written records; in the United States, they are architectural structures or districts, archaeological objects, and archaeological features dating from 1492 and later. Ordinarily, sites less than 50 years old are not considered historic, but exceptions can be made for such properties if they are of particular importance, such as structures associated with Cold War themes. Native American resources are sites, areas, and materials important to Native Americans for religious or heritage reasons. Such resources may include geographical features, plants, animals, cemeteries, battlefields, trails, and environmental features.

The primary ROI used for the cultural and paleontological resource analyses encompasses the land areas directly disturbed by construction and operation of the proposed facilities. The natural setting of those resources was considered a contextual component thereof.

F.5.2 Description of Impact Assessment

The SPD EIS study addressed the potential direct and indirect impacts on cultural resources at each of the candidate sites from the proposed action and alternatives (see Table F–5). The assessment of direct impacts focused on ground-disturbing activities and alterations to existing resources, particularly those listed or eligible for listing on the National Register of Historic Places (National Register), and those considered important to

Table F–5. Impact Assessment Protocol for Cultural and Paleontological Resources

	Required Data		
Resource	**Affected Environment**	**Facility Design**	**Measure of Impact**
Prehistoric resources	Site cultural resource inventory/management plan reflecting listing or eligibility for listing on National Register Existing programmatic agreements	Location of proposed facility on the site Areas to be disturbed	Potential for physical destruction, damage, or alteration; isolation or alteration of the character of the property; introduction of visual, audible, or atmospheric elements out of character; and neglect of resources listed or eligible for listing on the National Register Noncompliance with existing laws, regulations, and programmatic agreements
Historic resources	Site cultural resource inventory/management plan reflecting listing or eligibility for listing on National Register Existing programmatic agreements	Location of proposed facility on the site Areas to be disturbed	Potential for physical destruction, damage, or alteration; isolation or alteration of the character of the property; introduction of visual, audible, or atmospheric elements out of character; and neglect of resources listed or eligible for listing on the National Register Noncompliance with existing laws, regulations, and programmatic agreements
Native American resources	Site cultural resource inventory/management plan reflecting listing or eligibility for listing on National Register Existing programmatic agreements Resources identified through consultations with Native American tribal governments	Location of proposed facility on the site Areas to be disturbed	Potential for disturbance of Native American resources as determined through consultations with potentially affected Native American tribal governments (per DOE Order 1230.2) Noncompliance with existing laws, regulations, and programmatic agreements
Paleontological resources	Site cultural resource inventory/management plan Existing programmatic agreements	Location of proposed facility on the site Areas to be disturbed	Potential for appropriation, excavation, injury, or destruction of resources without permission (per Antiquities Act of 1906) Noncompliance with existing laws, regulations, and programmatic agreements

Native Americans. Potential indirect impacts of surplus plutonium disposition activities were also assessed—impacts associated with reduced access to a resource site, as well as impacts associated with increased traffic and visitation in sensitive areas.

For specific sites, depending on the alternative, more detailed information was required (e.g., file investigations, Native American consultations, implementation of the Native American policy of DOE, predictive modeling) to determine the types, numbers, and locations, as well as the National Register eligibility or importance in other respects of resources in the proposed project area.

Plans were drawn up for consultation with each State Historic Preservation Officer and reviews of existing DOE site cultural resource surveys and management plans to determine the National Register eligibility and importance of the resources, and to assess measures designed to mitigate the impacts of the proposed actions.

The measure of impact on a particular resource will depend largely on specific cultural resource management agreements with the candidate sites, the consultations with State Historic Preservation Officers and affected Native American tribes, and overall compliance with Section 106 of the National Historic Preservation Act.

F.6 LAND RESOURCES

F.6.1 Description of Affected Resources

Land resources include the land on and contiguous to each candidate site; the physical features that influence current or proposed uses; local urban and rural population density; pertinent State, county, and municipal land-use plans and regulations; land ownership and availability; and the aesthetic characteristics of the site and surrounding areas.

Land resources analysis for the SPD EIS determined the potential beneficial or adverse impacts on land use and visual resources for the defined ROI. The ROI for land use at each candidate site varies due to disparities in population density and growth trends, the extent of Federal land ownership, adjacent land-use patterns and trends, and other geographic or safety considerations. The ROI for visual resources includes those lands within the viewshed of the proposed action and alternatives.

F.6.2 Description of Impact Assessment

F.6.2.1 Land-Use Analysis

Requirements for the SPD EIS included estimating the impacts of the alternatives on land use within each DOE site, adjacent Federal or State lands, adjacent communities, and wildlife or resource areas. At issue were the net land area affected; its relationship to conforming and nonconforming land uses; current growth trends, land values, and other socioeconomic factors pertaining to land use; and the projected modifications to other facility activities and missions consistent with the proposed alternatives (see Table F–6). Land-use impacts could vary considerably from site to site, depending on existing facility land-use configurations, adjoining land uses, plans for transportation security, proximity to residential areas, and other environmental and containment factors.

Evaluation of existing land uses at each of the potentially affected sites required review of existing and future facility land-use plans. Where land adjacent to the proposed site is managed by local government, applicable community general plans, zoning ordinances, and population growth trend data were reviewed. Where such land is managed or under the jurisdiction of a Federal or State land management agency, the respective agency resource management plans and policies were reviewed. Total land area requirements include those areas to be occupied by the footprint of each building and nonbuilding support area in conjunction with all paved roads, parking areas, graveled areas, and construction laydown areas, and any land graded and cleared of vegetation. Land area requirements were identified using proposed facility data reports.

Table F–6. Impact Assessment Protocol for Land Resources

Resource	Required Data Affected Environment	 Facility Design	Measure of Impact
Land use; area used	Total site acreage; available acreage	Location of proposed facility on the site; total land area requirements	Facility land requirements greater than 30% of available acreage
Compatibility with existing or future land-use plans, policies, or regulations	Existing facility and regional land-use configurations; applicable plans, policies, or regulations	Location of proposed facility on the site; facility D&D procedures; expected modifications of other facility activities and missions to accommodate proposed alternatives	Incompatibility with existing facility or adjacent land use; encroachment by disturbed area onto sensitive lands protected by existing management plans or policies; significant long-term or permanent loss of land use resulting from facility construction, operation, or D&D
Visual resources	Delineation of nearby visual resources and viewsheds, including Class I areas	Location of proposed facility on the site; facility dimensions and appearance	Significant reduction of assigned VRM classification for a notable viewshed

Key: D&D, decontamination and decommissioning; VRM, Visual Resource Management.

F.6.2.2 Visual Resources Analysis

Visual resource impacts are changes in the physical features of the landscape attributable to the proposed action. Visual resource assessment was based on the Bureau of Land Management Visual Resource Management (VRM) classification scheme (DOI 1986a, 1986b). Impacts on scenic or visual resources were analyzed by identifying existing VRM classifications and documenting any potential reductions therein at each of the alternative locations as a result of the proposed action or alternatives (see Table F–6). Existing class designation was derived from an inventory of scenic qualities, sensitivity levels, and distance zones for particular areas. The elements of scenic quality are landforms, vegetation, water, color, adjacent scenery, scarcity, and cultural modification. Scenic value is determined by the variety and harmonious composition of the elements of scenic quality. Sensitivity levels are determined by user volumes and user attention. Distance zones concern the visibility from travel routes or observation points.

Important concerns of the visual resources analysis were the degree of contrast between the proposed action and the surrounding landscape, the location and sensitivity levels of public vantage points, and the visibility of the proposed action from the vantage points. The distance from a vantage point to the affected area and atmospheric conditions were also taken into consideration, as distance and haze can diminish the degree of contrast and visibility. A qualitative assessment of the degree of contrast between the proposed facilities or activities and the existing visual landscape was also presented. Reduction of an assigned VRM classification could result if the affected area could be seen from the vantage point with a high sensitivity level.

F.7 INFRASTRUCTURE

F.7.1 Description of Affected Resources

Site infrastructure includes physical resources required to support the construction and operation of facilities. It includes the capacities of the onsite road and rail transportation networks; electric power and electrical load capacities; natural gas, coal, and fuel oil capacities; and water supply system capacities.

The ROI is generally limited to the boundaries of DOE sites. However, should infrastructure requirements exceed site capacities, the ROI would be expanded (for analysis) to include the sources of additional supply. For example, if electrical demand (with added facilities) exceeded site availability, then the ROI would be expanded to include the likely source of additional power: the power pool currently supplying the site.

F.7.2 Description of Impact Assessment

In general, infrastructure impacts were assessed by evaluating the requirements of each alternative against the site capacities. An impact assessment was made for each resource (road networks, rail interfaces, electricity, fuel, and water) for the various alternatives (see Table F–7). Tables reflecting site availability and infrastructure requirements were developed for each alternative. Data for these tables were obtained from reports describing the existing infrastructure at the sites, and from the data reports for each facility. If necessary, design mitigation considerations conducive to reduction of the infrastructure demand were also identified.

Table F–7. Impact Assessment Protocol for Infrastructure

	Required Data		
Resource	**Affected Environment**	**Facility Design**	**Measure of Impact**
Transportation Roads (km) Railroads (km)	Site capacity and current usage	Facility requirements	Additional requirement (with added facilities) exceeding site capacity
Electricity Energy consumption (MWh/yr) Peak load (MW)	Site capacity and current usage	Facility requirements	Additional requirement (with added facilities) exceeding site capacity
Fuel Natural gas (m^3/yr) Oil (l/yr) Coal (t/yr)	Site capacity and current usage	Facility requirements	Additional requirement (with added facilities) exceeding site capacity
Water (l/yr)	Site capacity and current usage	Facility requirements	Additional requirement (with added facilities) exceeding site capacity

Any projected demand for infrastructure resources exceeding site availability can be regarded as an indicator of environmental impact. Whenever projected demand approaches or exceeds capacity, further analysis for that resource is warranted. Often, design changes can mitigate the impact of additional demand for a given resource. For example, substituting fuel oil for natural gas (or vice versa) for heating or industrial processes can be accomplished at little cost during the design of a facility, provided the potential for impact is identified early. Similarly, a dramatic "spike" in peak demand for electricity can sometimes be mitigated by changes to operational procedures or parameters.

F.8 WASTE MANAGEMENT

F.8.1 Description of Affected Resources

The operation of surplus plutonium disposition support facilities would generate several types of waste, depending on the alternative. Such wastes include the following:

- **Transuranic:** Waste containing more than 100 nCi of alpha-emitting transuranic (TRU) isotopes with half-lives greater than 20 year per gram of waste, except for (1) high-level waste; (2) waste that DOE has determined, with the concurrence of EPA, does not need the degree of isolation required by 40 CFR 191, and (3) waste that the U.S. Nuclear Regulatory Commission (NRC) has approved for disposal, case by case in accordance with 10 CFR 61. Mixed transuranic waste contains hazardous components regulated under the Resource Conservation and Recovery Act (RCRA).

- **Low-level:** Waste that contains radioactivity and is not classified as high-level waste, TRU waste, or spent nuclear fuel,[1] or the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the TRU concentration is less than 100 nCi/g of waste.

- **Mixed low-level:** Low-level waste that also contains hazardous components regulated under RCRA.

- **Hazardous:** Under RCRA, a solid waste that, because of its characteristics, may (1) cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness, or (2) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed. Hazardous wastes appear on special EPA lists or possess at least one of the following characteristics: ignitability, corrosivity, reactivity, or toxicity. This category does not include source, special nuclear, or byproduct material as defined by the Atomic Energy Act.

- **Nonhazardous:** Discarded material including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities. This category does not include source, special nuclear, or byproduct material as defined by the Atomic Energy Act.

The alternatives for surplus plutonium disposition could have an impact on existing site facilities devoted to the treatment, storage, and disposal of these categories of waste.

For new facilities, construction wastes would be similar to those generated by any construction project of comparable scale. Wastes generated during the modification of existing nuclear facilities, however, could produce additional radioactive or hazardous demolition debris.

For all but nonhazardous wastes, DOE chose to combine the liquid and solid waste generation estimates into one waste generation rate for ease of comparison to site waste generation rates. Liquid waste was converted from liters to cubic meters using a conversion factor of 1,000 liters per cubic meter. This is likely to be conservative because it includes the volume of the liquid waste before treatment.

Waste management activities in support of the disposition of surplus plutonium would be contingent on Records of Decision (RODs) issued for the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DOE 1997a). Depending on future waste-type-specific RODs, in accordance with that EIS, wastes could be treated and disposed of on the site or at regionally or centrally located waste management centers. The ROD for hazardous waste issued on August 5, 1998, states that most DOE sites will continue to use offsite facilities for the treatment and disposal of major portions of nonwastewater hazardous waste, with the Oak Ridge Reservation and SRS continuing to treat some of their own hazardous waste on the site in existing facilities where this is economically favorable. According to the TRU Waste ROD issued on January 20, 1998, TRU and TRU mixed waste would be treated on the site according to the current planning-basis Waste Isolation Pilot Plant (WIPP) Waste Acceptance Criteria and shipped to WIPP for disposal. The impacts of disposing of TRU waste at WIPP are

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[1] Fuel withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated by reprocessing.

described in the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* (DOE 1997b). Current schedules for shipment of TRU waste to WIPP would accommodate shipment of contact-handled TRU waste from surplus plutonium disposition facilities beginning in 2016 (DOE 1997c:17). Therefore, it is assumed TRU waste would be stored on the site until 2016.

F.8.2 Description of Impact Assessment

As shown in Table F–8, impacts were assessed by comparing the projected waste stream volumes generated from the proposed activities at each site with current site waste generation rates and storage volumes.[2] Furthermore, projected waste generation rates for the proposed activities were compared with processing rates and capacities of those existing treatment, storage, and disposal facilities likely to be involved in managing the additional waste. Most likely, each waste type would be managed at many different facilities; for simplicity, however, it was assumed that the entire waste volume would be managed at one treatment facility, one storage facility, and one disposal facility.

Table F–8. Impact Assessment Protocol for Waste Management

Resource	Required Data		Measure of Impact
	Affected Environment	Facility Design	
Waste management capacity TRU waste Low-level waste Mixed low-level waste Hazardous waste Nonhazardous waste	Site generation rates (m^3/yr) for each waste type Site management capacities (m^3) or rates (m^3/yr) for potentially affected treatment, storage, and disposal facilities for each waste type	Construction and operation generation rates (m^3/yr) for each waste type	SPD facility waste generation rates are a large percentage of existing site generation rates and a large percentage of capacities of applicable waste management facilities
Disposal capacity for transuranic waste (including mixed TRU waste)	TRU waste volume (m^3) expected to be disposed of at WIPP Capacity at WIPP (m^3)	Total TRU waste generated (m^3) for SPD facilities	Combination of SPD facility TRU waste generation and existing TRU waste generation exceeds capacity of WIPP

Key: SPD, surplus plutonium disposition; TRU, transuranic; WIPP, Waste Isolation Pilot Plant.

F.9 SOCIOECONOMICS

F.9.1 Description of Affected Resources

Socioeconomic impacts may be defined as the environmental consequences of a proposed action in terms of demographic and economic changes. Two types of jobs would be created as a result of DOE's adopting any of the surplus plutonium disposition alternatives: (1) construction-related jobs, transient in nature and short in duration, and thus less likely to impact public services; and (2) jobs related to plant operations, required for a decade or more and thus possibly creating additional service requirements in the ROI.

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[2] For the SPD EIS, only the impacts relative to the capacities of waste management facilities were considered. Environmental impacts of waste management facility operation are evaluated in other facility-specific or sitewide NEPA documents.

F.9.2 Description of Impact Assessment

Before the socioeconomic analyses could begin, the socioeconomic environment had to be defined for two geographic regions, the regional economic area (REA) and ROI. The REA is used to assess potential effects of an action on the regional economy. REAs are the broad markets defined by the economic linkages among and between the regional industrial and service sectors and the communities within a region. These linkages determine the nature and magnitude of any multiplier effect associated with a change in economic activity.

For example, as work expands at a given site, the money spent on accomplishing this work flows into the local economy; it is spent on additional jobs, goods, and services within the REA. Using the Regional Input-Output Modeling System developed by the Bureau of Economic Analysis of the U.S. Department of Commerce, the regional economic impacts of a proposed project can be estimated over the life of the project.

Similarly, potential demographic impacts were assessed for the ROI. The ROI could represent a smaller geographic area—one in which only the housing market and local community services would be significantly affected by a given alternative. Site-specific ROIs were identified as those counties in which at least 90 percent of the site's workforce reside. This distribution reflects existing residential preferences for people currently employed at the sites and was used to estimate the distribution of new workers required to support the alternatives.

For each REA, data were compiled on the current socioeconomic conditions, including unemployment rates, economic sector activities, and the civilian labor force. For each ROI, statistics were compiled on the housing demand and community services. These data were combined with population forecasts developed using Census Bureau data to project changes to reflect the various siting alternatives being considered. Site-specific data were then used to help determine whether the overall workforce would be increased by the alternatives being considered (see Table F–9).

In some cases, a site’s overall workforce was projected to decrease at the same time additional workers would be needed to support an alternative under consideration in the SPD EIS. In these cases, there would be little change in the site's overall workforce from current levels, and thus very little change in requirements for community services would be expected from a particular alternative. In the alternative, where the projected increases in the site workforce were greater than current levels, the impacts on community services were assessed by determining the increase in community services required to maintain the current status.

F.10 HUMAN HEALTH RISK DURING NORMAL OPERATIONS

F.10.1 Description of Affected Resources

Assessments for the SPD EIS aimed in part at enhancing public understanding of the potential impacts of each of the alternatives on their own health and that of workers. Included was a description of the radiological and chemical releases resulting from construction activities and normal operations for each alternative, including No Action, and the impacts on public and occupational health.

The risks from radiation were not added to those from hazardous chemicals, given the considerable uncertainty as to their combined effects. Impacts of some chemicals are enhanced by radiation, while those of others are not affected or can even be reduced. The reverse also holds true: chemicals can increase, decrease, or not influence radiological effects.

For the public, impacts on individuals (maximally exposed and average exposed) and on the population within 80 km (50 mi) of the site were evaluated; for workers, the focus was impacts on individuals and on the total

Table F–9. Impact Assessment Protocol for Socioeconomics

Resource	Required Data: Affected Environment	Required Data: Facility Design	Measure of Impact
Workforce requirements	Site workforce projections from DOE sites	Estimated construction and operating staff requirements and timeframes	Workforce requirements added to sites' workforce projections
REA civilian labor force	Labor force projections based on State population projections	Estimated construction and operating staff requirements and timeframes	Workforce requirements as a percentage of the civilian labor force
Unemployment rate	1996 unemployment rates in counties surrounding sites and in host States	Estimated construction and operating staff requirements	Projected change in unemployment rates
Health care services Number of hospital beds per 100,000 residents	Latest available rates based on telephone interviews with area hospitals and State hospital associations	Estimated influx of new health care facilities to meet construction and operating staff requirements	Projected change in numbers to maintain current rates
Number of physicians per 100,000 residents	Latest available rates based on AMA data	Estimated influx of new health care employees to meet construction and operating staff requirements	Projected change in numbers to maintain current rates
Housing—Percent of occupied housing units	Latest available rates from the Census Bureau	Estimated influx of new housing units needed for influx of construction and operating staff requirements	Projected change in numbers to maintain current rates
Schools			
Percent operating capacity for school districts in ROI	Latest available rates based on telephone interviews with school districts	Estimated influx of new students generated by movement of employees and their families into ROI	Projected change in operating capacity for school districts in ROI
Teacher-to-student ratio	Latest available rates based on telephone interviews with school districts	Estimated influx of new students generated by movement of employees and their families into ROI	Projected change in number of teachers to maintain current teacher-to-student ratio
Community services			
Ratio of police to 100,000 residents	Latest number of sworn officers based on telephone interviews with police departments	Estimated influx of new officers to meet construction and operating staff requirements	Projected change in number of officers to maintain current police-to-resident ratio
Ratio of firefighters to 100,000 residents	Latest number of firefighters based on telephone interviews with fire departments	Estimated influx of new firefighters to meet construction and operating requirements	Projected change in number of firefighters to maintain current firefighter-to-resident ratio

Key: AMA, American Medical Association; REA, regional economic area; ROI, region of influence.

facility workforce. The basic health risk issue addressed was whether any of the alternatives would result in undue numbers of health effects (e.g., cancers among workers or the public). Because protection of human health is regulated by DOE, EPA, NRC, and the Occupational Safety and Health Administration (OSHA), estimates of public and worker doses and associated health risks are also necessary to demonstrate that surplus plutonium disposition facilities are being designed in compliance with the applicable standards issued by these agencies.

F.10.2 Description of Impact Assessment

F.10.2.1 Public Health Risks

The health risks to the general public were determined in the following ways: (1) for present operations, doses stated in the most recent environmental or safety reports were used to calculate health risks; and (2) for operations of the proposed facilities, incremental radiological and chemical doses were modeled using specific facility data and site-dependent parameters and converted into their associated health risks.

Radiological and chemical impacts associated with the No Action Alternative were estimated from projected releases from all site facilities that are expected to be operating at the time the actions assessed in the SPD EIS are under way. For each of the other alternatives, radiological and chemical effluents were obtained from facility data reports specific to each surplus plutonium disposition process.

F.10.2.1.1 Radiological Risks

Public health risk assessments from radiological releases during normal operations of the proposed facilities at the candidate sites were performed using the Generation II computer code, to calculate doses from inhalation, ingestion of terrestrial foods, drinking water, fish, and direct exposure to radiation in plumes or on the ground. This type of assessment uses site-dependent factors, including meteorology, population distributions, agricultural production, and facility locations on a given site. As reflected in Table F–10, doses were calculated for the maximally exposed individual (MEI) member of the public, for the average exposed member of the public, and for the total population living within 80 km (50 mi) of a given release location (NRC 1977:1.109.30).

Total site doses were compared with regulatory limits and, for perspective, with background radiation levels in the vicinity of the site. These doses were also converted into a projected number of fatal cancers using a risk estimator of 500 fatal cancers per 1 million person-rem derived from data prepared by the National Research Council's Committees on the Biological Effects of Ionizing Radiations and by the International Commission on Radiological Protection (ICRP 1991). The calculated health effects were compared with those arising among the same population groups from other causes.

[Text deleted.]

F.10.2.1.2 Chemical Risks

The potential impacts on the offsite public from exposure to hazardous chemicals released to the atmosphere as a result of the construction or routine operation of the proposed facilities were evaluated. The receptor considered in these evaluations was the MEI member of the offsite population at each candidate site. The MEI is the hypothetical individual in the population who has the highest potential exposure.

Table F–10. Impact Assessment Protocol for Human Health Risk

Risk	Required Data: Affected Environment	Required Data: Facility Design	Measure of Impact
Radiation: public			
Offsite MEI dose via airborne pathways	Current annual dose (mrem) to MEI via all airborne pathways at site	Annual radionuclide release rates (Ci) to air from proposed facility. Stack height. Location of proposed facility on the site.	Annual dose greater than 10 mrem via airborne releases (NESHAPs limit), and 5 mrem (airborne external [10 CFR 50]).
Offsite MEI dose via liquid pathways	Current annual dose (mrem) to MEI via all liquid pathways at site	Annual radionuclide release rates (Ci) to liquid pathways.	Annual dose via liquid releases greater than 4 mrem (SDWA) and 3 mrem (10 CFR 50).
Offsite MEI dose via all pathways, including air, water, and others (e.g., direct radiation)	Current annual dose (mrem) to MEI via all pathways at site Annual radionuclide release rates to air and water from site release locations Joint frequency meteorological data Water dilution factors Distances from radionuclide release points to site boundary for 16 cardinal directions Exposure information associated with other potential pathways (e.g., direct radiation from each site area)	Annual radionuclide releases to air and via any other pathway (e.g., direct radiation) from proposed facility. Stack height. Location of proposed facility on the site. Exposure information associated with other potential pathways (e.g., direct radiation).	Annual dose greater than 100 mrem via all pathways (DOE 5400.5 and 10 CFR 20)
Dose to population within 80 km (50 mi) of site via all pathways	Current annual population dose (person-rem) via all pathways at site Projected population distribution within an 80-km (50-mi) radius from radionuclide release points Latest available milk, meat, and vegetable distributions within an 80-km (50-mi) radius from radionuclide release points Joint frequency meteorological data Water usage values (e.g., fish harvest, number of water drinkers) Water dilution factors	Annual radionuclide release rates (Ci) to air and liquid from proposed facility. Stack height. Location of proposed facility on the site.	Annual population dose greater than 100 person-rem via all pathways (proposed 10 CFR 834).

Table F–10. Impact Assessment Protocol for Human Health Risk (Continued)

Risk	Required Data: Affected Environment	Required Data: Facility Design	Measure of Impact
Radiation: occupational			
Average dose to involved (facility) worker[a]	Not applicable	Annual average dose (mrem) to the facility worker.	Annual dose of more than 750 mrem. This value represents 15% of 10 CFR 835 and 10 CFR 20 limit of 5,000 mrem/yr and 37.5% of DOE administrative control level of 2,000 mrem/yr, and has been chosen to ensure that dose received by average worker is well below dose limits and administrative control level. Annual dose of more than 5,000 mrem/yr for commercial plants (10 CFR 20).
Average dose to noninvolved (site) worker[a]	Current annual average dose (mrem) among all noninvolved workers at site	Not applicable.	Annual dose of more than 250 mrem. This value represents 5% of 10 CFR 835 limit of 5,000 mrem/yr and 12.5% of the DOE administrative control level of 2,000 mrem/yr, and has been chosen to ensure that dose received by average worker is well below dose limits and administrative control level.
Total dose to involved (facility) workers	Not applicable	Annual total dose (person-rem) among all facility workers. Number of facility workers.	Annual dose of more than 750 mrem times number of involved workers. Annual dose of more than 5,000 mrem/yr for commercial plants (10 CFR 20).
Total dose to noninvolved (site) workers	Current annual total dose (person-rem) among all workers at site Number of noninvolved workers	Not applicable.	Annual dose of more than 250 mrem times number of noninvolved workers at site.
Radiation: construction workers			
Average dose to construction worker[a]	Level of existing contamination and dose expected from working in that area of site	Annual average and total dose to construction worker.	For average worker, 50% of values given above for public's MEI. This is based on interpretation of a construction worker as a member of the public and application of a reduction factor of 2 in going to an average rather than a maximally exposed worker.
Total dose to construction workers		Numbers of construction workers.	For total workforce, number of workers in workforce times doses for an average worker.

Table F–10. Impact Assessment Protocol for Human Health Risk (Continued)

Risk	Required Data: Affected Environment	Required Data: Facility Design	Measure of Impact
Hazardous chemicals: public			
Offsite MEI latent cancer incidence risk	Distribution of population in ROI Joint frequency meteorological data	Airborne release (kg/yr) of hazardous chemicals.	Probability of latent cancer incidence for MEI.
[Text deleted.]			

[a] More meaningful in determining health risk than dose to maximally exposed worker, which varies significantly each year. Monitoring, however, will ensure that dose to the maximally exposed worker remains within regulatory limits.

Key: CFR, Code of Federal Regulations; MEI, maximally exposed individual; NESHAPs, National Emission Standards for Hazardous Air Pollutants; ROI, region of influence; SDWA, Safe Drinking Water Act.

As a result of releases from construction and routine operation of facilities, receptors are expected to be potentially exposed to concentrations of hazardous chemicals that are below those that could cause acutely toxic health effects. Acutely toxic health effects result from short-term exposure to relatively high concentrations of contaminants, such as those that may be encountered during facility accidents. Long-term exposure to relatively lower concentrations of hazardous chemicals can produce adverse chronic health effects that may include both carcinogenic and noncarcinogenic effects. However, the health effect endpoint evaluated in this analysis is limited to the probability of an excess latent cancer incidence for the offsite population MEI because only carcinogenic chemicals are expected to be released from the proposed actions.

Estimates of airborne concentrations of hazardous chemicals were developed using the ISC air dispersion model. This model was developed by EPA for regulatory air-dispersion-modeling applications (EPA 1996b). ISC3 is the most recent version of the model and is approved for use for a wide variety of emission sources and conditions. The ISC model estimates atmospheric concentrations based on the airborne emissions from the facility for each block in a circular grid comprising 16 directional sectors (e.g., north, north-northeast, northeast) at radial distances out to 80 km (50 mi) from the point of release, producing a distribution of atmospheric concentrations. The offsite population MEI is located in the block with the highest estimated concentration.

For carcinogenic chemicals, risk is estimated by the following equation:

$$\text{Risk} = \text{CA} \times \text{URF}$$

where

Risk = unitless probability of cancer incidence
CA = contaminant concentration in air (in $\mu g/m^3$)
URF = cancer inhalation unit risk factor (in units of cancers per $\mu g/m^3$)

Cancer unit risk factors are used in risk assessments to estimate an upper-bound lifetime probability of an individual developing cancer as a result of exposure to a particular concentration of a potential carcinogen.

For the proposed actions, benzene is the only potential carcinogen that may be released to the atmosphere during facility construction activities (UC 1998a, 1998b, 1998c, and 1998d). EPA considers benzene to be a human carcinogen based on several studies that show increased incidence of nonlymphocytic leukemia from occupational exposure, increased incidence of neoplasia in rats and mice exposed by inhalation and gavage, and increases in chromosomal aberrations of bone marrow cells and peripheral lymphocytes in workers exposed to benzene and in laboratory studies with rabbits and rats (EPA 1997g).

F.10.2.2 Occupational Health Risks

F.10.2.2.1 Radiological Risks

Health risks from radiological exposure were determined for two types of workers: the facility worker, (i.e., the worker inside one of the plutonium-processing facilities or one of the commercial plants); and the site worker (i.e., the worker elsewhere on the site but not involved in plutonium processing). Health risks to individual workers and to total workforces were assessed.

The facility worker's dose was based on data from design reports on specific surplus plutonium disposition facilities or from the commercial plant historical data. It was assumed that the noninvolved site worker only receives a dose that results from his or her primary onsite activities. No additional dose to these workers would be expected from surplus plutonium disposition facility operation.

Worker doses were converted into the number of projected fatal cancers using the risk estimator of 400 fatal cancers per 1 million person-rem given in the International Commission on Radiological Protection Publication 60 (ICRP 1991). This risk estimator, compared with that for members of the public, reflects the absence of the most radiosensitive age groups (i.e., infants and children) in the workforce.

F.10.2.2.2 Hazardous Chemical Risks

Impacts of exposures to hazardous chemicals for workers directly involved in the proposed actions were not quantitatively evaluated. The use of personal protective equipment by the workers, as well as the use of engineering process controls, will limit worker exposure to levels within OSHA *Permissible Exposure Limits* (in 29 CFR 1910) or American Conference of Governmental Industrial Hygienists *Threshold Limit Values.*

F.11 FACILITY ACCIDENTS

F.11.1 Description of Affected Resources

Processing any hazardous material poses a risk of accidents impacting involved workers (workers directly involved in facility processes), noninvolved workers (workers on the site but not directly involved in facility processes), and members of the public. The consequences of such accidents could involve the release of radioactive or chemical material or the release of hazardous (e.g., explosive) energy, beyond the intended confines of the process. Risk is determined by the development of a representative spectrum of accidents, each of which is conservatively characterized by a likelihood (i.e., expected frequency of occurrence) and a consequence.

For the purpose of this analysis, involved workers were defined as workers in the immediate vicinity of the process involved in the accident; noninvolved workers, as workers located at the closer of 1,000 m (3,281 ft) from the accident (emission) source or the site boundary; and members of the public, as persons residing outside the site boundary and within 80 km (50 mi) of the facility.

F.11.2 Description of Impact Assessment

To avoid duplication, the analysis of potential accidents performed for the SPD EIS took full cognizance of the corresponding analyses in the *Storage and Disposition PEIS* (DOE 1996a), including accident sequence development, source term definition, and consequence analysis. The analysis focused on the likelihoods and consequences of a variety of a bounding spectrum of accidents postulated for each alternative, from high-consequence, low-frequency accidents to low-consequence, high-frequency accidents.

One objective of the accident analysis, a follow-on to a hazard analysis, was to translate each source term into a probabilistic distribution of consequences based on site-specific modeling of meteorological dispersion of the hazardous material and resulting uptake of that material by members of the human population. To predict the impacts of postulated accidents on the health of workers and the public, source terms were translated into consequences using the Melcor Accident Consequence Code System (MACCS2).

Metrics used to measure the impact of each accident include the accident frequency, the mean and 95th percentile doses for the noninvolved worker at the closer of 1,000 m (3,281 ft) or the site boundary, the mean and 95th percentile doses for the MEI at the site boundary, and the mean and 95th percentile doses for members of the general public within 80 km (50 mi) of the facility. Additionally, the individual doses were translated into the probability of latent cancer fatality, and the dose to the general public into the expected number of latent cancer fatalities (see Table F–11). Additional information on the development of accident sequences, source term definition, and consequence analysis can be found in Appendix K.

Table F–11. Impact Assessment Protocol for Facility Accidents

	Required Data		
Accident	**Affected Environment**	**Facility Design**	**Measure of Impact**
Operational events External events NPH events	Meteorological data Data on population within 80 km (50 mi) of facility Site boundary data	Accident source terms Accident frequencies Facility location	Radiological dose at 1,000 m (3,281 ft) from accident source Probability of latent cancer fatality given dose at 1,000 m (3,281 ft) Radiological dose to offsite MEI Probability of latent cancer fatality given dose at site boundary Dose to general public within 80 km (50 mi) of facility Latent cancer fatalities among general public within 80 km (50 mi) of facility

Key: MEI, maximally exposed individual; NPH, natural phenomena hazard.

F.12 TRANSPORTATION

F.12.1 Description of Affected Resources

Overland transportation of any commodity involves a risk to both transportation crew members and members of the public. This risk results directly from transportation-related accidents and indirectly from the increased levels of pollution from vehicle emissions, regardless of cargo. The transportation of plutonium, radioactive waste, or other nuclear materials can pose additional risks owing to the unique properties of the material.

Accordingly, DOE, NRC, and the U.S. Department of Transportation have instituted strict policies and regulations governing the transport of such materials. The requirements are applicable throughout a shipment's ROI, which encompasses the onsite roadways, as well as the public roads between DOE sites and between DOE sites and commercial sites. For site-to-site transport, for example, shippers are required to use interstate highways predominantly.

F.12.2 Description of Impact Assessment

The risk from incident-free transportation was assessed for persons living within 0.8 km (0.5 mi) of the route; the risk from hypothetical accidents, for persons living within 80 km (50 mi) of the route. Assessment of the human health risks of overland transportation is crucial to a complete appraisal of the environment impacts of transportation associated with the surplus plutonium disposition alternatives.

The impacts associated with overland transportation were calculated per shipment, and then multiplied by the number of shipments. This approach allowed for maximum flexibility in determining the risk for a variety of alternatives (see Table F–12).

Fundamental assumptions of this analysis were consistent with those of the *Storage and Disposition PEIS* (DOE 1996a), and the same computer codes, release data, and accident scenarios were used. The HIGHWAY computer program was used for selecting highway routes for transporting radioactive materials by truck. The HIGHWAY database is a computerized road atlas that currently describes approximately 386,242 km (240,000 mi) of roads. A complete description of the interstate system and all U.S. highways is included in the database. Most of the principal State highways and many local and community roadways are also identified. The code is updated periodically to reflect current road conditions, and has been benchmarked against the reported mileages and observations of commercial trucking firms.

The first analytic step in the ground transportation analysis was to determine the incident-free and accident risk factors per shipment for transportation of the various types of hazardous materials. As with any risk estimate, the risk factors were calculated as the product of the probability and the magnitude of the exposure. Accident risk factors were calculated for radiological and nonradiological traffic accidents. The probabilities (much lower than unity [i.e., 1]) and the magnitudes of exposure were multiplied, yielding risk numbers. Incident-free risk factors were calculated for crew and public exposure to radiation emanating from the package and for public exposure to the chemical toxicity of the transportation vehicle exhaust. The probability of incident-free exposure is unity.

The RADTRAN 4 computer code (Neuhauser and Kanipe 1995) was used for the incident-free and accident risk assessments to estimate the impacts on collective populations. RADTRAN 4 was developed by Sandia National Laboratories to calculate population risk associated with the transportation of radioactive materials by a variety of modes: truck, rail, air, ship, and barge. Calculations are in terms of the probabilities and consequences of potential exposure events.

The RISKIND computer code (Yuan et al. 1995) was used to estimate the incident-free doses to MEIs and to develop impact estimates for use in the accident consequence assessment. This code was developed for DOE's Office of Civilian Radioactive Waste Management to analyze the exposure of individuals during incident-free transportation. It also allows for a detailed assessment of the consequences for individuals and population subgroups of severe transportation accidents in various environmental settings.

RISKIND calculations supplemented the collective risk results achieved with RADTRAN 4; they addressed areas of specific concern to individuals and population subgroups. Essentially, the RISKIND analyses answered the “what if” questions, such as, “What if I live next to a site access road?” or “What if an accident happens near my town?”

Radiological doses, expressed in units of rem, were multiplied by the ICRP 60 (ICRP 1991) conversion factors and the estimated numbers of shipments to produce risk estimates in units of latent cancer fatalities. The vehicle emission risk factors were calculated in terms of latent fatalities; the vehicle accident risk factors, in fatalities. The nonradiological risk factors were multiplied by the number of shipments.

For each alternative, risks of both incident-free and accident conditions were assessed. For the incident-free assessment, risks were calculated for “collective populations” of potentially exposed individuals and for MEIs. (The collective population risk is a measure of the radiological risk posed to society as a whole by the

Table F–12. Impact Assessment Protocol for Transportation

Risk	Required Data Affected Environment	Required Data Facility Design	Measure of Impact
Incident-free transportation			
Radiation dose to crew		Origin and destination of shipments Characterization of vehicles and material shipped	Dose and latent cancer fatalities to crew
Radiation dose to public On-link Off-link During stops	Population within 0.8 km (0.5 mi) of route Number of persons using a highway Traffic conditions along route	Origin and destination of shipments Characterization of vehicles and material shipped	Dose and latent cancer fatalities to public
Maximally exposed crew member		Origin and destination of shipments Characterization of vehicles and material shipped Location of workers	Radiation doses compared with 10 CFR 20 limits (2 mrem/hr and 100 mrem/yr)
Maximally exposed member of public		Origin and destination of shipments Characterization of vehicles and material shipped	Radiation doses compared with 10 CFR 20 limits (2 mrem/hr and 100 mrem/yr)
Health risks from vehicle emissions		Origin and destination of shipments Characterization of vehicles	Fatalities
Transportation accidents			
Radiological risk to public	Population within 80 km (50 mi) of route	Origin and destination of shipments Characterization of vehicles and material shipped	Doses and latent cancer fatalities
Nonradiological risk to public (nonradiological)	Traffic conditions along route	Origin and destination of shipments	Fatalities
Maximally exposed individual		Origin and destination of shipments Characterization of vehicles and material shipped	Doses and latent cancer fatalities

Key: CFR, Code of Federal Regulations.

alternative being considered. It was the primary means of comparing the various alternatives.) The accident assessment had two components: (1) a probabilistic risk assessment, which addressed the probabilities and consequences of a range of possible transportation accident environments, including low-probability accidents with high consequences and high-probability accidents with low consequences; and (2) an accident consequence assessment, which concerned only the consequences of the most severe transportation accidents postulated.

F.13 ENVIRONMENTAL JUSTICE

F.13.1 Description of Affected Resources

Constituting the affected environment are the low-income and minority populations residing in the potentially affected area. For the analysis of environmental justice relative to incident-free transportation, that area was defined as a corridor 1.6 km (1 mi) wide centered on rail or truck routes. For analyses pertaining to transportation accidents and evaluations of environmental justice in facility environs, it consisted of the geographical area within an 80 km (50 mi) distance of the accident site or facility.

Minority populations were split among four groups: Asians, Blacks, Hispanics, and Native Americans. The population group designated as Hispanic includes all persons who identified themselves as having Hispanic origins, regardless of race. For example, a person self-identified as Asian and of Hispanic origin was included among Hispanics. Persons self-identified as Asian and not of Hispanic origin were included in the Asian population.

Block group spatial resolution was used throughout the analysis (see Table F–13). The Census Bureau defines block group to include 250–500 housing units with 400 being typical. The minority population residing in the affected area was determined from data contained in Table P12 of Standard Tape File 3A published by the Census Bureau (DOC 1992). Low-income populations were estimated from data in Table P121 (DOC 1992:B-28, B-29), which provides statistical data characterizing income status relative to the poverty threshold for each block group.

F.13.2 Description of Impact Assessment

Formal requirements for inclusion of environmental justice concerns in environmental documentation were initiated by Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*, issued in February 1994. The Council on Environmental Quality has oversight responsibility for implementation of the Executive order in documentation prepared under the provisions of NEPA. The Council issued draft guidance for environmental justice in May 1996 (CEQ 1997). These guidelines provide the foundation for evaluation of environmental justice in the SPD EIS.

Analysis of environmental justice for the SPD EIS focused on the “block group,” one of the geographical aggregations of demographic data typically provided by the Census Bureau (DOC 1992). Block groups provide the finest spatial resolution available for evaluation of low-income populations. It is rare, however, that the boundaries of block groups coincide with those of affected areas. Uniform population distribution within block groups is also uncommon. Such uniformity was assumed, however, for purposes of SPD EIS population estimates. Thus, for each block group, the percentage of the population included in the population count equaled the percentage of the geographical area of the block group that lay within the affected area. An upper bound for the potentially affected population was obtained by including the total population of partially included block groups in the population count; a lower bound, by excluding the total population of such block groups from the count.

The following definitions were used in the evaluation:

- **Minority individuals:** Persons who are members of any of the following population groups: Asian or Pacific Islander, Black, Hispanic, or Native Americans (American Indian, Eskimo, or Aleut). This definition includes all persons except those self-designated as not of Hispanic origin and as either White or “Other Race” (one of the classifications used by the Census Bureau in the 1990 census).

Table F–13. Impact Assessment Protocol for Environmental Justice

	Required Data		
Resource	**Affected Environment**	**Health Effects**	**Measure of Impact**
Minority population	Minority population data at block group spatial resolution from Table P12 of STF3A (DOC 1992)		Disproportionately high annual population dose to minority population (CEQ 1997:app. A)
	Distribution within 80 km (50 mi) of each candidate site	Population dose for sectors within 80-km (50-mi) radius of candidate site	
	Distribution within 1.6 km (1 mi) of transportation corridors	Population dose for areas within 1.6-km (1-mi) radius of transportation corridor	
Low-income population	Low-income population data at block group spatial resolution from Table P121 of STF3A (DOC 1992)		Disproportionately high annual population dose to low-income population (CEQ 1997:app. A)
	Distribution within 80 km (50 mi) of each candidate site	Population dose for sectors within 80-km (50-mi) radius of candidate site	
	Distribution within 1.6 km (1 mi) of transportation corridor	Population dose for areas within 1.6-km (1-mi) radius of transportation corridor	

Key: CEQ, Council on Environmental Quality; DOC, U.S. Department of Commerce; STF, Standard Tape File.

- **Minority population:** The total number of minority individuals residing within a potentially affected area.

- **Low-income individuals:** All persons whose self-reported income is below the poverty threshold as adopted by the Census Bureau (DOC 1992:app. B, B-28).

- **Low-income population:** The total number of low-income individuals residing within a potentially affected area.

If the analysis of health or other environmental effects showed that the actions consistent with the proposed alternatives would have significant impacts on the general population, then additional analysis of impacts on the minority and low-income populations was conducted. The analysis method was identical to that described for the evaluation of radiological impacts on the general population. Given the impracticality of extrapolating block level population and income data, minority and low-income populations within each block group were assumed to increase in direct proportion to the increase in general population from the year 1990 to the year of interest.

F.14 CUMULATIVE IMPACTS

Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7). The cumulative impact analysis for the SPD EIS involved combining the impacts of the SPD EIS alternatives (including No Action) with the impacts of other past, present, and reasonably foreseeable activities.

[Text deleted.]

In general, cumulative impacts were calculated by adding the values for the baseline,[3] the maximum impacts from the proposed activities at the candidate sites, and other future actions. This cumulative value was then weighed against the appropriate impact indicators to determine the potential for impact. Table F–14 shows the selected indicators of cumulative impacts evaluated in the SPD EIS. The analysis focused on the potential for cumulative impacts at each candidate site from DOE actions under detailed consideration at the time of the SPD EIS (see Table F–15). Non-DOE actions were also considered where information was readily available. Public documents prepared by agencies of Federal, State, and local government were the primary sources of information for the non-DOE actions.

Table F–14. Selected Indicators of Cumulative Impact

Category	Indicator
Resource use	Land occupied
	Electricity use
	Water use
	Workers required
[Text deleted.]	
Air quality	Percent of NAAQS for criteria pollutants
Human health	Offsite population
	MEI dose
	Total dose
	Latent cancer fatalities
	Workers
	Average dose
	Total dose
	Latent cancer fatalities
Waste generation	Site waste generation rate versus capacity
	TRU waste
	LLW
	Mixed LLW
	Hazardous waste
	Nonhazardous waste
Transportation	Number of offsite trips
	MEI dose
	Risk of latent cancer fatality

Key: LLW, low-level waste; MEI, maximally exposed individual; NAAQS, National Ambient Air Quality Standards; TRU, transuranic.

It is assumed that construction impacts would not be cumulative because such construction is typically of short duration and construction impacts are generally temporary. However, waste created during construction as well as any radiation doses received by construction workers have been added to the cumulative totals for all

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[3] The conditions attributable to actions, past and present, by DOE and other public and private entities.

Table F–15. Other Past, Present, and Reasonably Foreseeable Actions Considered in the Cumulative Impact Assessment for Candidate DOE Sites

Activities	Hanford	INEEL	Pantex	SRS	LLNL	LANL	ORNL
Storage and Disposition of Weapons-Usable Fissile Materials	X	X	X	X			X
Disposition of Surplus Highly Enriched Uranium				X			X
Interim Management of Nuclear Materials at SRS				X			
[Text deleted.]							
Tritium Supply and Recycling				X			
Waste Management	X	X	X	X		X	X
Spent Nuclear Fuel Management and INEL Environmental Restoration and Waste Management	X	X		X			
Foreign Research Reactor Spent Nuclear Fuel	X	X		X			
Tank Waste Remediation System	X						
Shutdown of the River Water System at SRS				X			
Radioactive releases from nuclear power plant sites, Vogtle and WNP	X			X			
Hanford Reach of the Columbia River Comprehensive River Conservation Study	X						
FEIS and Environmental Information Report for Continued Operation of LLNL and SNL					X		
Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapons Components			X				
Stockpile Stewardship and Management			X	X	X		X
[Text deleted.]							
Management of Plutonium Residues and Scrub Alloy at Rocky Flats				X			
Spent Nuclear Fuel Management (SRS)				X			
DWPF Final Supplemental				X			
Supplemental EIS for In-Tank Precipitation Process Alternatives				X			
Construction and Operation of a Tritium Extraction Facility at SRS				X			
Supplement Analysis for Storing Plutonium in the Actinide Packaging and Storage Facility and Building 105–K at SRS				X			
Los Alamos Site-Wide EIS						X	
Hanford Remedial Action and Comprehensive Land Use Plan	X						
Advanced Mixed Waste Treatment Project		X					
Construction and Operation of the Spallation Neutron Source							X
Long-Term Management and Use of Depleted Uranium Hexafluoride							X

Key: DWPF, Defense Waste Processing Facility; LANL, Los Alamos National Laboratory; LLNL, Lawrence Livermore National Laboratory; ORNL, Oak Ridge National Laboratory; SNL, Sandia National Laboratories; WNP, Washington Nuclear Power.

proposed surplus plutonium disposition activities. D&D of the proposed facilities was not addressed in the cumulative impact estimates. Given the uncertainty regarding the timing of D&D, any impact estimate at this time would be highly speculative. A detailed evaluation of D&D will be provided in follow-on NEPA documentation closer to the actual time of those actions.

Recent sitewide NEPA documents (see Table F–16) provide the latest comprehensive evaluation of cumulative impacts for the sites.

Table F–16. Recent Comprehensive National Environmental Policy Act Documents for the DOE Sites

Site	Document	Year	ROD Issued[a]
Hanford	*Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement*	1996	February 1997
INEEL	*DOE Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement*	1995	March 1996
Pantex	*Final Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components*	1996	January 1997
SRS	*Savannah River Site Waste Management Final Environmental Impact Statement*	1995	October 1995
LLNL	*Final Site-Wide Environmental Impact Statement for Continued Operation of the Lawrence Livermore National Laboratory*	1992	January 1993
LANL	*Final Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory*	1999	Pending

[a] Date of the first ROD issued.

Key: ROD, Record of Decision.

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Appendix G
Air Quality

This appendix presents detailed information that support the air quality impact assessments in Chapter 4. Data are provided for the four candidate U.S. Department of Energy sites: the Hanford Site (Hanford), Idaho National Engineering and Environmental Laboratory (INEEL), the Pantex Plant (Pantex), and the Savannah River Site (SRS).

G.1 HANFORD

G.1.1 Assessment Data

Emission rates for criteria, hazardous, and toxic air pollutants at Hanford are presented in Table F.1.2.2–1 of the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement (Storage and Disposition PEIS)* (DOE 1996a:F-6). These emission rates were used as input into the modeled No Action Alternative pollutant concentrations presented in that environmental impact statement (EIS) and reflect projected Hanford facility emissions for 2005. The storage alternative selected for Hanford results in no change in these concentrations (DOE 1996a:4-34). In addition to the concentrations projected for 2005, the concentrations for the Phased Implementation Alternative—Phase II Operation of the vitrification facilities presented in the *Tank Waste Remediation System Final EIS* (DOE 1996b:5-68) were included in the estimate of the No Action concentration for surplus plutonium disposition as shown in Table G–1. Other onsite activities related to programs analyzed in EISs for spent nuclear fuel and waste management are also included. Other activities at Hanford that may occur during the time period 2005–2015 are discussed in the cumulative impacts section. Radiological impacts, including those from emissions to the air, are discussed in Appendix J.

Table G–1. Estimated Concentrations ($\mu g/m^3$) From No Action at Hanford

Pollutant	Averaging Period	PEIS Estimated Base Year (2005)	Tank Waste Remediation	Other Onsite From PEIS	No Action
Carbon monoxide	8 hours	0.08	34	0	34.1
	1 hour	0.30	48	0	48.3
Nitrogen dioxide	Annual	0.03	0.12	0.1	0.25
PM_{10}	Annual	<0.01	0.0079	0	0.0179
	24 hours	0.02	0.75	0	0.77
Sulfur dioxide	Annual	<0.01	0.02	1.6	1.63
	24 hours	<0.01	1.6	7.3	8.91
	3 hours	0.01	3.6	26	29.6
	1 hour	0.02	4.0	29	32.9
Total suspended particulates	Annual	<0.01	0.0079	0	0.0179
	24 hours	<0.02	0.75	0	0.77
Benzene	Annual	(a)	0.000006	0	0.000006
[Text deleted.]					

[a] No sources of this pollutant have been identified at the site.

Key: PEIS, *Storage and Disposition PEIS*.

Source: DOE 1996a:4-34, 4-912; 1996b:5-68.

G.1.2 Facilities

G.1.2.1 Pit Conversion Facility

G.1.2.1.1 Construction of Pit Conversion Facility

Potential air quality impacts from modification of the Fuels and Materials Examination Facility (FMEF) and construction of support facilities for pit disassembly and conversion at Hanford were analyzed using the Industrial Source Complex Model, Short-Term, Version 3 (ISCST3) as described in Appendix F.1. Construction impacts result from emissions from diesel fuel-burning construction equipment, particulate matter emissions from soil disturbance by construction equipment and other vehicles (construction fugitive emissions), operation of a concrete batch plant, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–2.

Table G–2. Emissions (kg/yr) From Construction of Pit Conversion Facility in FMEF at Hanford

Pollutant	Diesel Equipment and Construction Fugitive Emissions	Vehicles
Carbon monoxide	1,000	11,300
Nitrogen dioxide	2,400	3,040
PM_{10}	3,500	10,300
Sulfur dioxide	160	0
Volatile organic compounds	200	1,400
Total suspended particulates	9,300	10,300

Key: FMEF, Fuels and Materials Examination Facility.
Source: UC 1998a.

Maximum air pollutant concentrations from construction activities are summarized in Table G–3.

Table G–3. Concentrations (μg/m^3) From Construction of Pit Conversion Facility in FMEF at Hanford

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Contribution	Total
Carbon monoxide	8 hours	10,000	34.1	0.277	34.4
	1 hour	40,000	48.3	1.88	50.2
Nitrogen dioxide	Annual	100	0.25	0.0199	0.27
PM_{10}	Annual	50	0.0179	0.029	0.047
	24 hours	150	0.77	0.323	1.09
Sulfur dioxide	Annual	50	1.63	0.00133	1.63
	24 hours	260	8.91	0.0148	8.93
	3 hours	1,300	29.6	0.1	29.7
	1 hour	660[b]	32.9	0.301	33.2
Total suspended particulates	Annual	60	0.0179	0.0771	0.095
	24 hours	150	0.77	0.857	1.63

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

[b] At Hanford, the level is not to be exceeded more than twice in any 7 consecutive days.

Key: FMEF, Fuels and Materials Examination Facility.

Source: EPA 1997; WDEC 1994.

G.1.2.1.2 Operation of Pit Conversion Facility

Potential air quality impacts from operation of the pit conversion and support facilities at Hanford were analyzed using ISCST3 as described in Appendix F.1. Operational impacts result from emissions from emergency diesel generators, process emissions, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–4. Emergency generators were modeled as a volume source. The process stack for radiological emissions was modeled with a 36 m (118 ft) height, 3.88 m (12.7 ft) diameter, stack exit temperature of 20 C (68 F), and an exit velocity of 3.3 m/s (10.8 ft/s). There was no boiler modeled because heating requirements would be met using electric power (UC 1998a).

Table G–4. Emissions (kg/yr) From Operation of Pit Conversion Facility in FMEF at Hanford

Pollutant	Emergency Generator	Process	Vehicles
Carbon monoxide	520	0	41,800
Nitrogen dioxide	2,000	0	11,200
PM_{10}	50	0	38,100
Sulfur dioxide	34	0	0
Volatile organic compounds	58	0	5,150
Total suspended particulates	50	0	38,100

Key: FMEF, Fuels and Materials Examination Facility.

Source: UC 1998a.

Maximum air pollutant concentrations resulting from the emergency diesel generators and process sources, plus the No Action concentrations, are summarized in Table G–5. Radiological impacts, including those from emissions to the air, are discussed in Appendix J.

Table G–5. Concentrations (μg/m^3) From Operation of Pit Conversion Facility in FMEF at Hanford

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Contribution	Total
Carbon monoxide	8 hours	10,000	34.1	0.144	34.2
	1 hour	40,000	48.3	0.978	49.3
Nitrogen dioxide	Annual	100	0.25	0.0166	0.267
PM_{10}	Annual	50	0.0179	0.000415	0.0183
	24 hours	150	0.77	0.00461	0.775
Sulfur dioxide	Annual	50	1.63	0.000282	1.63
	24 hours	260	8.91	0.00313	8.91
	3 hours	1,300	29.6	0.0213	29.6
	1 hour	660[b]	32.9	0.064	33.0
Total suspended particulates	Annual	60	0.0179	0.000415	0.0183
	24 hours	150	0.77	0.00461	0.775

[a] The more stringent of the Federal and State standards is presented if both exist for the averaging period.
[b] At Hanford, the level is not to be exceeded more than twice in any 7 consecutive days.
Key: FMEF, Fuels and Materials Examination Facility.
Source: EPA 1997; WDEC 1994.

G.1.2.2 Immobilization Facility

G.1.2.2.1 Construction of Immobilization Facility

Potential air quality impacts from modification of FMEF and construction of support facilities for plutonium conversion and immobilization (ceramic or glass) at Hanford were analyzed using ISCST3 as described in Appendix F.1. Construction impacts result from emissions from diesel fuel-burning construction equipment, particulate matter emissions from soil disturbance by construction equipment and other vehicles (construction fugitive emissions), operation of a concrete batch plant, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–6.

Table G–6. Emissions (kg/yr) From Construction of Immobilization Facility in FMEF at Hanford

Pollutant	Diesel Equipment	Construction Fugitive Emissions[a]	Concrete Batch Plant	Vehicles
Carbon monoxide	1,170	0	0	39,900
Nitrogen dioxide	3,010	0	0	10,700
PM_{10}	230[b]	193[b]	65[b]	36,400
Sulfur dioxide	310	0	0	0
Volatile organic compounds	240	0	0	4,920
Total suspended particulates	230	193	65	36,400

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

[b] PM_{10} emissions were assumed to be the same as total suspended particulate emissions for the purpose of this analysis resulting in some overestimate of PM_{10} concentrations.

Key: FMEF, Fuels and Materials Examination Facility.

Source: UC 1999a, 1999b.

Maximum air pollutant concentrations from construction activities are summarized in Table G–7.

Table G–7. Concentrations (μg/m^3) From Construction of Immobilization Facility in FMEF at Hanford

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Ceramic or Glass	Total
Carbon monoxide	8 hours	10,000	34.1	0.324	34.4
	1 hour	40,000	48.3	2.2	50.5
Nitrogen dioxide	Annual	100	0.25	0.025	0.275
PM_{10}	Annual	50	0.0179	0.00405	0.022
	24 hours	150	0.77	0.158	0.928
Sulfur dioxide	Annual	50	1.63	0.00257	1.63
	24 hours	260	8.91	0.0286	8.94
	3 hours	1,300	29.6	0.194	29.8
	1 hour	660[b]	32.9	0.583	33.5
Total suspended particulates	Annual	60	0.0179	0.00405	0.022
	24 hours	150	0.77	0.158	0.928

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

[b] At Hanford, the level is not to be exceeded more than twice in any 7 consecutive days.

Key: FMEF, Fuels and Materials Examination Facility.

Source: EPA 1997; WDEC 1994.

G.1.2.2.2 Operation of Immobilization Facility

Potential air quality impacts from operation of immobilization (ceramic or glass) and support facilities at Hanford were analyzed using ISCST3 as described in Appendix F.1. Operational impacts result from emissions from emergency diesel generators, process emissions, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–8. Emergency generators were modeled as a volume source. The process stack for radiological emissions was modeled with a 35.6 m (116.8 ft) height, 3.88 m (12.7 ft) diameter, stack exit temperature of 20 C (68 F), and an exit velocity of 3.3 m/s (10.8 ft/s). There was no boiler modeled because heating requirements would be met using electric power (UC 1999a, 1999b).

Table G–8. Emissions (kg/yr) From Operation of Immobilization Facility in FMEF at Hanford

Pollutant	Emergency Generator	Ceramic or Glass Process	Vehicles
Carbon monoxide	980	0	46,400
Nitrogen dioxide	4,530	0	12,500
PM_{10}	320	0	42,400
Sulfur dioxide	300	0	0
Volatile organic compounds	370	0	5,720
Total suspended particulates	320	0	42,400

Key: FMEF, Fuels and Materials Examination Facility.
Source: UC 1999a, 1999b.

Maximum air pollutant concentrations resulting from the emergency diesel generators and process sources, plus the No Action concentrations, are summarized in Table G–9. Radiological impacts, including those from emissions to the air, are discussed in Appendix J.

Table G–9. Concentrations ($\mu g/m^3$) From Operation of Immobilization Facility in FMEF at Hanford

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Ceramic or Glass	Total
Carbon monoxide	8 hours	10,000	34.1	0.271	34.4
	1 hour	40,000	48.3	1.84	50.1
Nitrogen dioxide	Annual	100	0.25	0.0376	0.288
PM_{10}	Annual	50	0.0179	0.00265	0.021
	24 hours	150	0.77	0.0295	0.799
Sulfur dioxide	Annual	50	1.63	0.00249	1.63
	24 hours	260	8.91	0.0277	8.94
	3 hours	1,300	29.6	0.188	29.8
	1 hour	660[b]	32.9	0.564	33.5
Total suspended particulates	Annual	60	0.0179	0.00265	0.021
	24 hours	150	0.77	0.0295	0.799

[a] The more stringent of the Federal and State standards is presented if both exist for the averaging period.
[b] At Hanford, the level is not to be exceeded more than twice in any 7 consecutive days.
Key: FMEF, Fuels and Materials Examination Facility.
Source: EPA 1997; WDEC 1994.

G.1.2.3 MOX Facility

G.1.2.3.1 Construction of MOX Facility

Potential air quality impacts from construction of new mixed oxide (MOX) and support facilities at Hanford were analyzed using ISCST3 as described in Appendix F.1. Construction impacts result from emissions from diesel fuel-burning construction equipment, particulate matter emissions from soil disturbance by construction equipment and other vehicles (construction fugitive emissions), operation of a concrete batch plant, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–10.

Table G–10. Emissions (kg/yr) From Construction of New MOX Facility at Hanford

Pollutant	Diesel Equipment	Construction Fugitive Emissions[a]	Concrete Batch Plant	Vehicles
Carbon monoxide	3,840	0	0	37,600
Nitrogen dioxide	10,080	0	0	10,100
PM_{10}	768[b]	6,880	1,460[b]	34,400
Sulfur dioxide	1,020	0	0	0
Volatile organic compounds	792	0	0	4,640
Total suspended particulates	768	13,600	1,460	34,400
Toxics[c]	0	<1	0	0

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

[b] PM_{10} emissions were assumed to be the same as total suspended particulate emissions for the purpose of this analysis, resulting in some overestimate of PM_{10} concentrations.

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

Source: UC 1998b.

Maximum air pollutant concentrations from construction activities are summarized in Table G–11.

Table G–11. Concentrations ($\mu g/m^3$) From Construction of New MOX Facility at Hanford

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Contribution	Total
Carbon monoxide	8 hours	10,000	34.1	1.06	35.1
	1 hour	40,000	48.3	7.22	55.5
Nitrogen dioxide	Annual	100	0.25	0.0836	0.334
PM_{10}	Annual	50	0.0179	0.0744	0.092
	24 hours	150	0.77	3.27	4.03
Sulfur dioxide	Annual	50	1.63	0.00846	1.64
	24 hours	260	8.91	0.094	9.
	3 hours	1,300	29.6	0.64	30.3
	1 hour	660[b]	32.9	1.92	34.8
Total suspended particulates	Annual	60	0.0179	0.132	0.15
	24 hours	150	0.77	5.88	6.66
Toxics[c]	Annual	0.12	0.000006	0.000008	0.000014

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

[b] At Hanford, the level is not to be exceeded more than twice in any 7 consecutive days.

[c] Various toxic air pollutants (e.g., lead, benzene, hexane) may be emitted during construction and were analyzed as benzene.

Source: EPA 1997; WDEC 1994.

G.1.2.3.2 Operation of MOX Facility

Potential air quality impacts from operation of the new MOX and support facilities at Hanford were analyzed using ISCST3 as described in Appendix F.1. Operational impacts result from emissions from emergency diesel generators, process emissions, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–12. Emergency generators were modeled as a volume source. The process stack for radiological emissions was modeled with a 35.6 m (116.8 ft) height, 0.3048 m (1.0 ft) diameter, stack exit temperature of 20 C (68 F), and an exit velocity of 0.03 m/s (0.1 ft/s). There was no boiler modeled because heating requirements would be met using electric power (UC 1998b).

Table G–12. Emissions (kg/yr) From Operation of New MOX Facility at Hanford

Pollutant	Emergency Generator	Process	Vehicles
Carbon monoxide	374	0	34,200
Nitrogen dioxide	1,738	0	9,170
PM_{10}	122	0	31,200
Sulfur dioxide	114	0	0
Volatile organic compounds	142	0	4,210
Total suspended particulates	122	0	31,200
[Text deleted.]			

[Text deleted.]
Source: UC 1998b.

Maximum air pollutant concentrations resulting from the emergency diesel generators and process sources, plus the No Action concentrations, are summarized in Table G–13. Radiological impacts, including those from emissions to the air, are discussed in Appendix J.

Table G–13. Concentrations ($\mu g/m^3$) From Operation of New MOX Facility at Hanford

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Contribution	Total
Carbon monoxide	8 hours	10,000	34.1	0.103	34.2
	1 hour	40,000	48.3	0.704	49.0
Nitrogen dioxide	Annual	100	0.25	0.0144	0.264
PM_{10}	Annual	50	0.0179	0.00101	0.0189
	24 hours	150	0.77	0.0113	0.781
Sulfur dioxide	Annual	50	1.63	0.000946	1.63
	24 hours	260	8.91	0.0105	8.92
	3 hours	1,300	29.6	0.0715	29.7
	1 hour	660[b]	32.9	0.214	33.1
Total suspended particulates	Annual	60	0.0179	0.00101	0.0189
	24 hours	150	0.77	0.0113	0.781
[Text deleted.]					

[a] The more stringent of the Federal and State standards is presented if both exist for the averaging period.
[b] At Hanford, the level is not to be exceeded more than twice in any 7 consecutive days.
[Text deleted.]
Source: EPA 1997; WDEC 1994.

G.1.2.4 Pit Conversion and Immobilization Facilities

G.1.2.4.1 Construction of Pit Conversion and Immobilization Facilities

Potential air quality impacts from modification of FMEF and construction of support facilities for pit disassembly and conversion and plutonium conversion and immobilization (ceramic or glass) at Hanford were analyzed using ISCST3 as described in Appendix F.1. Construction impacts result from emissions from diesel fuel-burning construction equipment, particulate matter emissions from soil disturbance by construction equipment and other vehicles (construction fugitive emissions), operation of a concrete batch plant, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized inTable G–14.

Table G–14. Emissions (kg/yr) From Construction of Pit Conversion and Immobilization Facilities in FMEF at Hanford

	Pit Conversion		Immobilization			
Pollutant	**Diesel Equipment and Construction Fugitive Emissions**	**Vehicles**	**Diesel Equipment**	**Construction Fugitive Emissions[a]**	**Concrete Batch Plant**	**Vehicles**
Carbon monoxide	1,000	11,300	3,060	0	0	40,000
Nitrogen dioxide	2,400	3,040	7,890	0	0	10,700
PM_{10}	3,500	10,300	600[b]	6,770	560[b]	36,500
Sulfur dioxide	160	0	800	0	0	0
Volatile organic compounds	200	1,400	620	0	0	4,930
Total suspended particulates	9,300	10,300	600	13,100	560	36,500

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

[b] PM_{10} emissions were assumed to be the same as total suspended particulate emissions for the purpose of this analysis resulting in some overestimate of PM_{10} concentrations.

Key: FMEF, Fuels and Materials Examination Facility.

Source: UC 1998a, 1999a, 1999b.

Maximum air pollutant concentrations from construction activities are summarized in Table G–15.

Table G–15. Concentrations ($\mu g/m^3$) From Construction of Pit Conversion and Immobilization Facilities in FMEF at Hanford

Pollutant	**Averaging Period**	**Most Stringent Standard or Guideline[a]**	**No Action**	**Pit Conversion**	**Immobilization (Ceramic or Glass)**	**Total**
Carbon monoxide	8 hours	10,000	34.1	0.277	0.846	35.2
	1 hour	40,000	48.3	1.88	5.76	55.9
Nitrogen dioxide	Annual	100	0.25	0.0199	0.0654	0.335
PM_{10}	Annual	50	0.0179	0.029	0.0651	0.112
	24 hours	150	0.77	0.323	2.96	4.05
Sulfur dioxide	Annual	50	1.63	0.00133	0.00664	1.64
	24 hours	260	8.91	0.0148	0.0737	9.
	3 hours	1,300	29.6	0.1	0.502	30.2
	[Text deleted.]					
	1 hour	660[b]	32.9	0.301	1.5	34.7
Total suspended particulates	Annual	60	0.0179	0.0771	0.117	0.212
	24 hours	150	0.77	0.857	5.58	7.21

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

[b] At Hanford, the level is not to be exceeded more than twice in any 7 consecutive days.

Key: FMEF, Fuels and Materials Examination Facility.

Source: EPA 1997; WDEC 1994.

G.1.2.4.2 Operation of Pit Conversion and Immobilization Facilities

Potential air quality impacts from operation of pit conversion, immobilization (ceramic or glass), and support facilities at Hanford were analyzed using ISCST3 as described in Appendix F.1. Operational impacts result from emissions from emergency diesel generators, process emissions, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–16. Stack parameters used for modeling were as stated previously.

Table G–16. Emissions (kg/yr) From Operation of Pit Conversion and Immobilization Facilities in FMEF at Hanford

	Pit Conversion			Immobilization		
Pollutant	**Emergency Generator**	**Process**	**Vehicles**	**Emergency Generator**	**Ceramic or Glass Process**	**Vehicles[a]**
Carbon monoxide	520	0	41,800	1,460	0	57,100
Nitrogen dioxide	2,000	0	11,200	6,790	0	15,300
PM_{10}	50	0	38,100	480	0	52,100
Sulfur dioxide	34	0	0	450	0	0
Volatile organic compounds	58	0	5,150	550	0	7,040
Total suspended particulates	50	0	38,100	480	0	52,100

[a] For 50-t (55-ton) case.

Key: FMEF, Fuels and Materials Examination Facility.

Source: UC 1998a, 1999a, 1999b.

Maximum air pollutant concentrations resulting from the emergency diesel generators and process sources, plus No Action concentrations, are summarized in Table G–17. Radiological impacts, including those from emissions to the air, are discussed in Appendix J.

Table G–17. Concentrations ($\mu g/m^3$) From Operation of Pit Conversion and Immobilization Facilities in FMEF at Hanford

Pollutant	Averaging Period	Most Stringent Standard or Guidelines[a]	No Action	Pit Conversion	Immobilization (Ceramic or Glass)	Total[b]
Carbon monoxide	8 hours	10,000	34.1	0.144	0.404	34.6
	1 hour	40,000	48.3	0.978	2.75	52.
Nitrogen dioxide	Annual	100	0.25	0.0166	0.0563	0.323
PM_{10}	Annual	50	0.0179	0.000415	0.00398	0.0223
	24 hours	150	0.77	0.00461	0.0443	0.819
Sulfur dioxide	Annual	50	1.63	0.000282	0.00373	1.63
	24 hours	260	8.91	0.00313	0.0415	8.95
	3 hours	1,300	29.6	0.0213	0.282	29.9
	[Text deleted.]					
	1 hour	660[c]	32.9	0.064	0.847	33.8
Total suspended particulates	Annual	60	0.0179	0.000415	0.00398	0.0223
	24 hours	150	0.77	0.00461	0.0443	0.819

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

[b] The concentrations for ceramic and glass are the same for both 17-t and 50-t cases.

[c] At Hanford, the level is not to be exceeded more than twice in any 7 consecutive days.

Key: FMEF, Fuels and Materials Examination Facility.

Source: EPA 1997; WDEC 1994.

G.1.2.5 Pit Conversion and MOX Facilities

G.1.2.5.1 Construction of Pit Conversion and MOX Facilities

Potential air quality impacts from modification of FMEF and construction of support facilities for pit disassembly and conversion and MOX fuel fabrication at Hanford were analyzed using ISCST3 as described in Appendix F.1. Construction impacts result from emissions from diesel fuel-burning construction equipment, particulate matter emissions from disturbance of soil by construction equipment and other vehicles (construction fugitive emissions), operation of a concrete batch plant, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–18.

Table G–18. Emissions (kg/yr) From Construction of Pit Conversion and MOX Facilities in FMEF at Hanford

	Pit Conversion		MOX			
Pollutant	**Diesel Equipment and Construction Fugitive Emissions**	**Vehicles**	**Diesel Equipment**	**Construction Fugitive Emissions[a]**	**Concrete Batch Plant**	**Vehicles**
Carbon monoxide	1,000	11,300	778	0	0	37,300
Nitrogen dioxide	2,400	3,040	2,009	0	0	10,000
PM_{10}	3,500	10,300	154[b]	2,830	435[b]	34,100
Sulfur dioxide	160	0	204	0	0	0
Volatile organic compounds	200	1,400	160	0	0	4,600
Total suspended particulates	9,300	10,300	154	5,590	435	34,100
Toxics[c]	0	0	0	<1	0	0

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

[b] PM_{10} emissions were assumed to be the same as total suspended particulate emissions for the purpose of this analysis resulting in some overestimate of PM_{10} concentrations.

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

Key: FMEF, Fuels and Materials Examination Facility.

Source: UC 1998a, 1998b.

Maximum air pollutant concentrations from construction activities are summarized in Table G–19.

Table G–19. Concentrations ($\mu g/m^3$) From Construction of Pit Conversion and MOX Facilities in FMEF at Hanford

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Pit Conversion	MOX	Total
Carbon monoxide	8 hours	10,000	34.1	0.277	0.215	34.6
	1 hour	40,000	48.3	1.88	1.46	51.6
Nitrogen dioxide	Annual	100	0.25	0.0199	0.0167	0.287
PM_{10}	Annual	50	0.0179	0.029	0.0274	0.0743
	24 hours	150	0.77	0.323	1.32	2.41
Sulfur dioxide	Annual	50	1.63	0.00133	0.00169	1.63
	24 hours	260	8.91	0.0148	0.0188	8.94
	3 hours	1,300	29.6	0.1	0.128	29.8
	[Text deleted.]					
	1 hour	660[b]	32.9	0.301	0.384	33.6
Total suspended particulates	Annual	60	0.0179	0.0771	0.051	0.146
	24 hours	150	0.77	0.857	2.4	4.03
Toxics[c]	Annual	0.12	0.000006	0	0.000008	0.000014

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

[b] At Hanford, the level is not to be exceeded more than twice in any 7 consecutive days.

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

Key: FMEF, Fuels and Materials Examination Facility.

Source: EPA 1997; WDEC 1994.

G.1.2.5.2 Operation of Pit Conversion and MOX Facilities

Potential air quality impacts from operation of pit conversion, MOX, and support facilities at Hanford were analyzed using ISCST3 as described in Appendix F.1. Operational impacts result from emissions from emergency diesel generators, process emissions, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–20. Stack parameters used for modeling were as stated previously.

Table G–20. Emissions (kg/yr) From Operation of Pit Conversion and MOX Facilities in FMEF at Hanford

	Pit Conversion			MOX		
Pollutant	**Emergency Generator**	**Process**	**Vehicles**	**Emergency Generator**	**Process**	**Vehicles**
Carbon monoxide	520	0	41,800	374	0	34,200
Nitrogen dioxide	2,000	0	11,200	1,738	0	9,170
PM_{10}	50	0	38,100	122	0	31,200
Sulfur dioxide	34	0	0	114	0	0
Volatile organic compounds	58	0	5,150	142	0	4,210
Total suspended particulates	50	0	38,100	122	0	31,200
[Text deleted.]						

[Text deleted.]
Key: FMEF, Fuels and Materials Examination Facility.
Source: UC 1998a, 1998b.

Maximum air pollutant concentrations resulting from the emergency diesel generators and process sources, plus the No Action concentrations, are summarized in Table G–21. Radiological impacts, including those from emissions to the air, are discussed in Appendix J.

Table G–21. Concentrations ($\mu g/m^3$) From Operation of Pit Conversion and MOX Facilities in FMEF at Hanford

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Pit Conversion	MOX	Total
Carbon monoxide	8 hours	10,000	34.1	0.144	0.103	34.3
	1 hour	40,000	48.3	0.978	0.704	50.0
Nitrogen dioxide	Annual	100	0.25	0.0166	0.0144	0.281
PM_{10}	Annual	50	0.0179	0.000415	0.00101	0.0193
	24 hours	150	0.77	0.00461	0.0113	0.786
Sulfur dioxide	Annual	50	1.63	0.000282	0.000946	1.63
	24 hours	260	8.91	0.00313	0.0105	8.92
	3 hours	1,300	29.6	0.0213	0.0715	29.7
	[Text deleted.]					
	1 hour	660[b]	32.9	0.064	0.214	33.2
Total suspended particulates	Annual	60	0.0179	0.000415	0.00101	0.0193
	24 hours	150	0.77	0.00461	0.0113	0.786
[Text deleted.]						

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

[b] At Hanford, the level is not to be exceeded more than twice in any 7 consecutive days.

[Text deleted.]

Key: FMEF, Fuels and Materials Examination Facility.

Source: EPA 1997; WDEC 1994.

G.1.2.6 Immobilization and MOX Facilities

G.1.2.6.1 Construction of Immobilization and MOX Facilities

Potential air quality impacts from modification of FMEF and construction of support facilities for collocating immobilization (ceramic or glass) and MOX facilities at Hanford were analyzed using ISCST3 as described in Appendix F.1. Construction impacts result from emissions from diesel fuel-burning construction equipment, particulate matter emissions from disturbance of soil by construction equipment and other vehicles (construction fugitive emissions), operation of a concrete batch plant, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–22.

Table G–22. Emissions (kg/yr) From Construction of Immobilization and MOX Facilities Collocated in FMEF at Hanford

	Immobilization (Ceramic or Glass)				MOX			
Pollutant	**Diesel Equipment**	**Construction Fugitive Emissions[a]**	**Concrete Batch Plant**	**Vehicles**	**Diesel Equipment**	**Construction Fugitive Emissions[a]**	**Concrete Batch Plant**	**Vehicles**
Carbon monoxide	3,900	0	0	49,000	778	0	0	37,300
Nitrogen dioxide	10,100	0	0	13,100	2,009	0	0	10,000
PM_{10}	770[b]	8,860[b]	733[b]	44,700	154	2,830	435[b]	34,100
Sulfur dioxide	1,020	0	0	0	204	0	0	0
Volatile organic compounds	800	0	0	6,040	160	0	0	4,600
Total suspended particulates	770	16,900	733	44,700	154	5,590	435	34,100
Toxics[c]	0	0	0	0	0	<1	0	0

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

[b] PM_{10} emissions were assumed to be the same as total suspended particulate emissions for the purpose of this analysis resulting in some overestimate of PM_{10} concentrations.

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

Key: FMEF, Fuels and Materials Examination Facility.

Source: UC 1998b, 1999a, 1999b.

Maximum air pollutant concentrations from construction activities are summarized in Table G–23.

Table G–23. Concentrations ($\mu g/m^3$) From Construction of Immobilization and MOX Facilities Collocated in FMEF at Hanford

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Immobilization (Ceramic or Glass)	MOX	Total
Carbon monoxide	8 hours	10,000	34.1	1.08	0.215	35.4
	1 hour	40,000	48.3	7.34	1.46	57.1
Nitrogen dioxide	Annual	100	0.25	0.0838	0.0167	0.351
PM_{10}	Annual	50	0.0179	0.0849	0.0274	0.13
	24 hours	150	0.77	3.85	1.32	5.94
Sulfur dioxide	Annual	50	1.63	0.00846	0.00169	1.64
	24 hours	260	8.91	0.094	0.0188	9.02
	3 hours	1,300	29.6	0.64	0.128	30.4
	[Text deleted.]					
	1 hour	660[b]	32.9	1.92	0.383	35.2
Total suspended particulates	Annual	60	0.0179	0.153	0.051	0.222
	24 hours	150	0.77	7.05	2.4	10.2
Toxics[c]	Annual	0.12	0.000006	0	0.000008	0.000014

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

[b] At Hanford, the level is not to be exceeded more than twice in any 7 consecutive days.

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

Key: FMEF, Fuels and Materials Examination Facility.

Source: EPA 1997; WDEC 1994.

G.1.2.6.2 Operation of Immobilization and MOX Facilities

Potential air quality impacts from operation of the collocated immobilization (ceramic or glass) and MOX and support facilities at Hanford were analyzed using ISCST3 as described in Appendix F.1. Operational impacts result from emissions from emergency diesel generators, process emissions, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–24. Stack parameters used for modeling were as stated previously.

Table G–24. Emissions (kg/yr) From Operation of Immobilization and MOX Facilities Collocated in FMEF at Hanford

	Immobilization			MOX		
Pollutant	**Emergency Generator**	**Ceramic or Glass Process**	**Vehicles**	**Emergency Generator**	**Process**	**Vehicles**
Carbon monoxide	1,460	0	52,700	374	0	34,200
Nitrogen dioxide	6,790	0	14,100	1,738	0	9,170
PM_{10}	480	0	48,100	122	0	31,200
Sulfur dioxide	450	0	0	114	0	0
Volatile organic compounds	550	0	6,490	142	0	4,210
Total suspended particulates	480	0	48,100	122	0	31,200
[Text deleted.]						

[Text deleted.]
Key: FMEF, Fuels and Materials Examination Facility.
Source: UC 1998b, 1999a, 1999b.

Maximum air pollutant concentrations resulting from the emergency diesel generators and process sources are summarized in Table G–25. Radiological impacts, including those from emissions to the air, are discussed in Appendix J.

Table G–25. Concentrations (μg/m^3) From Operation of Immobilization and MOX Facilities Collocated in FMEF at Hanford

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Immobilization (Ceramic or Glass)	MOX	Total With Ceramic or Glass
Carbon monoxide	8 hours	10,000	34.1	0.404	0.103	34.6
	1 hour	40,000	48.3	2.75	0.704	51.8
Nitrogen dioxide	Annual	100	0.25	0.0563	0.0144	0.321
PM_{10}	Annual	50	0.0179	0.00398	0.00101	0.023
	24 hours	150	0.77	0.0443	0.0113	0.825
Sulfur dioxide	Annual	50	1.63	0.00373	0.000946	1.64
	24 hours	260	8.91	0.0415	0.0105	8.96
	3 hours	1,300	29.6	0.282	0.0715	30
	[Text deleted.]					
	1 hour	660[b]	32.9	0.847	0.214	34
Total suspended particulates	Annual	60	0.0179	0.00398	0.00101	0.0229
	24 hours	150	0.77	0.0443	0.0113	0.825
[Text deleted.]						

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

[b] At Hanford, the level is not to be exceeded more than twice in any 7 consecutive days.

[Text deleted.]

Key: FMEF, Fuels and Materials Examination Facility.

Source: EPA 1997; WDEC 1994.

G.1.2.7 Pit Conversion, Immobilization, and MOX Facilities

G.1.2.7.1 Construction of Pit Conversion, Immobilization, and MOX Facilities

Potential air quality impacts from modification of FMEF for pit disassembly and conversion and plutonium conversion and immobilization (ceramic or glass), and new construction of MOX and support facilities at Hanford were analyzed using ISCST3 as described in Appendix F.1. Construction impacts result from emissions from diesel fuel-burning construction equipment, particulate matter emissions from soil disturbance by construction equipment and other vehicles (construction fugitive emissions), operation of a concrete batch plant, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–26.

Maximum air pollutant concentrations from construction activities are summarized in Table G–27.

Table G–26. Emissions (kg/yr) From Construction of Pit Conversion and Immobilization Facilities in FMEF and MOX in New Construction at Hanford

	Pit Conversion		Immobilization				MOX			
Pollutant	**Diesel Equipment & Construction Fugitive Emissions**	**Veh**	**Diesel Equipment**	**Construction Fugitive Emissions[a]**	**Concrete Batch Plant**	**Veh**	**Diesel Equipment**	**Construction Fugitive Emissions[a]**	**Concrete Batch Plant**	**Veh**
CO	1,000	11,300	3,060	0	0	40,000	3,840	0	0	37,600
NO_2	2,400	3,040	7,890	0	0	10,700	10,080	0	0	10,100
PM_{10}	3,500	10,300	600[b]	6,770	560[b]	36,500	768[b]	6,880	1,460[b]	34,400
SO_2	160	0	800	0	0	0	1,020	0	0	0
VOC	200	1,400	620	0	0	4,930	792	0	0	4,640
TSP	9,300	10,300	600	13,100	560	36,500	768	13,600	1,460	34,400
Toxics[c]	0	0	0	0	0	0	0	<1	0	0

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

[b] PM_{10} emissions were assumed to be the same as TSP emissions for the purpose of this analysis resulting in some overestimate of PM_{10} concentrations.

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

Key: CO, carbon monoxide; FMEF, Fuels and Materials Examination Facility; NO_2, nitrogen dioxide; SO_2, sulfur dioxide; TSP, total suspended particulates; Veh, vehicles; VOC, volatile organic compounds.

Source: UC 1998a, 1998b, 1999a, 1999b.

Table G–27. Concentrations ($\mu g/m^3$) From Construction of Pit Conversion and Immobilization Facilities in FMEF and MOX in New Construction at Hanford

Pollutant	**Averaging Period**	**Most Stringent Standard or Guideline[a]**	**No Action**	**Pit Conversion**	**Immobilization (Ceramic or Glass)**	**MOX**	**Total**
Carbon monoxide	8 hours	10,000	34.1	0.277	0.846	1.06	36.3
	1 hour	40,000	48.3	1.88	5.76	7.22	63.2
Nitrogen dioxide	Annual	100	0.25	0.0199	0.0654	0.0836	0.419
PM_{10}	Annual	50	0.0179	0.029	0.0651	0.0744	0.186
	24 hours	150	0.77	0.323	2.96	3.27	7.32
Sulfur dioxide	Annual	50	1.63	0.00133	0.00664	0.00846	1.65
	24 hours	260	8.91	0.0148	0.0737	0.094	9.09
	3 hours	1,300	29.6	0.1	0.502	0.64	30.9
	[Text deleted.]						
	1 hour	660[b]	32.9	0.301	1.5	1.92	36.6
Total suspended particulates	Annual	60	0.0179	0.0771	0.117	0.132	0.344
	24 hours	150	0.77	0.857	5.58	5.88	13.1
Toxics[c]	Annual	0.12	0.000006	0	0	0.000008	0.000014

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

[b] At Hanford, the level is not to be exceeded more than twice in any 7 consecutive days.

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

Key: FMEF, Fuels and Materials Examination Facility.

Source: EPA 1997; WDEC 1994.

G.1.2.7.2 Operation of Pit Conversion, Immobilization, and MOX Facilities

Potential air quality impacts from operation of the three surplus plutonium disposition and support facilities at Hanford were analyzed using ISCST3 as described in Appendix F.1. Operational impacts result from emissions from emergency diesel generators, process emissions, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–28. Stack parameters used for modeling were as stated previously.

Table G–28. Emissions (kg/yr) From Operation of Pit Conversion and Immobilization Facilities in FMEF and MOX in New Construction at Hanford

	Pit Conversion			Immobilization			MOX		
Pollutant	**EG**	**Process**	**Veh**	**EG**	**Process[a]**	**Veh**	**EG**	**Process**	**Veh**
Carbon monoxide	520	0	41,800	1,460	0	52,700	374	0	34,200
Nitrogen dioxide	2,000	0	11,200	6,790	0	14,100	1,738	0	9,170
PM_{10}	50	0	38,100	480	0	48,100	122	0	31,200
Sulfur dioxide	34	0	0	450	0	0	114	0	0
Volatile organic compounds	58	0	5,150	550	0	6,490	142	0	4,210
Total suspended particulates	50	0	38,100	480	0	48,100	122	0	31,200
[Text deleted.]									

[a] Ceramic or glass.

Key: EG, emergency generator; FMEF, Fuels and Materials Examination Facility; Veh, vehicle.

Source: UC 1998a, 1998b, 1999a, 1999b.

Maximum air pollutant concentrations resulting from the emergency diesel generators and process sources, plus the No Action concentrations, are summarized in Table G–29. Radiological impacts, including those from emissions to the air, are discussed in Appendix J.

Table G–29. Concentrations ($\mu g/m^3$) From Operation of Pit Conversion and Immobilization Facilities in FMEF and MOX in New Construction at Hanford

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Pit Conversion	Immobilization (Ceramic or Glass)	MOX	Total
Carbon monoxide	8 hours	10,000	34.1	0.144	0.404	0.103	34.7
	1 hour	40,000	48.3	0.978	2.75	0.704	52.7
Nitrogen dioxide	Annual	100	0.25	0.0166	0.0563	0.0144	0.337
PM_{10}	Annual	50	0.0179	0.000415	0.00398	0.00101	0.023
	24 hours	150	0.77	0.00461	0.0442	0.0113	0.83
Sulfur dioxide	Annual	50	1.63	0.000282	0.00373	0.000946	1.64
	24 hours	260	8.91	0.00313	0.0415	0.0105	8.97
	3 hours	1,300	29.6	0.0213	0.282	0.0715	30
	[Text deleted.]						
	1 hour	660[b]	32.9	0.064	0.847	0.214	34
Total suspended particulates	Annual	60	0.0179	0.000415	0.00398	0.00101	0.023
	24 hours	150	0.77	0.00461	0.0443	0.0113	0.83
[Text deleted.]							

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

[b] At Hanford, the level is not to be exceeded more than twice in any 7 consecutive days.

[Text deleted.]

Key: FMEF, Fuels and Materials Examination Facility.

Source: EPA 1997; WDEC 1994.

G.2 INEEL

G.2.1 Assessment Data

Emission rates for criteria, hazardous, and toxic pollutants at INEEL are presented in Table F.1.2.4–1 of the *Storage and Disposition PEIS* (DOE 1996a:F-10). These emission rates were used as input into the modeled No Action pollutant concentrations presented in that document and reflect INEEL facility emissions for 1990, which were assumed to be representative of No Action for 2005. The storage alternative selected for INEEL results in no change in these concentrations (DOE 1996a:4-138). Other onsite activities related to programs analyzed in EISs for spent nuclear fuel and waste management are also included in the estimates of the No Action concentration for surplus plutonium disposition shown in Table G–30. For the cumulative impacts analysis, additional emissions from the proposed Advanced Mixed Waste Treatment Project are also considered. Radiological impacts, including those from emissions to the air, are discussed in Appendix J.

Table G–30. Estimated Concentrations (μg/m^3) From No Action at INEEL

Pollutant	Averaging Period	PEIS Estimated Base Year (2005)	Other Onsite From PEIS	No Action	AMWTP[a]
Carbon monoxide	8 hours	284	18	302	0.85
	1 hour	614	605	1,219	115
Nitrogen dioxide	Annual	4	7	11	0.34
PM_{10}	Annual	3	0	3	0.006
	24 hours	33	6	39	4.6
Sulfur dioxide	Annual	6	0	6	0.012
	24 hours	135	2	137	4.5
	3 hours	579	12	591	25
Benzene	Annual	0.029	0	0.029	0.0001
[Text deleted.]					

[a] Contribution from the Advanced Mixed Waste Treatment Project proposed action with microencapsulation or vitrification (included in cumulative impacts analysis).

Key: AMWTP, *INEEL Advanced Mixed Waste Treatment Project Final EIS*; PEIS, *Storage and Disposition PEIS*.

Source: DOE 1996a:4-138, 4-928, 4-929; DOE 1999.

G.2.2 Facilities

G.2.2.1 Pit Conversion Facility

G.2.2.1.1 Construction of Pit Conversion Facility

Potential air quality impacts from modification of the Fuel Processing Facility (FPF) and construction of new support facilities at INEEL for pit disassembly and conversion were analyzed using ISCST3 as described in Appendix F.1. Construction impacts result from emissions from diesel fuel-burning construction equipment, particulate matter emissions from soil disturbance by construction equipment and other vehicles (construction fugitive emissions), operation of a concrete batch plant, employee vehicles, and trucks moving materials and wastes. Emissions from construction of a new facility are higher than for modification of an existing facility described previously. Emissions from these sources are summarized in Table G–31.

Maximum air pollutant concentrations from construction activities are summarized in Table G–32 but are not expected to result in the exceedance of the ambient air quality standards.

Table G–31. Emissions (kg/yr) From Construction of Pit Conversion Facility in FPF at INEEL

Pollutant	Diesel Equipment and Construction Fugitive Emissions	Vehicles
Carbon monoxide	1,300	44,100
Nitrogen dioxide	5,600	11,100
PM_{10}	3,900	33,300
Sulfur dioxide	370	0
Volatile organic compounds	460	5,390

Key: FPF, Fuel Processing Facility.
Source: UC 1998c.

Table G–32. Concentrations ($\mu g/m^3$) From Construction of Pit Conversion Facility in FPF at INEEL

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Contribution	Total
Carbon monoxide	8 hours	10,000	302	0.524	303
	1 hour	40,000	1,219	1.42	1,220
Nitrogen dioxide	Annual	100	11	0.0658	11.1
PM_{10}	Annual	50	3	0.0458	3.05
	24 hours	150	39	0.585	39.6
Sulfur dioxide	Annual	80	6	0.00434	6
	24 hours	365	137	0.0555	137
	3 hours	1,300	591	0.223	591

[a] The more stringent of the Federal and State standards is presented if both exist for the averaging period.
Key: FPF, Fuel Processing Facility.
Source: EPA 1997; ID DHW 1995.

G.2.2.1.2 Operation of Pit Conversion Facility

Potential air quality impacts from operation of the pit conversion and support facilities at INEEL were analyzed using ISCST3 as described in Appendix F.1. Operational impacts result from emissions from boilers, emergency diesel generators, process emissions, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–33. Emergency generators were modeled as a volume source. The process stack for radiological emissions was modeled with a 35 m (115 ft) height, 1.82 m (6.0 ft) diameter, stack exit temperature of 11 °C (52 °F), and an exit velocity of 0.03 m/s (0.1 ft/s). The boiler stack was modeled with a 45.7 m (150 ft) height, 1.85 m (6.1 ft) diameter, stack exit temperature of 174 °C (345 °F), and an exit velocity of 3.25 m/s (10.7 ft/s) (UC 1998c).

Table G–33. Emissions (kg/yr) From Operation of Pit Conversion Facility in FPF at INEEL

Pollutant	Boilers	Emergency Generator	Process	Vehicles
Carbon monoxide	580	520	0	74,100
Nitrogen dioxide	18,000	2,000	0	18,600
PM_{10}	1,250	50	0	56,000
Sulfur dioxide	30,000	34	0	0
Volatile organic compounds	62	58	0	9,050

Key: FPF, Fuel Processing Facility.
Source: UC 1998c.

Maximum air pollutant concentrations resulting from the boilers, emergency diesel generators, and process sources, plus the No Action concentrations, are summarized in Table G–34.

Table G–34. Concentrations ($\mu g/m^3$) From Operation of Pit Conversion Facility in FPF at INEEL

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Contribution	Total
Carbon monoxide	8 hours	10,000	302	0.253	302
	1 hour	40,000	1,219	0.80	1,220
Nitrogen dioxide	Annual	100	11	0.0838	11.1
PM_{10}	Annual	50	3	0.00477	3.00
	24 hours	150	39	0.0494	39.1
Sulfur dioxide	Annual	80	6	0.101	6.10
	24 hours	365	137	1.01	138
	3 hours	1,300	591	5.42	596

[a] The more stringent of the Federal and State standards is presented if both exist for the averaging period.
Key: FPF, Fuel Processing Facility.
Source: EPA 1997; ID DHW 1995.

At the nearest prevention of significant deterioration (PSD) Class I area, Craters of the Moon National Monument, the contribution to air pollutant concentrations is less than 0.01 $\mu g/m^3$ for nitrogen dioxide, particulate matter with an aerodynamic diameter less than or equal to 10 μm (PM_{10}), and sulfur dioxide, except for the 24-hr sulfur dioxide value, which is 0.05 $\mu g/m^3$, and the 3-hr sulfur dioxide value, which is 0.23 $\mu g/m^3$. Radiological impacts, including those from emissions to the air, are discussed in Appendix J.

G.2.2.2 MOX Facility

G.2.2.2.1 Construction of MOX Facility

Potential air quality impacts from construction of new MOX and support facilities at INEEL were analyzed using ISCST3 as described in Appendix F.1. Construction impacts result from emissions from diesel fuel-burning construction equipment, particulate matter emissions from disturbance of soil by construction equipment and other vehicles (construction fugitive emissions), operation of a concrete batch plant, employee vehicles, and trucks moving materials and wastes. Emissions from construction of a new facility are higher than for modification of an existing facility described previously. Emissions from these sources are summarized in Table G–35.

Table G–35. Emissions (kg/yr) From Construction of New MOX Facility at INEEL

Pollutant	Diesel Equipment	Construction Fugitive Emissions[a]	Concrete Batch Plant	Vehicles
Carbon monoxide	3,840	0	0	114,000
Nitrogen dioxide	10,080	0	0	28,600
PM_{10}	768	6,860	1,460	85,900
Sulfur dioxide	1,020	0	0	0
Volatile organic compounds	792	0	0	13,900
Toxics[b]	0	<1	0	0

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

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

Source: UC 1998d.

Maximum air pollutant concentrations from construction activities are summarized in Table G–36.

Table G–36. Concentrations ($\mu g/m^3$) From Construction of New MOX Facility at INEEL

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Contribution	Total
Carbon monoxide	8 hours	10,000	302	1.54	304
	1 hour	40,000	1,219	4.18	1,220
Nitrogen dioxide	Annual	100	11	0.118	11.1
PM_{10}	Annual	50	3	0.105	3.11
	24 hours	150	39	5.32	44.3
Sulfur dioxide	Annual	80	6	0.012	6.01
	24 hours	365	137	0.153	137
	3 hours	1,300	591	0.614	592
Toxics[b]	Annual	0.12	0.029	0.00001	0.029

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

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

Source: EPA 1997; ID DHW 1995.

G.2.2.2.2 Operation of MOX Facility

Potential air quality impacts from operation of the new MOX and support facilities at INEEL were analyzed using ISCST3 as described in Appendix F.1. Operational impacts result from emissions from boilers, emergency diesel generators, process emissions, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–37. Emergency generators were modeled as a volume source. The process stack for radiological emissions was modeled with a 8 m (26 ft) height, 0.3048 m (1.0 ft) diameter, stack exit temperature of 11 C (52 F), and an exit velocity of 0.03 m/s (0.1 ft/s). The boiler stack was modeled with a 45.7 m (150 ft) height, 1.85 m (6.1 ft) diameter, stack exit temperature of 174 C (345 F), and exit velocity of 3.25 m/s (10.7 ft/s) (UC 1998d).

Maximum air pollutant concentrations resulting from the boilers, emergency diesel generators, and process sources, plus the No Action concentrations, are summarized in Table G–38.

Table G–37. Emissions (kg/yr) From Operation of New MOX Facility at INEEL

Pollutant	Boilers	Emergency Generator	Process	Vehicles
Carbon monoxide	4,800	374	0	77,600
Nitrogen dioxide	12,000	1,738	0	19,500
PM_{10}	636	122	0	58,600
Sulfur dioxide	72,600	114	0	0
Volatile organic compounds	0	142	0	9,470
[Text deleted.]				

[Text deleted.]
Source: UC 1998d.

Table G–38. Concentrations ($\mu g/m^3$) From Operation of New MOX Facility at INEEL

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Contribution	Total
Carbon monoxide	8 hours	10,000	302	0.509	303
	1 hour	40,000	1,219	2.34	1,220
Nitrogen dioxide	Annual	100	11	0.0606	11.1
PM_{10}	Annual	50	3	0.00356	3.
	24 hours	150	39	0.0396	39.
Sulfur dioxide	Annual	80	6	0.244	6.24
	24 hours	365	137	2.45	139
	3 hours	1,300	591	13.2	604
[Text deleted.]					

[a] The more stringent of the Federal and State standards is presented if both exist for the averaging period.
[Text deleted.]
Source: EPA 1997; ID DHW 1995.

At the nearest PSD Class I area, Craters of the Moon National Monument, the contribution to air pollutant concentrations is less than 0.01 $\mu g/m^3$ for nitrogen dioxide and PM_{10}. For sulfur dioxide the annual value is 0.01 $\mu g/m^3$, the 24-hr value is 0.11 $\mu g/m^3$, and the 3-hr value is 0.46 $\mu g/m^3$. Radiological impacts, including those from emissions to the air, are discussed in Appendix J.

G.2.2.3 Pit Conversion and MOX Facilities

G.2.2.3.1 Construction of Pit Conversion and MOX Facilities

Potential air quality impacts from modification of FPF for pit disassembly and conversion and construction of new MOX and support facilities at INEEL were analyzed using ISCST3 as described in Appendix F.1. Construction impacts result from emissions from diesel fuel-burning construction equipment, particulate matter emissions from disturbance of soil by construction equipment and other vehicles (construction fugitive emissions), operation of a concrete batch plant, employee vehicles, and trucks moving materials and wastes. Emissions from construction of a new facility are higher than for modification of an existing facility described previously. Emissions from these sources are summarized in Table G–39.

Table G–39. Emissions (kg/yr) From Construction of Pit Conversion Facility in FPF and New MOX Facility at INEEL

	Pit Conversion		MOX			
Pollutant	**Diesel Equipment and Construction Fugitive Emissions**	**Vehicles**	**Diesel Equipment**	**Construction Fugitive Emissions[a]**	**Concrete Batch Plant**	**Vehicles**
Carbon monoxide	1,300	44,100	3,840	0	0	114,000
Nitrogen dioxide	5,600	11,100	10,080	0	0	28,600
PM_{10}	3,900	33,300	768	6,860	1,460	85,900
Sulfur dioxide	370	0	1,020	0	0	0
Volatile organic compounds	460	5,390	792	0	0	13,900
Toxics[b]	0	0	0	<1	0	0

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

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

Key: FPF, Fuel Processing Facility.

Source: UC 1998c, 1998d.

Maximum air pollutant concentrations from construction activities are summarized in Table G–40.

Table G–40. Concentrations ($\mu g/m^3$) From Construction of Pit Conversion Facility in FPF and New MOX Facility at INEEL

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Pit Conversion	MOX	Total
Carbon monoxide	8 hours	10,000	302	0.524	1.55	304
	1 hour	40,000	1,219	1.42	4.18	1,220
Nitrogen dioxide	Annual	100	11	0.0658	0.118	11.2
PM_{10}	Annual	50	3	0.0458	0.105	3.15
	24 hours	150	39	0.585	5.32	44.9
Sulfur dioxide	Annual	80	6	0.00434	0.012	6.02
	24 hours	365	137	0.0555	0.153	137
	3 hours	1,300	591	0.223	0.614	592
Toxics[b]	Annual	0.12	0.029	0	0.00001	0.029

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

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

Key: FPF, Fuel Processing Facility.

Source: EPA 1997; ID DHW 1995.

G.2.2.3.2 Operation of Pit Conversion and MOX Facilities

Potential air quality impacts from operation of the new pit conversion, MOX, and support facilities at INEEL were analyzed using ISCST3 as described in Appendix F.1. Operational impacts result from boilers, emissions from emergency diesel generators, process emissions, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–41. Stack parameters used for modeling were as stated previously.

Table G–41. Emissions (kg/yr) From Operation of Pit Conversion Facility in FPF and New MOX Facility at INEEL

	Pit Conversion				MOX			
Pollutant	**Boilers**	**Emergency Generator**	**Process**	**Vehicles**	**Boilers**	**Emergency Generator**	**Process**	**Vehicles**
Carbon monoxide	580	520	0	74,100	4,800	374	0	77,600
Nitrogen dioxide	18,000	2,000	0	18,600	12,000	1,738	0	19,500
PM_{10}	1,250	50	0	56,000	636	122	0	58,600
Sulfur dioxide	30,000	34	0	0	72,600	114	0	0
Volatile organic compounds	62	58	0	9,050	0	142	0	9,470
[Text deleted.]								

[Text deleted.]
Key: FPF, Fuel Processing Facility.
Source: UC 1998c, 1998d.

Maximum air pollutant concentrations resulting from the boilers, emergency diesel generators, and process sources, plus the No Action concentrations, are summarized in Table G–42.

Table G–42. Concentrations ($\mu g/m^3$) From Operation of Pit Conversion Facility in FPF and New MOX Facility at INEEL

Pollutant	**Averaging Period**	**Most Stringent Standard or Guideline**[a]	**No Action**	**Pit Conversion**	**MOX**	**Total**
Carbon monoxide	8 hours	10,000	302	0.253	0.509	303
	1 hour	40,000	1,219	0.80	2.34	1,220
Nitrogen dioxide	Annual	100	11	0.0838	0.0606	11.1
PM_{10}	Annual	50	3	0.00477	0.00356	3.01
	24 hours	150	39	0.0494	0.0396	39.1
Sulfur dioxide	Annual	80	6	0.101	0.244	6.35
	24 hours	365	137	1.01	2.45	140
	3 hours	1,300	591	5.42	13.2	610
[Text deleted.]						

[a] The more stringent of the Federal and State standards is presented if both exist for the averaging period.
[Text deleted.]
Key: FPF, Fuel Processing Facility.
Source: EPA 1997; ID DHW 1995.

At the nearest PSD Class I area, Craters of the Moon National Monument, the contribution to air pollutant concentrations are 0.01 $\mu g/m^3$ or less for nitrogen dioxide and PM_{10}. For sulfur dioxide the annual value is 0.01 $\mu g/m^3$, the 24-hr value is 0.16 $\mu g/m^3$, and the 3-hr value is 0.69 $\mu g/m^3$. Radiological impacts, including those from emissions to the air, are discussed in Appendix J.

G.3 PANTEX

G.3.1 Assessment Data

Emission rates for criteria, hazardous, and toxic air pollutants at Pantex are presented in Table 4.7.2.1–3 of the *Final Environmental Impact Statement for the Continued Operation of Pantex* (DOE 1996c:4-147). These emission rates were used as input into the modeled pollutant concentrations presented in that document and reflect Pantex facility emissions for over a 10-year period to about 2006. These concentrations are assumed to be representative of No Action for 2005 and include the upgrade storage alternative selected for Pantex and discussed in the *Storage and Disposition PEIS* (DOE 1996a:4-190). Other onsite activities related to programs analyzed in EISs for stockpile stewardship management and waste management are added to these concentrations as shown in Table G–43. Radiological impacts, including those from emissions to the air, are discussed in Appendix J.

Table G–43. Estimated Concentrations (μg/m^3) From No Action at Pantex

Pollutant	Averaging Period	PEIS No Action[a]	Other Onsite From PEIS	No Action
Carbon monoxide	8 hours	602	17.5	620
	1 hour	2,900	92.8	2,990
Nitrogen dioxide	Annual	0.542	1.4	1.94
PM_{10}	Annual	8.73	0.06	8.79
	24 hours	88.5	0.93	89.4
Sulfur dioxide	Annual	0	0	0
	24 hours	0.00002	0	0.00002
	3 hours	0.00008	0	0.00008
	30 minutes	0.00016	0	0.00016
Total suspended particulates	3 hours	(a)	(a)	(a)
	1 hour	(a)	(a)	(a)
Benzene	Annual	0.0547	0	0.0547
	1 hour	19.4	0	19.4
[Text deleted.]				

[a] Three- and 1-hr concentrations for total suspended particulates were not reported in the source document.

[Text deleted.]

Key: PEIS, *Storage and Disposition PEIS*.

Source: DOE 1996a:4-936, 4-937; 1996c:4-139.

G.3.2 Facilities

G.3.2.1 Pit Conversion Facility

G.3.2.1.1 Construction of Pit Conversion Facility

Potential air quality impacts from construction of new pit conversion and support facilities at Pantex were analyzed using ISCST3 as described in Appendix F.1. Construction impacts result from emissions from diesel fuel-burning construction equipment, particulate matter emissions from disturbance of soil by construction equipment and other vehicles (construction fugitive emissions), operation of a concrete batch plant, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–44.

Maximum air pollutant concentrations from construction activities are summarized in Table G–45.

Table G–44. Emissions (kg/yr) From Construction of New Pit Conversion Facility at Pantex

Pollutant	Diesel Equipment and Construction Fugitive Emissions	Vehicles
Carbon monoxide	6,400	40,500
Nitrogen dioxide	29,200	11,200
PM_{10}	20,300	38,900
Sulfur dioxide	1,900	0
Volatile organic compounds	2,400	5,140
Total suspended particulates	47,500	38,900

Source: UC 1998e.

Table G–45. Concentrations ($\mu g/m^3$) From Construction of New Pit Conversion Facility at Pantex

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Contribution	Total
Carbon monoxide	8 hours	10,000	620	3.77	623
	1 hour	40,000	2,990	23.5	3,020
Nitrogen dioxide	Annual	100	1.94	0.501	2.44
PM_{10}	Annual	50	8.79	0.349	9.14
	24 hours	150	89.4	4.18	93.6
Sulfur dioxide	Annual	80	0	0.0326	0.0326
	24 hours	365	0.00002	0.392	0.392
	3 hours	1,300	0.00008	1.71	1.71
	30 minutes	1,048	0.00016	6.98	6.98
Total suspended particulates	3 hours	200	(b)	42.7	42.7
	1 hour	400	(b)	174	174

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

[b] Three- and 1-hr concentrations for total suspended particulates were not listed in the source document.

Source: EPA 1997; TNRCC 1997a, 1997b.

G.3.2.1.2 Operation of Pit Conversion Facility

Potential air quality impacts from operation of the new pit conversion and support facilities at Pantex were analyzed using ISCST3 as described in Appendix F.1. Operational impacts result from emissions from boilers, emergency diesel generators, process emissions, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–46. Emergency generators were modeled as a volume source. The process stack for radiological emissions was modeled with a 35 m (115 ft) height, 1.82 m (6.0 ft) diameter, stack exit temperature of 20 C (68 F), and an exit velocity of 0.03 m/s (0.1 ft/s). The boiler stack was modeled with a 19.8 m (65 ft) height, 1.7 m (5.6 ft) diameter, stack exit temperature of 124 C (255 F), and an exit velocity of 6.2 m/s (20 ft/s) (UC 1998e).

Maximum air pollutant concentrations resulting from the boilers, emergency diesel generators and process sources, plus the No Action concentrations, are summarized in Table G–47. Radiological impacts, including those from emissions to the air, are discussed in Appendix J.

Table G–46. Emissions (kg/yr) From Operation of New Pit Conversion Facility at Pantex

Pollutant	Boilers	Emergency Generator	Process	Vehicles
Carbon monoxide	780	520	0	38,800
Nitrogen dioxide	700	2,000	0	10,800
PM_{10}	300	50	0	37,300
Sulfur dioxide	13	34	0	0
Volatile organic compounds	132	58	0	4,920
Total suspended particulates	300	50	0	37,300

Source: UC 1998e.

Table G–47. Concentrations ($\mu g/m^3$) From Operation of New Pit Conversion Facility at Pantex

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Contribution	Total
Carbon monoxide	8 hours	10,000	620	0.381	620
	1 hour	40,000	2,990	2.14	2,990
Nitrogen dioxide	Annual	100	1.94	0.0374	1.98
PM_{10}	Annual	50	8.79	0.00215	8.79
	24 hours	150	89.4	0.0225	89.5
Sulfur dioxide	Annual	80	0	0.00064	0.00064
	24 hours	365	0.00002	0.00753	0.00755
	3 hours	1,300	0.00008	0.0327	0.0328
	30 minutes	1,048	0.00016	0.129	0.129
Total suspended particulates	3 hours	200	(b)	0.0937	0.0937
	1 hour	400	(b)	0.273	0.273

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

[b] Three- and 1-hr concentrations for total suspended particulates were not listed in the source document.

Source: EPA 1997; TNRCC 1997a, 1997b.

G.3.2.2 MOX Facility

G.3.2.2.1 Construction of MOX Facility

Potential air quality impacts from construction of new MOX and support facilities at Pantex were analyzed using ISCST3 as described in Appendix F.1. Construction impacts result from emissions from diesel fuel-burning construction equipment, particulate matter emissions from disturbance of soil by construction equipment and other vehicles (construction fugitive emissions), operation of a concrete batch plant, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–48.

Maximum air pollutant concentrations from construction activities are summarized in Table G–49.

Table G–48. Emissions (kg/yr) From Construction of New MOX Facility at Pantex

Pollutant	Diesel Equipment	Construction Fugitive Emissions[a]	Concrete Batch Plant	Vehicles
Carbon monoxide	3,840	0	0	35,800
Nitrogen dioxide	10,080	0	0	9,930
PM_{10}	768[b]	6,890	1,460[b]	34,400
Sulfur dioxide	1,020	0	0	0
Volatile organic compounds	792	0	0	4,540
Total suspended particulates	768	13,700	1,460	34,400
Toxics[c]	0	<1	0	0

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

[b] PM_{10} emissions were assumed to be the same as total suspended particulate emissions for the purpose of this analysis resulting in some overestimate of PM_{10} concentrations.

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

Source: UC 1998f.

Table G–49. Concentrations (μg/m^3) From Construction of New MOX Facility at Pantex

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Contribution	Total
Carbon monoxide	8 hours	10,000	620	2.26	622
	1 hour	40,000	2,990	14.1	3,010
Nitrogen dioxide	Annual	100	1.94	0.173	2.12
PM_{10}	Annual	50	8.79	0.154	8.94
	24 hours	150	89.4	7.31	96.7
Sulfur dioxide	Annual	80	0	0.0175	0.018
	24 hours	365	0.00002	0.21	0.21
	3 hours	1,300	0.00008	0.917	0.918
	30 minutes	1,048	0.00016	3.75	3.75
Total suspended particulates	3 hours	200	(b)	57.4	57.4
	1 hour	400	(b)	234	234
Toxics[c]	Annual	3[d]	0.0547	0.00002	0.0547
	1 hour	75[d]	19.4	0.0162	19.4

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

[b] Three- and 1-hr concentrations for total suspended particulates were not listed in the source document.

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

[d] Effects-screening level of the Texas Natural Resource Conservation Commission. Such levels are not ambient air standards, but merely "tools" used by the Toxicology and Risk Assessment staff to evaluate impacts of air pollutant emissions. Thus, exceedance of the screening levels by ambient air contaminants does not necessarily indicate a problem. That circumstance, however, would prompt a more thorough evaluation.

[Text deleted.]

Source: EPA 1997; TNRCC 1997a, 1997b.

G.3.2.2.2 Operation of MOX Facility

Potential air quality impacts from operation of the new MOX and support facilities at Pantex were analyzed using ISCST3 as described in Appendix F.1. Operational impacts result from emissions from boilers, emergency diesel generators, process emissions, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–50. Emergency generators were modeled as a volume source. The process stack for radiological emissions was modeled with a 8 m (26 ft) height, 0.3048 m

Table G–50. Emissions (kg/yr) From Operation of New MOX Facility at Pantex

Pollutant	Boilers	Emergency Generator	Process	Vehicles
Carbon monoxide	1,080	374	0	34,800
Nitrogen dioxide	1,470	1,738	0	9,660
PM_{10}	247	122	0	33,400
Sulfur dioxide	11	114	0	0
Volatile organic compounds	102	142	0	4,410
Total suspended particulates	247	122	0	33,400
[Text deleted.]				

Source: UC 1998f.

(1.0 ft) diameter, stack exit temperature of 20 C (68 F), and an exit velocity of 0.03 m/s (0.1 ft/s). The boiler stack was modeled with a 19.8 m (65 ft) height, 1.7 m (5.6 ft) diameter, stack exit temperature of 124 C (255 F), and an exit velocity of 6.2 m/s (20 ft/s) (UC 1998f).

Maximum air pollutant concentrations resulting from the boilers, emergency diesel generators and process sources, plus the No Action concentrations, are summarized in Table G–51. Radiological impacts, including those from emissions to the air, are discussed in Appendix J.

Table G–51. Concentrations ($\mu g/m^3$) From Operation of New MOX Facility at Pantex

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Contribution	Total
Carbon monoxide	8 hours	10,000	620	0.324	620
	1 hour	40,000	2,990	1.70	2,990
Nitrogen dioxide	Annual	100	1.94	0.0362	1.98
PM_{10}	Annual	50	8.79	0.00316	8.79
	24 hours	150	89.4	0.0352	89.5
Sulfur dioxide	Annual	80	0	0.00201	0.002
	24 hours	365	0.00002	0.0239	0.0239
	3 hours	1,300	0.00008	0.104	0.104
	30 minutes	1,048	0.00016	0.422	0.422
Total suspended particulates	3 hours	200	(b)	0.15	0.15
	1 hour	400	(b)	0.522	0.522
[Text deleted.]					

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

[b] Three- and 1-hr concentrations for total suspended particulates were not listed in the source document.

[Text deleted.]

Source: EPA 1997; TNRCC 1997a, 1997b.

G.3.2.3 Pit Conversion and MOX Facilities

G.3.2.3.1 Construction of Pit Conversion and MOX Facilities

Potential air quality impacts from construction of new pit conversion, MOX, and support facilities at Pantex were analyzed using ISCST3 as described in Appendix F.1. Construction impacts result from emissions from diesel fuel-burning construction equipment, particulate matter emissions from disturbance of soil by construction equipment and other vehicles (construction fugitive emissions), operation of a concrete batch plant, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–52.

Table G–52. Emissions (kg/yr) From Construction of New Pit Conversion and MOX Facilities at Pantex

	Pit Conversion		MOX			
Pollutant	Diesel Equipment and Construction Fugitive Emissions	Vehicles	Diesel Equipment	Construction Fugitive Emissions[a]	Concrete Batch Plant	Vehicles
Carbon monoxide	6,400	40,500	3,840	0	0	35,800
Nitrogen dioxide	29,200	11,200	10,080	0	0	9,930
PM$_{10}$	20,300	38,900	768[b]	6,890	1,460[b]	34,400
Sulfur dioxide	1,900	0	1,020	0	0	0
Volatile organic compounds	2,400	5,140	792	0	0	4,540
Total suspended particulates	47,500	38,900	768	13,700	1,460	34,400
Toxics[c]	0	0	0	<1	0	0

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

[b] PM$_{10}$ emissions were assumed to be the same as total suspended particulate emissions for MOX for the purpose of this analysis resulting in some overestimate of PM$_{10}$ concentrations.

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

Source: UC 1998e, 1998f.

Maximum air pollutant concentrations from construction activities are summarized in Table G–53.

Table G–53. Concentrations (μ/m^3) From Construction of New Pit Conversion and MOX Facilities at Pantex

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Pit Conversion	MOX	Total
Carbon monoxide	8 hours	10,000	620	3.77	2.26	626
	1 hour	40,000	2,990	23.5	14.1	3,030
Nitrogen dioxide	Annual	100	1.94	0.501	0.173	2.62
PM$_{10}$	Annual	50	8.79	0.349	0.154	9.29
	24 hours	150	89.4	4.18	7.31	100
Sulfur dioxide	Annual	80	0	0.0326	0.0175	0.0501
	24 hours	365	0.00002	0.392	0.21	0.602
	3 hours	1,300	0.00008	1.71	0.917	2.63
	30 minutes	1,048	0.00016	6.98	3.75	10.7
Total suspended particulates	3 hours	200	(b)	42.7	57.4	100
	1 hour	400	(b)	174	234	409
Toxics[c]	Annual	3	0.0547	0.00	0.00002	0.0547
	1 hour	75	19.4	0.00	0.0162	19.4

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

[b] Three- and 1-hr concentrations for total suspended particulates were not listed in the source document.

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

[Text deleted.]

Source: EPA 1997; TNRCC 1997a, 1997b.

G.3.2.3.2 Operation of Pit Conversion and MOX Facilities

Potential air quality impacts from operation of the new pit conversion, MOX, and support facilities at Pantex were analyzed using ISCST3 as described in Appendix F.1. Operational impacts result from emissions from boilers, emergency diesel generators, process emissions, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–54. Stack parameters used for modeling were as stated previously.

Table G–54. Emissions (kg/yr) From Operation of New Pit Conversion and MOX Facilities at Pantex

	Pit Conversion				MOX			
Pollutant	Boilers	Emergency Generator	Process	Vehicles	Boilers	Emergency Generator	Process	Vehicles
Carbon monoxide	780	520	0	38,800	1,080	374	0	34,800
Nitrogen dioxide	700	2,000	0	10,800	1,470	1,738	0	9,660
PM_{10}	300	50	0	37,300	247	122	0	33,400
Sulfur dioxide	13	34	0	0	11	114	0	0
Volatile organic compounds	132	58	0	4,920	102	142	0	4,410
Total suspended particulates	300	50	0	37,300	247	122	0	33,400
[Text deleted.]								

[Text deleted.]
Source: UC 1998e, 1998f.

Maximum air pollutant concentrations resulting from the boilers, emergency diesel generators, and process sources, plus the No Action concentrations, are summarized in Table G–55. Radiological impacts, including those from emissions to the air, are discussed in Appendix J.

Table G–55. Concentrations ($\mu g/m^3$) From Operation of New Pit Conversion and MOX Facilities at Pantex

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Pit Conversion	MOX	Total
Carbon monoxide	8 hours	10,000	620	0.381	0.324	620
	1 hour	40,000	2,990	2.14	1.7	3,000
Nitrogen dioxide	Annual	100	1.94	0.0374	0.0362	2.02
PM_{10}	Annual	50	8.79	0.00215	0.00316	8.80
	24 hours	150	89.4	0.0225	0.0352	89.5
Sulfur dioxide	Annual	80	0	0.00064	0.00201	0.00265
	24 hours	365	0.00002	0.00753	0.0239	0.0315
	3 hours	1,300	0.00008	0.0327	0.104	0.137
	30 minutes	1,048	0.00016	0.129	0.422	0.551
Total suspended particulates	3 hours	200	(b)	0.0937	0.15	0.244
	1 hour	400	(b)	0.273	0.522	0.796
[Text deleted.]						

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

[b] Three- and 1-hr concentrations for total suspended particulates were not listed in the source document.

[Text deleted.]
Source: EPA 1997; TNRCC 1997a, 1997b.

G.4 SRS

G.4.1 Assessment Data

Emission rates for 1994 for criteria, hazardous, and toxic air pollutants at SRS were used as input into the modeling of pollutant concentrations presented in the *Savannah River Site Spent Nuclear Fuel Management Draft Environmental Impact Statement* (DOE 1998a:3-26). Presented in Table G–56 are concentration estimates assumed to be representative of the No Action Alternative at SRS for 2005. These estimates take into account the storage upgrade to accommodate nonpit material from the Rocky Flats Environmental Technology Site (DOE 1996a:4-299), as well as other onsite activities responsive to EIS Records of Decision in various program areas, specifically, foreign research reactor spent nuclear fuel, highly enriched uranium disposition, interim management of nuclear materials, stockpile stewardship and management, tritium supply and recycling, and waste management (DOE 1996a:4-953, 4-954). Other activities at SRS, which may occur during the time period 2005–2015, including operation of the Tritium Extraction Facility and spent nuclear fuel processing, are discussed in the cumulative impacts section. Radiological impacts, including those from emissions to the air, are discussed in Appendix J.

Table G–56. Estimated Concentrations (μg/m^3) From No Action at SRS

Pollutant	Averaging Period	1994 Baseline Concentration[a]	Other Onsite Sources	No Action	TEF	SNF
Carbon monoxide	8 hours	632	39.1	671	0.45	1.3
	1 hour	5,010	82.2	5,100	3.6	9.8
Nitrogen dioxide	Annual	8.8	2.57	11.4	0.0055	3.4
PM_{10}	Annual	4.8	0.14	4.94	0.00009	0.02
	24 hours	80.6	5.13	85.7	0.01	0.13
Sulfur dioxide	Annual	16.3	0.39	16.7	0.00009	0.02
	24 hours	215	6.96	222	0.001	0.13
	3 hours	690	34.9	725	0.088	0.98
Total suspended particulates	Annual	43.3	2.08	45.4	0.00016	0.02
Benzene	24 hours	20.7	0	20.7	0	0
[Text deleted.]						

[a] DOE 1998a:3-26.

Key: SNF, SRS *Spent Nuclear Fuel Management Draft EIS*; TEF, *Construction and Operation of a Tritium Extraction Facility at SRS Draft EIS*.

Source: DOE 1995a:E-10–E-13; 1995b:5-3; 1995c: vol. 1, app. C, 5-9; 1995d:4-408; 1996a:4-299; 1996d:4-26; 1998a:5-4; 1998b:4-6.

G.4.2 Facilities

G.4.2.1 Pit Conversion Facility

G.4.2.1.1 Construction of Pit Conversion Facility

Potential air quality impacts from construction of new pit conversion and support facilities at SRS were analyzed using ISCST3 as described in Appendix F.1. Construction impacts result from emissions from diesel fuel-burning construction equipment, particulate matter emissions from disturbance of soil by construction equipment and other vehicles (construction fugitive emissions), operation of a concrete batch plant, employee vehicles, and trucks moving materials and wastes. Emissions from construction of a new facility are higher than for modification of an existing facility described previously. Emissions from these sources are summarized in Table G–57.

Table G–57. Emissions (kg/yr) From Construction of New Pit Conversion Facility at SRS

Pollutant	Diesel Equipment and Construction Fugitive Emissions	Vehicles
Carbon monoxide	6,400	38,600
Nitrogen dioxide	29,200	11,200
PM_{10}	20,300	39,500
Sulfur dioxide	1,900	0
Volatile organic compounds	2,400	5,160
Total suspended particulates	47,500	39,500

Source: UC 1998g.

Maximum air pollutant concentrations from construction activities are summarized in Table G–58.

Table G–58. Concentrations ($\mu g/m^3$) From Construction of New Pit Conversion Facility at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Contribution	Total
Carbon monoxide	8 hours	10,000	671	0.911	672
	1 hour	40,000	5,100	4.14	5,100
Nitrogen dioxide	Annual	100	11.4	0.0601	11.4
PM_{10}	Annual	50	4.94	0.0418	4.98
	24 hours	150	85.7	1.03	86.8
Sulfur dioxide	Annual	80	16.7	0.00391	16.7
	24 hours	365	222	0.0964	222
	3 hours	1,300	725	0.578	726
Total suspended particulates	Annual	75	45.4	0.0977	45.5

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

Source: EPA 1997; SCDHEC 1996.

G.4.2.1.2 Operation of Pit Conversion Facility

Potential air quality impacts from operation of the new pit conversion and support facilities at SRS were analyzed using ISCST3 as described in Appendix F.1. Operational impacts result from emissions from boilers, emergency diesel generators, process emissions, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–59. Emergency generators were modeled as a volume source. The process stack for radiological emissions was modeled with a 35 m (115 ft) height, 1.82 m (6 ft) diameter, stack exit temperature of 20 C (68 F), and an exit velocity of 0.03 m/s (0.1 ft/s). The boiler stack was modeled with a 38.1 m (125 ft) height, 3.01 m (9.9 ft) diameter, stack exit temperature of 160 C (320 F), and an exit velocity of 10.67 m/s (35 ft/s) (UC 1998g).

Maximum air pollutant concentrations resulting from the boilers, emergency diesel generators, and process sources, plus the No Action concentrations, are summarized in Table G–60. Radiological impacts, including those from emissions to the air, are discussed in Appendix J.

Table G–59. Emissions (kg/yr) From Operation of New Pit Conversion Facility at SRS

Pollutant	Boilers	Emergency Generator	Process	Vehicles
Carbon monoxide	587	520	0	39,600
Nitrogen dioxide	20,000	2,000	0	11,500
PM_{10}	1,400	50	0	40,500
Sulfur dioxide	33,300	34	0	0
Volatile organic compounds	69	58	0	5,300
Total suspended particulates	1,400	50	0	40,500

Source: UC 1998g.

Table G–60. Concentrations ($\mu g/m^3$) From Operation of New Pit Conversion Facility at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Contribution	Total
Carbon monoxide	8 hours	10,000	671	0.0942	672
	1 hour	40,000	5,100	0.373	5,100
Nitrogen dioxide	Annual	100	11.4	0.0287	11.4
PM_{10}	Annual	50	4.94	0.00182	4.94
	24 hours	150	85.7	0.026	85.8
Sulfur dioxide	Annual	80	16.7	0.041	16.7
	24 hours	365	222	0.56	223
	3 hours	1,300	725	1.46	726
Total suspended particulates	Annual	75	45.4	0.00182	45.4

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

Source: EPA 1997; SCDHEC 1996.

G.4.2.2 [Text deleted.]

G.4.2.3 Immobilization Facility

G.4.2.3.1 Construction of Immobilization Facility

Potential air quality impacts from construction of new immobilization (ceramic or glass) and support facilities at SRS were analyzed using ISCST3 as described in Appendix F.1. Construction impacts result from emissions from diesel fuel-burning construction equipment, particulate matter emissions from disturbance of soil by construction equipment and other vehicles (construction fugitive emissions), operation of a concrete batch plant, employee vehicles, and trucks moving materials and wastes. Emissions from construction of a new facility are higher than for modification of an existing facility described previously. Emissions from these sources are summarized in Table G–61.

Maximum air pollutant concentrations from construction activities are summarized in Table G–62.

Table G–61. Emissions (kg/yr) From Construction of New Immobilization Facility at SRS

Pollutant	Diesel Equipment	Construction Fugitive Emissions[a]	Concrete Batch Plant	Vehicles
Carbon monoxide	20,300	0	0	48,700
Nitrogen dioxide	52,700	0	0	14,100
PM_{10}	3,930[b]	11,300	2,610[b]	49,900
Sulfur dioxide	24,400	0	0	0
Volatile organic compounds	3,900	0	0	6,520
Total suspended particulates	3,930	21,600	2,610	49,900

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

[b] PM_{10} emissions were assumed to be the same as total suspended particulate emissions for this analysis, resulting in some overestimate of PM_{10} concentrations.

Source: UC 1999c, 1999d.

Table G–62. Concentrations ($\mu g/m^3$) From Construction of New Immobilization Facility at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Ceramic or Glass	Total
Carbon monoxide	8 hours	10,000	671	2.89	674
	1 hour	40,000	5,100	13.1	5,110
Nitrogen dioxide	Annual	100	11.4	0.108	11.5
PM_{10}	Annual	50	4.94	0.0366	4.98
	24 hours	150	85.7	3.56	89.3
Sulfur dioxide	Annual	80	16.7	0.0502	16.7
	24 hours	365	222	1.24	223
	3 hours	1,300	725	7.42	732
Total suspended particulates	Annual	75	45.4	0.0581	45.4

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

Source: EPA 1997; SCDHEC 1996.

G.4.2.3.2 Operation of Immobilization Facility

Potential air quality impacts from operation of new immobilization (ceramic or glass) and support facilities at SRS were analyzed using ISCST3 as described in Appendix F.1. Operational impacts result from emissions from boilers, emergency diesel generators, process emissions, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–63. Emergency generators were modeled as a volume source. The process stack for radiological emissions was modeled with a 41 m (135 ft) height, 5.1 m (17 ft) diameter, stack exit temperature of 20 C (68 F), and an exit velocity of 7 m/s (23 ft/s). The boiler stack was modeled with a 38.1 m (125 ft) height, 3.01 m (9.9 ft) diameter, stack exit temperature of 160 C (320 F), and an exit velocity of 10.67 m/s (35 ft/s) (UC 1999c, 1999d).

Maximum air pollutant concentrations resulting from the boilers, emergency diesel generators, and process sources, plus the No Action concentrations, are summarized in Table G–64. Radiological impacts, including those from emissions to the air, are discussed in Appendix J.

Table G–63. Emissions (kg/yr) From Operation of New Immobilization Facility at SRS

Pollutant	Boilers	Emergency Generator	Ceramic or Glass Process	Vehicles[a]
Carbon monoxide	370	980	0	46,500
Nitrogen dioxide	12,100	4,530	0	13,500
PM_{10}	940	320	0	47,600
Sulfur dioxide	35,500	300	0	0
Volatile organic compounds	80	370	0	6,220
Total suspended particulates	940	320	0	47,600

[a] For 50-t (55-ton) case.

Source: UC 1999c, 1999d.

Table G–64. Concentrations ($\mu g/m^3$) From Operation of New Immobilization Facility at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Ceramic or Glass	Total
Carbon monoxide	8 hours	10,000	671	0.152	671
	1 hour	40,000	5,100	0.657	5,100
Nitrogen dioxide	Annual	100	11.4	0.0242	11.4
PM_{10}	Annual	50	4.94	0.00181	4.94
	24 hours	150	85.7	0.032	85.8
Sulfur dioxide	Annual	80	16.7	0.0442	16.7
	24 hours	365	222	0.61	223
	3 hours	1,300	725	1.63	727
Total suspended particulates	Annual	75	45.4	0.00181	45.4

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

Source: EPA 1997; SCDHEC 1996.

G.4.2.4 MOX Facility

G.4.2.4.1 Construction of MOX Facility

Potential air quality impacts from construction of new MOX and support facilities at SRS were analyzed using ISCST3 as described in Appendix F.1. Construction impacts result from emissions from diesel fuel-burning construction equipment, particulate matter emissions from disturbance of soil by construction equipment and other vehicles (construction fugitive emissions), operation of a concrete batch plant, employee vehicles, and trucks moving materials and wastes. Emissions from construction of a new facility are higher than for modification of an existing facility described previously. Emissions from these sources are summarized in Table G–65.

Maximum air pollutant concentrations from construction activities are summarized in Table G–66.

Table G–65. Emissions (kg/yr) From Construction of New MOX Facility at SRS

Pollutant	Diesel Equipment	Construction Fugitive Emissions[a]	Concrete Batch Plant	Vehicles
Carbon monoxide	3,840	0	0	33,600
Nitrogen dioxide	10,100	0	0	9,740
PM_{10}	768[b]	6,870	1,310[b]	34,400
Sulfur dioxide	1,020	0	0	0
Volatile organic compounds	792	0	0	4,490
Total suspended particulates	768	13,600	1,310	34,400
Toxics[c]	0	<1	0	0

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

[b] PM_{10} emissions were assumed to be the same as total suspended particulate emissions for this analysis resulting in some overestimate of PM_{10} concentrations.

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

Source: UC 1998h.

Table G–66. Concentrations ($\mu g/m^3$) From Construction of New MOX Facility at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Contribution	Total
Carbon monoxide	8 hours	10,000	671	0.547	672
	1 hour	40,000	5,100	2.48	5,100
Nitrogen dioxide	Annual	100	11.4	0.0207	11.4
PM_{10}	Annual	50	4.94	0.0185	4.96
	24 hours	150	85.7	1.8	87.5
Sulfur dioxide	Annual	80	16.7	0.0021	16.7
	24 hours	365	222	0.0517	222
	3 hours	1,300	725	0.31	725
Total suspended particulates	Annual	75	45.4	0.0321	45.4
Toxics[b]	24 hours	150	20.7	0.000224	20.7

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

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

Source: EPA 1997; SCDHEC 1996.

G.4.2.4.2 Operation of MOX Facility

Potential air quality impacts from operation of the new MOX and support facilities at SRS were analyzed using ISCST3 as described in Appendix F.1. Operational impacts result from emissions from boilers, emergency diesel generators, process emissions, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–67. Emergency generators were modeled as a volume source. The process stack for radiological emissions was modeled with a 8 m (26 ft) height, 0.3048 m (1.0 ft) diameter, stack exit temperature of 20 C (68 F), and an exit velocity of 0.03 m/s (0.1 ft/s). The boiler stack was modeled with a 38.1 m (125 ft) height, 3.01 m (9.9 ft) diameter, stack exit temperature of 160 C (320 F), and an exit velocity of 10.67 m/s (35 ft/s) (UC 1998h).

Table G–67. Emissions (kg/yr) From Operation of New MOX Facility at SRS

Pollutant	Boilers	Emergency Generator	Process	Vehicles
Carbon monoxide	2,040	374	0	32,700
Nitrogen dioxide	5,640	1,740	0	9,470
PM_{10}	276	122	0	33,400
Sulfur dioxide	31,300	114	0	0
Volatile organic compounds	0	142	0	4,370
Total suspended particulates	276	122	0	33,400
[Text deleted.]				

[Text deleted.]

Source: UC 1998h.

Maximum air pollutant concentrations resulting from the boilers, emergency diesel generators, and process sources, plus the No Action concentrations, are summarized in Table G–68. Radiological impacts, including those from emissions to the air, are discussed in Appendix J.

Table G–68. Concentrations ($\mu g/m^3$) From Operation of New MOX Facility at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Contribution	Total
Carbon monoxide	8 hours	10,000	671	0.123	671
	1 hour	40,000	5,100	0.371	5,100
Nitrogen dioxide	Annual	100	11.4	0.0105	11.4
PM_{10}	Annual	50	4.94	0.00059	4.94
	24 hours	150	85.7	0.0108	85.7
Sulfur dioxide	Annual	80	16.7	0.0387	16.7
	24 hours	365	222	0.531	222
	3 hours	1,300	725	1.39	726
Total suspended particulates	Annual	75	45.4	0.00059	45.4
[Text deleted.]					

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

[Text deleted.]

Source: EPA 1997; SCDHEC 1996.

G.4.2.5 Pit Conversion and Immobilization Facilities

G.4.2.5.1 Construction of Pit Conversion and Immobilization Facilities

Potential air quality impacts from construction of new pit conversion, immobilization (ceramic or glass), and support facilities at SRS were analyzed using ISCST3 as described in Appendix F.1. [Text deleted.] Construction impacts result from emissions from fuel-burning construction equipment, particulate matter emissions from soil disturbance by construction equipment and other vehicles (construction fugitive emissions), operation of a concrete batch plant, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–69.

Table G–69. Emissions (kg/yr) From Construction of New Pit Conversion and Immobilization Facilities at SRS

	Pit Conversion		Immobilization (Ceramic or Glass)			
Pollutant	**Diesel Equipment and Construction Fugitive Emissions**	**Veh**	**Diesel Equipment**	**Construction Fugitive Emissions**[a]	**Concrete Batch Plant**	**Veh**
Carbon monoxide	6,400	38,600	20,300	0	0	48,700
Nitrogen dioxide	29,200	11,200	52,700	0	0	14,100
PM_{10}	20,300	39,500	3,930[b]	11,300	2,610[b]	49,900
Sulfur dioxide	1,900	0	24,400	0	0	0
Volatile organic compounds	2,400	5,160	3,900	0	0	6,520
Total suspended particulates	47,500	39,500	3,930	21,600	2,610	49,900

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

[b] PM_{10} emissions were assumed to be the same as total suspended particulate emissions for this analysis, resulting in some overestimate of PM_{10} concentrations.

Key: Veh, vehicles.

Source: UC 1998g, 1999c, 1999d.

Maximum air pollutant concentrations from construction activities are summarized in Table G–70.

Table G–70. Concentrations ($\mu g/m^3$) From Construction of New Pit Conversion and Immobilization Facilities at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Pit Conversion	Immobilization (Ceramic or Glass)	Total
Carbon monoxide	8 hours	10,000	671	0.911	2.89	675
	1 hour	40,000	5,100	4.14	13.1	5,110
Nitrogen dioxide	Annual	100	11.4	0.0601	0.108	11.5
PM_{10}	Annual	50	4.94	0.0418	0.0366	5.02
	24 hours	150	85.7	1.03	3.56	90.3
Sulfur dioxide	Annual	80	16.7	0.00391	0.0502	16.7
	24 hours	365	222	0.0964	1.24	223
	3 hours	1,300	725	0.578	7.42	733
Total suspended particulates	Annual	75	45.4	0.0977	0.0581	45.5

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

Source: EPA 1997; SCDHEC 1996.

G.4.2.5.2 Operation of Pit Conversion and Immobilization Facilities

Potential air quality impacts from operation of new pit conversion, immobilization (ceramic or glass), and support facilities at SRS were analyzed using ISCST3 as described in Appendix F.1. Operational impacts result from emissions from boilers, emergency diesel generators, process emissions, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–71. Stack parameters used for modeling were as stated previously.

Table G–71. Emissions (kg/yr) From Operation of New Pit Conversion and Immobilization Facilities at SRS

	Pit Conversion				Immobilization			
Pollutant	**Boilers**	**EG**	**Process**	**Veh**	**Boilers**	**EG**	**Process**	**Veh**[a]
Carbon monoxide	587	520	0	39,600	370	980	0	46,500
Nitrogen dioxide	20,000	2,000	0	11,500	12,100	4,530	0	13,500
PM_{10}	1,400	50	0	40,500	940	320	0	47,600
Sulfur dioxide	33,300	34	0	0	35,500	300	0	0
Volatile organic compounds	69	58	0	5,300	80	370	0	6,220
Total suspended particulates	1,400	50	0	40,500	940	320	0	47,600

[a] For 50-t (55-ton) case.

[Text deleted.]

Key: EG, emergency generator; Veh, vehicles.

Source: UC 1998g, 1999c, 1999d.

Maximum air pollutant concentrations resulting from the boilers, emergency diesel generators, and process sources, plus the No Action concentrations, are summarized in Table G–72. Radiological impacts, including those from emissions to the air, are discussed in Appendix J.

Table G–72. Concentrations ($\mu g/m^3$) From Operation of New Pit Conversion and Immobilization Facilities at SRS

Pollutant	**Averaging Period**	**Most Stringent Standard or Guideline**[a]	**No Action**	**Pit Conversion**	**Immobilization (Ceramic or Glass)**	**Total**
Carbon monoxide	8 hours	10,000	671	0.0942	0.152	671
	1 hour	40,000	5,100	0.373	0.657	5,100
Nitrogen dioxide	Annual	100	11.4	0.0287	0.0242	11.4
PM_{10}	Annual	50	4.94	0.00182	0.00181	4.94
	24 hours	150	85.7	0.026	0.032	85.8
Sulfur dioxide	Annual	80	16.7	0.041	0.0442	16.8
	24 hours	365	222	0.56	0.61	223
	3 hours	1,300	725	1.46	1.63	728
Total suspended particulates	Annual	75	45.4	0.00182	0.00181	45.4

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

[Text deleted.]

Source: EPA 1997; SCDHEC 1996.

G.4.2.6 Pit Conversion and MOX Facilities

G.4.2.6.1 Construction of Pit Conversion and MOX Facilities

Potential air quality impacts from construction of new pit conversion, MOX, and support facilities at SRS were analyzed using ISCST3 as described in Appendix F.1. Construction impacts result from emissions from diesel fuel-burning construction equipment, particulate matter emissions from soil disturbance by construction equipment and other vehicles (construction fugitive emissions), operation of a concrete batch plant, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–73.

Table G–73. Emissions (kg/yr) From Construction of New Pit Conversion and MOX Facilities at SRS

	Pit Conversion		MOX			
Pollutant	**Diesel Equipment and Construction Fugitive Emissions**	**Vehicles**	**Diesel Equipment**	**Construction Fugitive Emissions[a]**	**Concrete Batch Plant**	**Vehicles**
Carbon monoxide	6,400	38,600	3,840	0	0	33,600
Nitrogen dioxide	29,200	11,200	10,100	0	0	9,740
PM_{10}	20,300	39,500	768[b]	6,870	1,310[b]	34,400
Sulfur dioxide	1,900	0	1,020	0	0	0
Volatile organic compounds	2,400	5,160	792	0	0	4,490
Total suspended particulates	47,500	39,500	768	13,600	1,310	34,400
Toxics[c]	0	0	0	<1	0	0

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

[b] PM_{10} emissions were assumed to be the same as total suspended particulate emissions for this analysis, resulting in some overestimate of PM_{10} concentrations.

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

Source: UC 1998g, 1998h.

Maximum air pollutant concentrations from construction activities are summarized in Table G–74.

Table G–74. Concentrations (μg/m^3) From Construction of New Pit Conversion and MOX Facilities at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Pit Conversion	MOX	Total
Carbon monoxide	8 hours	10,000	671	0.911	0.547	672
	1 hour	40,000	5,100	4.14	2.48	5,110
Nitrogen dioxide	Annual	100	11.4	0.0601	0.0207	11.5
PM_{10}	Annual	50	4.94	0.0418	0.0185	5.
	24 hours	150	85.7	1.03	1.8	88.5
Sulfur dioxide	Annual	80	16.7	0.00391	0.0021	16.7
	24 hours	365	222	0.0964	0.0517	222
	3 hours	1,300	725	0.578	0.31	726
Total suspended particulates	Annual	75	45.4	0.0977	0.0321	45.5
Toxics[b]	24 hours	150	20.7	0	0.000224	20.7

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

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

Source: EPA 1997; SCDHEC 1996.

G.4.2.6.2 Operation of Pit Conversion and MOX Facilities

Potential air quality impacts from operation of the new pit conversion and MOX facilities at SRS were analyzed using ISCST3 as described in Appendix F.1. Operational impacts result from emissions from boilers, emergency diesel generators, process emissions, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–75. Stack parameters used for modeling were as stated previously.

Table G–75. Emissions (kg/yr) From Operation of New Pit Conversion and MOX Facilities at SRS

	Pit Conversion				MOX			
Pollutant	**Boilers**	**EG**	**Process**	**Vehicles**	**Boilers**	**EG**	**Process**	**Vehicles**
Carbon monoxide	587	520	0	39,600	2,040	374	0	32,700
Nitrogen dioxide	20,000	2,000	0	11,500	5,640	1,740	0	9,470
PM_{10}	1,400	50	0	40,500	276	122	0	33,400
Sulfur dioxide	33,300	34	0	0	31,300	114	0	0
Volatile organic compounds	69	58	0	5,300	0	142	0	4,370
Total suspended particulates	1,400	50	0	40,500	276	122	0	33,400
[Text deleted.]								

[Text deleted.]
Key: EG, emergency generator.
Source: UC 1998g, 1998h.

Maximum air pollutant concentrations resulting from the boilers, emergency diesel generators, and process sources, plus the No Action concentrations, are summarized in Table G–76. Radiological impacts, including those from emissions to the air, are discussed in Appendix J.

Table G–76. Concentrations (μg/m^3) From Operation of New Pit Conversion and MOX Facilities at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Pit Conversion	MOX	Total
Carbon monoxide	8 hours	10,000	671	0.0942	0.123	671
	1 hour	40,000	5,100	0.373	0.371	5,100
Nitrogen dioxide	Annual	100	11.4	0.0287	0.0105	11.4
PM_{10}	Annual	50	4.94	0.00182	0.00059	4.94
	24 hours	150	85.7	0.026	0.0108	85.7
Sulfur dioxide	Annual	80	16.7	0.041	0.0387	16.8
	24 hours	365	222	0.56	0.531	223
	3 hours	1,300	725	1.46	1.39	728
Total suspended particulates	Annual	75	45.4	0.00182	0.00059	45.4
[Text deleted.]						

[a] The more stringent of the Federal and State standards is presented if both exist for the averaging period.
[Text deleted.]
Source: EPA 1997; SCDHEC 1996.

G.4.2.7 Immobilization and MOX Facilities

G.4.2.7.1 Construction of Immobilization and MOX Facilities

Potential air quality impacts from construction of new immobilization (ceramic or glass), MOX, and support facilities at SRS were analyzed using ISCST3 as described in Appendix F.1. [Text deleted.] Construction impacts result from emissions from diesel fuel-burning construction equipment, particulate matter emissions from disturbance of soil by construction equipment and other vehicles (construction fugitive emissions), operation of a concrete batch plant, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–77.

Table G–77. Emissions (kg/yr) From Construction of New Immobilization and MOX Facilities at SRS

	Immobilization (Ceramic or Glass)				MOX			
Pollutant	**DE**	**CFE[a]**	**CBP**	**Veh**	**DE**	**CFE[a]**	**CBP**	**Veh**
Carbon monoxide	20,300	0	0	48,700	3,840	0	0	33,600
Nitrogen dioxide	52,700	0	0	14,100	10,100	0	0	9,740
PM_{10}	3,930[b]	11,300	2,610[b]	49,900	768[b]	6,810	1,310[b]	34,400
Sulfur dioxide	24,400	0	0	0	1,020	0	0	0
Volatile organic compounds	3,900	0	0	6,520	792	0	0	4,490
Total suspended particulates	3,930	21,600	2,610	49,900	768	13,600	1,310	34,400
Toxics[c]	0	0	0	0	0	<1	0	0

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

[b] PM_{10} emissions were assumed to be the same as total suspended particulate emissions for this analysis, resulting in some overestimate of PM_{10} concentrations.

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

Key: CBP, concrete batch plant; CFE, construction fugitive emissions; DE, diesel equipment; Veh, vehicles.

Source: UC 1998h, 1999c, 1999d.

Maximum air pollutant concentrations from construction activities are summarized in Table G–78.

Table G–78. Concentrations ($\mu g/m^3$) From Construction of New Immobilization and MOX Facilities at SRS

Pollutant	**Averaging Period**	**Most Stringent Standard or Guideline[a]**	**No Action**	**Immobilization (Ceramic or Glass)**	**MOX**	**Total**
Carbon monoxide	8 hours	10,000	671	2.89	0.547	675
	1 hour	40,000	5,100	13.1	2.48	5,110
Nitrogen dioxide	Annual	100	11.4	0.108	0.0207	11.5
PM_{10}	Annual	50	4.94	0.0366	0.0185	5
	24 hours	150	85.7	3.56	1.8	91.1
Sulfur dioxide	Annual	80	16.7	0.0502	0.0021	16.7
	24 hours	365	222	1.24	0.0517	223
	3 hours	1,300	725	7.42	0.31	733
Total suspended particulates	Annual	75	45.4	0.0581	0.0321	45.5
Toxics[b]	24 hours	150	20.7	0	0.000224	20.7

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

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

Source: EPA 1997; SCDHEC 1996.

G.4.2.7.2 Operation of Immobilization and MOX Facilities

Potential air quality impacts from operation of new immobilization (ceramic or glass), MOX, and support facilities at SRS were analyzed using ISCST3 as described in Appendix F.1. Operational impacts result from emissions from boilers, emergency diesel generators, process emissions, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–79. Stack parameters used for modeling were as stated previously.

Table G–79. Emissions (kg/yr) From Operation of New Immobilization and MOX Facilities at SRS

	Immobilization				MOX			
Pollutant	**Boilers**	**Emergency Generator**	**Process**[a]	**Vehicles**	**Boilers**	**Emergency Generator**	**Process**	**Vehicles**
Carbon monoxide	370	980	0	44,400	2,040	374	0	32,700
Nitrogen dioxide	12,100	4,530	0	12,900	5,640	1,740	0	9,470
PM_{10}	940	320	0	45,400	276	122	0	33,400
Sulfur dioxide	35,500	300	0	0	31,300	114	0	0
Volatile organic compounds	80	370	0	5,940	0	142	0	4,370
Total suspended particulates	940	320	0	45,400	276	122	0	33,400
[Text deleted.]								

[a] Ceramic or glass.

[Text deleted.]

Source: UC 1998h, 1999c, 1999d.

Maximum air pollutant concentrations resulting from the boilers, emergency diesel generators, and process sources, plus the No Action concentrations, are summarized in Table G–80. Radiological impacts, including those from emissions to the air, are discussed in Appendix J.

Table G–80. Concentrations (μg/m^3) From Operation of New Immobilization and MOX Facilities at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Immobilization	MOX	Total
Carbon monoxide	8 hours	10,000	671	0.152	0.123	671
	1 hour	40,000	5,100	0.657	0.371	5,100
Nitrogen dioxide	Annual	100	11.4	0.0242	0.0105	11.4
PM_{10}	Annual	50	4.94	0.00181	0.00059	4.94
	24 hours	150	85.7	0.032	0.0108	85.8
Sulfur dioxide	Annual	80	16.7	0.0442	0.0388	16.8
	24 hours	365	222	0.61	0.531	223
	3 hours	1,300	725	1.63	1.39	728
Total suspended particulates	Annual	75	45.4	0.00181	0.00059	45.4
[Text deleted.]						

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

[Text deleted.]

Source: EPA 1997; SCDHEC 1996.

G.4.2.8 Pit Conversion, Immobilization, and MOX Facilities

G.4.2.8.1 Construction of Pit Conversion, Immobilization, and MOX Facilities

Potential air quality impacts from construction of new pit conversion, immobilization (ceramic or glass), MOX, and support facilities at SRS were analyzed using ISCST3 as described in Appendix F.1. [Text deleted.] Construction impacts result from emissions from diesel fuel-burning construction equipment, particulate matter emissions from soil disturbance by construction equipment and other vehicles (construction fugitive emissions), operation of a concrete batch plant, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–81.

Table G–81. Emissions (kg/yr) From Construction of New Pit Conversion, Immobilization, and MOX Facilities at SRS

	Pit Conversion		Immobilization (Ceramic or Glass)				MOX			
Pollutant	**DE & CFE**	**Veh**	**DE**	**CFE[a]**	**CBP**	**Veh**	**DE**	**CFE[a]**	**CBP**	**Veh**
Carbon monoxide	6,400	38,600	20,300	0	0	48,700	3,840	0	0	33,600
Nitrogen dioxide	29,200	11,200	52,700	0	0	14,100	10,080	0	0	9,740
PM_{10}	20,300	39,500	3,930[b]	11,300	2,610[b]	49,900	768[b]	6,870	1,310[b]	34,400
Sulfur dioxide	1,900	0	24,400	0	0	0	1,020	0	0	0
Volatile organic compounds	2,400	5,160	3,900	0	0	6,520	792	0	0	4,490
Total suspended particulates	47,500	39,500	3,930	21,600	2,610	49,900	768	13,600	1,310	34,400
Toxics[c]	0	0	0	0	0	0	0	<1	0	0

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

[b] PM_{10} emissions were assumed to be the same as total suspended particulate emissions for this analysis, resulting in some overestimate of PM_{10} concentrations.

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

Key: CBP, concrete batch plant; CFE, construction fugitive emissions; DE, diesel equipment; Veh, vehicles.

Source: UC 1998g, 1998h, 1999c, 1999d.

Maximum air pollutant concentrations from construction activities are summarized in Table G–82.

Table G–82. Concentrations ($\mu g/m^3$) From Construction of New Pit Conversion, Immobilization, and MOX Facilities at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Pit Conversion	Immobilization (Ceramic or Glass)	MOX	Total
Carbon monoxide	8 hours	10,000	671	0.911	2.89	0.547	675
	1 hour	40,000	5,100	4.14	13.1	2.48	5,120
Nitrogen dioxide	Annual	100	11.4	0.0601	0.108	0.0207	11.6
PM_{10}	Annual	50	4.94	0.0418	0.0366	0.0185	5.04
	24 hours	150	85.7	1.03	3.56	1.8	92.1
Sulfur dioxide	Annual	80	16.7	0.00391	0.0502	0.0021	16.7
	24 hours	365	222	0.0964	1.24	0.0517	223
	3 hours	1,300	725	0.578	7.42	0.31	733
Total suspended particulates	Annual	75	45.4	0.0977	0.0581	0.0321	45.6
Toxics[b]	24 hours	150	20.7	0	0	0.000224	20.7

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

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

Source: EPA 1997; SCDHEC 1996.

G.4.2.8.2 Operation of Pit Conversion, Immobilization, and MOX Facilities

Potential air quality impacts from operation of the three surplus plutonium disposition and support facilities at SRS were analyzed using ISCST3 as described in Appendix F.1. Operational impacts result from emissions from emergency diesel generators, process emissions, steam boilers, employee vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table G–83. Stack parameters used for modeling were as stated previously.

Table G–83. Emissions (kg/yr) From Operation of New Pit Conversion, Immobilization, and MOX Facilities at SRS

	Pit Conversion				Immobilization				MOX			
Pollutant	**Boilers**	**EG**	**Process**	**Veh**	**Boilers**	**EG**	**Process[a]**	**Veh**	**Boilers**	**EG**	**Process**	**Veh**
CO	587	520	0	39,600	370	980	0	44,400	2,040	374	0	32,700
NO_2	20,000	2,000	0	11,500	12,100	4,530	0	12,900	5,640	1,740	0	9,470
PM_{10}	1,400	50	0	40,500	940	320	0	45,400	276	122	0	33,400
SO_2	33,300	34	0	0	35,500	300	0	0	31,300	114	0	0
VOC	69	58	0	5,300	80	370	0	5,940	0	142	0	4,370
TSP	1,400	50	0	40,500	940	320	0	45,400	276	122	0	33,400
[Text deleted.]												

[a] Ceramic or glass.

[Text deleted.]

Key: CO, carbon monoxide; EG, emergency generator; NO_2, nitrogen dioxide; SO_2, sulfur dioxide; TSP, total suspended particulates; Veh, vehicles; VOC, volatile organic compounds.

Source: UC 1998g, 1998h, 1999c, 1999d.

Maximum air pollutant concentrations resulting from the boilers, emergency diesel generators, and process sources, plus the No Action concentrations, are summarized in Table G–84. Radiological impacts, including those emissions to the air, are discussed in Appendix J.

Table G–84. Concentrations ($\mu g/m^3$) From Operation of New Pit Conversion, Immobilization, and MOX Facilities at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	No Action	Pit Conversion	Immobilization (Ceramic or Glass)	MOX	Total
Carbon monoxide	8 hours	10,000	671	0.0942	0.152	0.123	671
	1 hour	40,000	5,100	0.373	0.657	0.371	5,100
Nitrogen dioxide	Annual	100	11.4	0.0287	0.0242	0.0105	11.4
PM_{10}	Annual	50	4.94	0.00182	0.00181	0.00059	4.94
	24 hours	150	85.7	0.0261	0.032	0.0108	85.8
Sulfur dioxide	Annual	80	16.7	0.041	0.0442	0.0387	16.8
	24 hours	365	222	0.56	0.61	0.531	224
	3 hours	1,300	725	1.46	1.63	1.39	729
Total suspended particulates	Annual	75	45.4	0.00182	0.00181	0.00059	45.4
[Text deleted.]							

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

[Text deleted.]

Source: EPA 1997; SCDHEC 1996.

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H.4 SRS

H.4.1 Assessment Data

Impacts on SRS waste management facilities were estimated using information on existing environmental conditions from Chapter 3 and information on the characteristics of the proposed surplus plutonium disposition facilities from Chapter 2 and the facility data reports. A description of the methods used to evaluate impacts on waste management is presented in Appendix F.8.

H.4.2 Facilities

H.4.2.1 Pit Conversion Facility

H.4.2.1.1 Construction of Pit Conversion Facility

Table H–27 compares the expected construction waste generation rates for the facilities that may be constructed at SRS with the existing site waste generation rates. No radioactive waste would be generated during the 3-year construction period because this action involves new construction only (UC 1998g). In addition, no soil contaminated with hazardous or radioactive constituents would be generated during construction. However, if any were generated, the waste would be managed in accordance with site practice and all applicable Federal and State regulations.

Table H–27. Potential Waste Management Impacts of Construction of New Pit Conversion Facility at SRS

Waste Type[a]	Estimated Waste Generation (m^3/yr)[b]	Site Waste Generation (m^3/yr)[c]	Percent of Site Waste Generation
Hazardous	50	74	68
Nonhazardous			
Liquid	5,300	416,100	1
Solid	120	6,670	2

[a] See definitions in Appendix F.8.
[b] UC 1998g. Values rounded to two significant figures.
[c] From the waste management section in Chapter 3.

Hazardous waste generated during construction includes liquids such as spent cleaning solutions, oils, hydraulic fluids, antifreeze solutions, paints and chemicals, and rags or wipes contaminated with these materials. These wastes are typically generated during construction of an industrial facility. Any hazardous waste generated during construction would be packaged in DOT-approved containers and shipped off the site to permitted commercial treatment and disposal facilities (UC 1998g). Hazardous waste generation for construction of this facility is estimated to be 68 percent of existing annual site waste generation. Because these wastes would be treated and disposed of at offsite commercial facilities, the additional waste load generated during construction should not have a major impact on the SRS hazardous waste management system.

Nonhazardous solid waste includes office garbage, concrete and steel waste, and other construction trash. Nonhazardous solid waste would be packaged in conformance with standard industrial practice, and shipped to commercial or municipal facilities for recycling or disposal (UC 1998g). Waste metals would be sent off the site for recycling and, therefore, were not included in the waste volumes. Nonhazardous-solid-waste generation during construction of this facility is estimated to be 2 percent of existing annual site waste generation. The additional waste load generated during construction should not have a major impact on the nonhazardous solid waste management system at SRS.

Nonhazardous liquid waste includes sanitary waste from sinks, showers, urinals, and water closets (UC 1998g). To be conservative, it was assumed that all nonhazardous liquid waste generated during construction would be managed at the Central Sanitary Wastewater Treatment Facility, even though it is likely that much of this waste would be collected in portable toilets and managed at offsite facilities. Nonhazardous liquid waste generated for construction of this facility is estimated to be 1 percent of existing annual site waste generation, 2 percent of the 276,000-m^3/yr (361,000-yd^3/yr) capacity of the F-Area sanitary sewer, less than 1 percent of the 1,449,050-m^3/yr (1,895,357-yd^3/yr) capacity of the Central Sanitary Wastewater Treatment Facility, and within the 1,032,950-m^3/yr (1,351,099-yd^3/yr) excess capacity of the Central Sanitary Wastewater Treatment Facility (Sessions 1997). Therefore, the management of this additional waste should not have a major impact on the system.

H.4.2.1.2 Operation of Pit Conversion Facility

The waste management facilities within the pit conversion facility would process, temporarily store, and ship all wastes generated. Table H–28 compares the expected waste generation rates from operating the new facility at SRS with the existing site waste generation rates. No HLW would be generated by the facility (UC 1998g). Depending in part on decisions in the RODs for the WM PEIS, wastes could be treated and disposed of on the site or at other DOE sites or commercial facilities. Per the ROD for TRU waste issued on January 20, 1998, TRU and mixed TRU waste would be certified on the site to current WIPP waste acceptance criteria and shipped to WIPP for disposal. Per the ROD for hazardous waste issued on August 5, 1998, nonwastewater hazardous waste would continue to be treated on the site in the Consolidated Incineration Facility and treated and disposed of at offsite commercial facilities. The SPD EIS also assumes that LLW, mixed LLW, and nonhazardous waste would be treated, stored, and disposed of in accordance with current site practices. Impacts of treatment, storage, and disposal of radioactive, hazardous, and mixed wastes at SRS are described in the *SRS Waste Management Final EIS* (DOE 1995b).

Table H–28. Potential Waste Management Impacts of Operation of New Pit Conversion Facility at SRS

Waste Type[a]	Estimated Waste Generation (m^3/yr)[b]	Site Waste Generation (m^3/yr)[c]	Percent of Site Waste Generation
TRU[d]	18	427	4
LLW	60	10,043	1
Mixed LLW	1	1,135	<1
Hazardous	2	74	3
Nonhazardous			
Liquid	25,000	416,100	6
Solid	1,800	6,670	27

[a] See definitions in Appendix F.8.
[b] UC 1998g. Values rounded to two significant figures.
[c] From the waste management section in Chapter 3.
[d] Includes mixed TRU waste.
Key: LLW, low-level waste; TRU, transuranic.

TRU wastes generated during operations include spent filters, contaminated beryllium pieces and cuttings, used containers and equipment, paper and cloth wipes, analytical and quality-control samples, and solidified inorganic solutions. Lead-lined gloves are likely to be managed as mixed TRU waste. It is anticipated that all TRU waste would be contact-handled waste. TRU wastes would be treated, packaged, and certified to WIPP waste acceptance criteria at the new facility. Liquid TRU wastes would be evaporated or solidified before being packaged for storage. Drum-gas testing, real-time radiography, and loading the TRUPACT for shipment to WIPP would occur at the planned TRU Waste Characterization and Certification Facility at SRS (UC 1998g). Impacts from the treatment of TRU waste to WIPP waste acceptance criteria are described in the WM PEIS (DOE 1997b) and the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

TRU waste generation for this facility is estimated to be 4 percent of existing annual site waste generation and 1 percent of the 1,720-m^3/yr (2,250-yd^3/yr) planned capacity of the TRU Waste Characterization and Certification Facility. A total of 180 m^3 (235 yd^3) of TRU waste would be generated over the 10-year operation period. This would be 3 percent of the 6,977 m^3 (9,126 yd^3) of contact-handled TRU waste currently in storage, and 1 percent of the 34,400-m^3 (44,995-yd^3) storage capacity available at SRS. Assuming that the waste were stored in 208-l (55-gal) drums each with a capacity of 0.21 m^3 (0.27 yd^3), about 860 drums would be required to store this waste. Assuming that these drums can be stacked two high, that each drum occupies an area of 0.4 m^2 (4 ft^2), and adding a 50 percent factor for aisle space, a storage area of about 260 m^2 (310 yd^2) would be required. Impacts of the storage of additional quantities of TRU waste on less than 0.1 ha (0.25 acre) of land at SRS should not be major.

The 180 m^3 (235 yd^3) of TRU waste generated by this facility would be less than 1 percent of the 143,000 m^3 (187,000 yd^3) of contact-handled TRU waste that DOE plans to dispose of at WIPP and within the 168,500 m^3 (220,400 yd^3) limit for WIPP (DOE 1997d:3-3). Impacts of disposal of TRU waste at WIPP are described in the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

LLW includes used equipment, wipes, protective clothing, solidified inorganic solutions, and tritium. It is likely that the LLW generated during operations would originate from activities in the processing areas containing the glovebox lines but not from operations within the gloveboxes. Operations within the gloveboxes are likely to generate mostly TRU waste. LLW would be treated, packaged, certified, and accumulated at the new facilities before being transferred for additional treatment and/or disposal in existing onsite facilities. Tritium recovered from pit disassembly would be disposed of as LLW (UC 1998g). A total of 600 m^3 (780 yd^3) of LLW would be generated over the operation period. LLW generation for this facility is estimated to be 1 percent of existing annual site waste generation, less than 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility, and 2 percent of the 30,500-m^3 (39,900-yd^3) capacity of the Low-Activity Waste Vaults. Using the 8,687-m^3/ha (4,598-yd^3/acre) disposal land usage factor for SRS published in the *Storage and Disposition PEIS* (DOE 1996a:E-9), 600 m^3 (780 yd^3) of waste would require 0.1 ha (0.25 acre) of disposal space at SRS. Therefore, impacts of the management of this additional LLW at SRS should not be major.

Mixed LLW includes lead shielding, solvents contaminated with plutonium, scintillation vials from the analytical laboratory, and hazardous constituents that were introduced as part of the incoming pits (UC 1998g). Mixed LLW would be stabilized, packaged, and stored on the site for treatment and offsite disposal in a manner consistent with the site treatment plan for SRS. Mixed LLW generation for this facility is estimated to be less than 1 percent of existing annual site waste generation, and less than 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility. Over the operating life of this facility, the 10 m^3 (13 yd^3) of mixed LLW generated would be 1 percent of the 1,900-m^3 (2,490-yd^3) capacity of the Mixed Waste Storage Buildings. Therefore, the management of this additional waste at SRS should not have a major impact on the mixed LLW management system.

Hazardous waste generated during operations includes spent cleaning solutions, vacuum pump oils, film processing fluids, hydraulic fluids, antifreeze solutions, paints, chemicals, lead packaging, and contaminated rags or wipes. Hazardous waste would be packaged for treatment and disposal at a combination of onsite and offsite permitted facilities (UC 1998g). Assuming that all hazardous waste is managed on the site, hazardous waste generation for this facility is estimated to be 3 percent of existing annual site waste generation, less than 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility, and less than 1 percent of the 5,200-m^3 (6,800-yd^3) capacity of the hazardous waste storage buildings. The management of these additional hazardous wastes at SRS should not have a major impact on the hazardous waste management system.

Nonhazardous solid waste includes office garbage, coal ash, machine shop waste, and other industrial wastes from utility and maintenance operations. Nonhazardous solid waste would be packaged in conformance with standard industrial practice. Recyclable solid wastes such as office paper, metal cans, and plastic and glass bottles would be sent off the site for recycling (UC 1998g). The remaining solid sanitary waste would be sent to the Three Rivers Landfill (DOE 1998a:3-42). Nonrecyclable, nonhazardous solid waste generated by this facility is estimated to be 27 percent of existing annual site waste generation. This additional waste load should not have a major impact on the nonhazardous solid waste management system at SRS.

Nonhazardous liquid waste includes sanitary waste from sinks, showers, urinals, and water closets and process wastewater from lab sinks and drains, mop water, cooling tower blowdown, and steam condensate. Wastewater would be treated, if necessary, before being discharged to the F-Area sanitary sewer system that connects to the Central Sanitary Wastewater Treatment Facility (UC 1998g). Nonhazardous liquid waste generated for this facility is estimated to be 6 percent of the existing annual site waste generation, 9 percent of the 276,000-m^3/yr (361,000-yd^3/yr) capacity of the F-Area sanitary sewer, 2 percent of the 1,449,050-m^3/yr (1,895,357-yd^3/yr) capacity of the Central Sanitary Wastewater Treatment Facility, and within the 1,032,950-m^3/yr (1,351,099-yd^3/yr) excess capacity of the Central Sanitary Wastewater Treatment Facility (Sessions 1997). Therefore the management of this additional waste should not have a major impact on the system.

H.4.2.2 Immobilization Facility

H.4.2.2.1 Construction of Immobilization Facility

Table H–29 compares the expected construction waste generation rates for the facilities that may be constructed at SRS with the existing site waste generation rates. No radioactive waste would be generated during the 3-year construction period because this action involves new construction only (UC 1999c, 1999d). In addition, no soil contaminated with hazardous or radioactive constituents would be generated during construction. However, if any were generated, the waste would be managed in accordance with site practice and all applicable Federal and State regulations. Construction waste generation would be the same for the ceramic and glass immobilization technologies and is the same for the 17-t (19-ton) and 50-t (55-ton) immobilization scenarios (UC 1999c, 1999d).

Table H–29. Potential Waste Management Impacts of Construction of New Immobilization Facility at SRS

Waste Type[a]	Estimated Waste Generation (m^3/yr)[b]	Site Waste Generation (m^3/yr)[c]	Percent of Site Waste Generation
Hazardous	35	74	47
Nonhazardous			
Liquid	21,000	416,100	5
Solid	2,200	6,670	33

[a] See definitions in Appendix F.8.
[b] UC 1999c, 1999d. Values rounded to two significant figures.
[c] From the waste management section in Chapter 3.
[Text deleted.]

[Text deleted.]

Hazardous waste generated during construction includes liquids such as spent cleaning solutions, lubricants, oils, hydraulic fluids, antifreeze solutions, paints and chemicals, and rags or wipes contaminated with these materials. These wastes are typically generated during construction of an industrial facility. Any hazardous waste generated during construction would be packaged in DOT-approved containers and shipped off the site to permitted commercial treatment and disposal facilities (UC 1999c, 1999d). Hazardous waste generation for construction of this facility is estimated to be 47 percent of existing annual site waste generation. Because these wastes would be treated and disposed of at offsite commercial facilities, the additional waste load generated during construction should not have a major impact on the SRS hazardous waste management system.

Nonhazardous solid waste includes office garbage, scrap lumber, concrete and steel waste, and other construction trash. Nonhazardous solid waste would be packaged in conformance with standard industrial practice and shipped to commercial or municipal facilities for recycling or disposal (UC 1999c, 1999d). Waste metals would be sent off the site for recycling and, therefore, were not included in the waste volumes. Nonhazardous-solid-waste generation during construction of this facility is estimated to be 33 percent of existing annual site waste generation. Because these wastes would be managed at commercial or municipal facilities, the additional waste load generated during construction should not have a major impact on the nonhazardous solid waste management system at SRS.

Nonhazardous liquid waste includes sanitary waste from sinks, showers, urinals, and water closets (UC 1999c, 1999d). To be conservative, it was assumed that all nonhazardous liquid waste generated during construction would be managed at the Central Sanitary Wastewater Treatment Facility, even though it is likely that much of this waste would be collected in portable toilets and managed at offsite facilities. Nonhazardous liquid waste generated for construction of this facility is estimated to be 5 percent of existing annual site waste generation, 8 percent of the 276,000-m^3/yr (361,000-yd^3/yr) capacity of the F-Area sanitary sewer, 1 percent of the 1,449,050-m^3/yr (1,895,357-yd^3/yr) capacity of the Central Sanitary Wastewater Treatment Facility, and within the 1,032,950-m^3/yr (1,351,099-yd^3/yr) excess capacity of the Central Sanitary Wastewater Treatment Facility (Sessions 1997). Therefore, the management of this additional waste should not have a major impact on the system.

H.4.2.2.2 Operation of Immobilization Facility

The waste management facilities within the immobilization facility would process, temporarily store, and ship all wastes generated. Table H–30 compares the expected waste generation rates from operating the new facility at SRS with the existing site waste generation rates. Although HLW would be used in the immobilization process, no HLW would be generated by the facility (UC 1999c, 1999d). Depending in part on decisions in the RODs for the WM PEIS, wastes could be treated and disposed of on the site or at other DOE sites or commercial facilities. Per the ROD for TRU waste issued on January 20, 1998, TRU and mixed TRU waste would be certified on the site to current WIPP waste acceptance criteria and shipped to WIPP for disposal. Per the ROD for hazardous waste issued on August 5, 1998, nonwastewater hazardous waste would continue to be treated on the site in the Consolidated Incineration Facility and treated and disposed of at offsite commercial facilities. The SPD EIS also assumes that LLW, mixed LLW, and nonhazardous waste would be treated, stored, and disposed of in accordance with current site practices. Waste generation would be the same for the ceramic and glass immobilization technologies, although the amount of waste generated would vary between the 17-t and the 50-t immobilization cases (UC 1999c, 1999d). Impacts of treatment, storage, and disposal of radioactive, hazardous, and mixed wastes at SRS are described in the *SRS Waste Management Final EIS* (DOE 1995b).

Table H–30. Potential Waste Management Impacts of Operation of New Immobilization Facility at SRS

Waste Type[a]	Estimated Waste Generation (m^3/yr)[b] 17 t	Estimated Waste Generation (m^3/yr)[b] 50 t	Site Waste Generation (m^3/yr)[c]	Percent of Site Waste Generation 17 t	Percent of Site Waste Generation 50 t
TRU[d]	95	130	427	22	30
LLW	81	110	10,043	1	1
Mixed LLW	1	1	1,135	<1	<1
Hazardous	89	89	74	120	120
Nonhazardous					
Liquid	55,000	57,000	416,100	13	14
Solid	850	850	6,670	13	13

[a] See definitions in Appendix F.8.
[b] UC 1999c, 1999d. Values rounded to two significant figures.
[c] From the waste management section in Chapter 3.
[d] Includes mixed TRU waste.
Key: LLW, low-level waste; TRU, transuranic.

TRU wastes generated during operations include metal cladding from fuel elements, spent filters, contaminated beryllium pieces and cuttings, used containers and equipment, paper and cloth wipes, analytical and quality-control samples, and solidified inorganic solutions. Lead-lined gloves are likely to be managed as mixed TRU waste. It is anticipated that all TRU waste would be contact-handled waste. TRU wastes would be treated, packaged, and certified to WIPP waste acceptance criteria at the new facility (UC 1999c, 1999d). Liquid TRU wastes would be evaporated or solidified before being packaged for storage. Drum-gas testing, real-time radiography, and loading the TRUPACT for shipment to WIPP would occur at the planned TRU Waste Characterization and Certification Facility at SRS. Impacts from the treatment of TRU waste to WIPP waste acceptance criteria are described in the WM PEIS (DOE 1997b) and the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

TRU waste generation for this facility is estimated to be 22 to 30 percent of existing annual site waste generation and 6 to 8 percent of the 1,720-m^3/yr (2,250-yd^3/yr) planned capacity of the TRU Waste Characterization and Certification Facility. A total of 950 to 1,300 m^3 (1,240 to 1,700 yd^3) of TRU waste would be generated over the 10-year operation period. This would be 14 to 19 percent of the 6,977 m^3 (9,126 yd^3) of contact-handled TRU waste currently in storage, and 3 to 4 percent of the 34,400-m^3 (44,995-yd^3) storage capacity available at SRS. Assuming that the waste were stored in 208-l (55-gal) drums each with a capacity of 0.21 m^3 (0.27 yd^3), about 4,500 to 6,000 drums would be required to store this waste. Assuming that these drums can be stacked two high, that each drum occupies an area of 0.4 m^2 (4 ft^2), and adding a 50 percent factor for aisle space, a storage area of about 1,400 to 1,800 m^2 (1,670 to 2,150 yd^2) would be required. Impacts of the storage of additional quantities of TRU waste on 0.14 to 0.18 ha (0.35 to 0.44 acre) of land at SRS should not be major.

The 950 to 1,300 m^3 (1,240 to 1,700 yd^3) of TRU waste generated by this facility would be 1 percent of the 143,000 m^3 (187,000 yd^3) of contact-handled TRU waste that DOE plans to dispose of at WIPP and within the 168,500 m^3 (220,400 yd^3) limit for WIPP (DOE 1997d:3-3). Impacts of disposal of TRU waste at WIPP are described in the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

LLW includes used equipment, wipes, protective clothing, and solidified inorganic solutions. It is likely that the LLW generated during operations would originate from activities in the processing areas containing the glovebox lines but not from operations within the gloveboxes. Operations within the gloveboxes are likely to generate mostly TRU waste. LLW would be treated, packaged, certified, and accumulated at the new facilities before being transferred for additional treatment and/or disposal in existing onsite facilities (UC 1999c, 1999d). A total of 810 to 1,100-m^3 (1,060- to 1,440-yd^3) LLW would be generated over the operation period. LLW generation for this facility is estimated to be 1 percent of existing annual site waste generation, 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility, and 3 to 4 percent of the 30,500-m^3 (39,900-yd^3) capacity of the Low-Activity Waste Vaults. Using the 8,687-m^3/ha (4,598-yd^3/acre) disposal land usage factor for SRS published in the *Storage and Disposition PEIS* (DOE 1996a:E-9), 810 to 1,080 m^3 (1,060 to 1,413 yd^3) of waste would require approximately 0.1 to 0.12 ha (0.25 to 0.30 acre) of disposal space at SRS. Therefore, impacts of the management of this additional LLW at SRS should not be major.

Mixed LLW includes leaded shielding, solvents contaminated with plutonium, and scintillation vials from the analytical laboratory (UC 1999c, 1999d). Mixed LLW would be stabilized, packaged, and stored on the site for treatment and offsite disposal in a manner consistent with the site treatment plan for SRS. Mixed LLW generation for this facility is estimated to be less than 1 percent of existing annual site waste generation, and less than 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility. Over the operating life of this facility, the 10 m^3 (13 yd^3) of mixed LLW generated would be 1 percent of the 1,900-m^3 (2,490-yd^3) capacity of the Mixed Waste Storage Buildings. Therefore, the management of this additional waste at SRS should not have a major impact on the mixed LLW management system.

Hazardous waste generated during operations includes spent cleaning solutions, lubricants, oils, film processing fluids, hydraulic fluids, coolants, paints, chemicals, batteries, fluorescent light tubes, and contaminated rags or wipes. Hazardous waste would be packaged for treatment and disposal at a combination of onsite and offsite permitted facilities (UC 1999c, 1999d). Assuming that all hazardous waste is managed on the site, hazardous waste generation for this facility is estimated to be 120 percent of existing annual site waste generation, but less than 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility, and 17 percent of the 5,200-m^3 (6,800-yd^3) capacity of the hazardous waste storage buildings. The management of these additional hazardous wastes at SRS should not have a major impact on the hazardous waste management system.

Nonhazardous solid waste includes office garbage, coal ash, machine shop waste, and other industrial wastes from utility and maintenance operations. Nonhazardous solid waste would be packaged in conformance with standard industrial practice. Recyclable solid wastes such as office paper, metal cans, and plastic and glass bottles would be sent off the site for recycling. Ash from the coal-fired steam generating plant would be disposed of in the onsite ash disposal landfills (UC 1999c, 1999d). The remaining solid sanitary waste would be sent to the Three Rivers Landfill (DOE 1998a:3-42). Nonrecyclable, nonhazardous solid waste generated by this facility is estimated to be 13 percent of existing annual site waste generation. This additional waste load should not have a major impact on the nonhazardous solid waste management system at SRS.

Nonhazardous liquid waste includes sanitary waste from sinks, showers, urinals, and water closets and wastewater from cooling tower blowdown and steam condensate. Nonhazardous wastewater would be treated, if necessary, before being discharged to the F-Area sanitary sewer system that connects to the Central Sanitary Wastewater Treatment Facility (UC 1999c, 1999d). Nonhazardous liquid waste generated for this facility is estimated to be 13 to 14 percent of the existing annual site waste generation, 20 to 21 percent of the 276,000-m^3/yr (361,000-yd^3/yr) capacity of the F-Area sanitary sewer, and 4 percent of the 1,449,050-m^3/yr (1,895,357-yd^3/yr) capacity of the Central Sanitary Wastewater Treatment Facility, and within the 1,032,950-m^3/yr (1,351,099-yd^3/yr) excess capacity of the Central Sanitary Wastewater Treatment Facility (Sessions 1997). Therefore, the management of this additional waste should not have a major impact on the system.

H.4.2.3 MOX Facility

H.4.2.3.1 Construction of MOX Facility

Table H–31 compares the expected construction waste generation rates for the facility that may be constructed at SRS with the existing site waste generation rates. No radioactive waste would be generated during the 3-year construction period because this action involves new construction only (UC 1998h). In addition, no soil contaminated with hazardous or radioactive constituents would be generated during construction. However, if any were generated, the waste would be managed in accordance with site practice and all applicable Federal and State regulations.

Table H–31. Potential Waste Management Impacts From Construction of New MOX Facility at SRS

Waste Type[a]	Estimated Waste Generation (m^3/yr)[b]	Site Waste Generation (m^3/yr)[c]	Percent of Site Waste Generation
Hazardous	19	74	26
Nonhazardous			
Liquid	20,000	416,100	5
Solid	8,600	6,670	128

[a] See definitions in Appendix F.8.
[b] DOE 1999a; UC 1998h. Values rounded to two significant figures.
[c] From the waste management section in Chapter 3.

Hazardous waste generated during construction includes liquids such as spent cleaning solutions, oils, hydraulic fluids, antifreeze solutions, paints and chemicals, and rags or wipes contaminated with these materials. These wastes are typically generated during construction of an industrial facility. Any hazardous waste generated during construction would be packaged in DOT-approved containers and shipped off the site to permitted commercial treatment and disposal facilities (UC 1998h). Hazardous waste generation for construction of this facility is estimated to be 26 percent of existing annual site waste generation. Because these wastes would be treated and disposed at offsite commercial facilities, the additional waste load generated during construction should not have a major impact on the SRS hazardous waste management system.

Nonhazardous solid waste includes office garbage, scrap lumber, concrete and steel waste, and other construction trash. Nonhazardous solid waste would be packaged in conformance with standard industrial practice and shipped to commercial or municipal facilities for recycling or disposal (UC 1998h). Waste metals would be sent off the site for recycling and, therefore, were not included in the waste volumes. Nonhazardous-solid-waste generation during construction of this facility is estimated to be 128 percent of existing annual site waste generation. Because these wastes would be managed at commercial or municipal facilities, the additional waste load generated during construction should not have a major impact on the nonhazardous solid waste management system at SRS.

Nonhazardous liquid waste includes sanitary waste from sinks, showers, urinals, and water closets and wastewater from dewatering (UC 1998h). To be conservative, it was assumed that all nonhazardous liquid waste generated during construction would be managed at the Central Sanitary Wastewater Treatment Facility, even though it is likely that much of this waste would be collected in portable toilets and managed at offsite facilities. Nonhazardous liquid waste generated for construction of this facility is estimated to be 5 percent of existing annual site waste generation, 7 percent of the 276,000-m^3/yr (361,000-yd^3/yr) capacity of the F-Area sanitary sewer, 1 percent of the 1,449,050-m^3/yr (1,895,357-yd^3/yr) capacity of the Central Sanitary Wastewater Treatment Facility, and within the 1,032,950-m^3/yr (1,351,099-yd^3/yr) excess capacity of the Central Sanitary

Wastewater Treatment Facility (Sessions 1997). Therefore, impacts on the system during construction should not be major.

H.4.2.3.2 Operation of MOX Facility

The waste management facilities within the MOX facility would process, temporarily store, and ship all wastes generated. Table H–32 compares the expected waste generation rates from operating the new facility at SRS with the existing site waste generation rates. No HLW would be generated by the facility (UC 1998h). Depending in part on decisions in the RODs for the WM PEIS, wastes could be treated and disposed of on the site or at other DOE sites or commercial facilities. Per the ROD for TRU waste issued on January 20, 1998, TRU and mixed TRU waste would be certified on the site to current WIPP waste acceptance criteria and shipped to WIPP for disposal. Per the ROD for hazardous waste issued on August 5, 1998, nonwastewater hazardous waste would continue to be treated on the site in the Consolidated Incineration Facility and treated and disposed of at offsite commercial facilities. The SPD EIS also assumes that LLW, mixed LLW, and nonhazardous waste would be treated, stored, and disposed of in accordance with the current site practices. Impacts of treatment, storage, and disposal of radioactive, hazardous, and mixed wastes at SRS are described in the *SRS Waste Management Final EIS* (DOE 1995b).

Table H–32. Potential Waste Management Impacts From Operation of New MOX Facility at SRS

Waste Type[a]	Estimated Waste Generation (m^3/yr)[b]	Site Waste Generation (m^3/yr)[c]	Percent of Site Waste Generation
TRU[d]	68	427	16
LLW	94	10,043	1
Mixed LLW	3	1,135	<1
Hazardous	3	74	4
Nonhazardous			
Liquid	26,000	416,100	6
Solid	440	6,670	7

[a] See definitions in Appendix F.8.
[b] DOE 1999a; UC 1998h. Values rounded to two significant figures.
[c] From the waste management section in Chapter 3.
[d] Includes mixed TRU waste.
Key: LLW, low-level waste; TRU, transuranic.

TRU wastes generated during operations include spent filters, used containers and equipment, paper and cloth wipes, analytical and quality-control samples, solidified inorganic solutions, and dirty plutonium oxide scrap. Lead-lined gloves are likely to be managed as mixed TRU waste. It is anticipated that all TRU waste would be contact-handled waste. TRU wastes would be treated, packaged, and certified to WIPP waste acceptance criteria at the new facility (UC 1998h). Liquid TRU wastes would be evaporated or solidified before being packaged for storage. Drum-gas testing, real-time radiography, and loading the TRUPACT for shipment to WIPP would occur at the planned TRU Waste Characterization and Certification Facility at SRS. Impacts from the treatment of TRU waste to WIPP waste acceptance criteria are described in the WM PEIS (DOE 1997b) and the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

TRU waste generation for this combination of facilities is estimated to be 16 percent of existing annual site waste generation and 4 percent of the 1,720-m^3/yr (2,250-yd^3/yr) planned capacity of the TRU Waste Characterization and Certification Facility. A total of 680 m^3 (890 yd^3) of TRU waste would be generated over the 10-year operation period. This would be 10 percent of the 6,977 m^3 (9,126 yd^3) of contact-handled TRU waste currently in storage, and 2 percent of the 34,400-m^3 (44,995-yd^3) storage capacity available at SRS. Assuming that the waste were stored in 208-l (55-gal) drums each with a capacity of 0.21 m^3 (0.27 yd^3), about 3,200 drums would be required to store this waste. Assuming that these drums can be stacked two high, that each drum occupies an area of 0.4 m^2 (4 ft^2), and adding a 50 percent factor for aisle space, a storage area of about 960 m^2 (1,150 yd^2) would be required. Impacts of the storage of additional quantities of TRU waste on 0.1 ha (0.25 acre) of land at SRS should not be major.

The 960 m^3 (1,150 yd^3) of TRU waste generated by this facility would be less than 1 percent of the 143,000 m^3 (187,000 yd^3) of contact-handled TRU waste that DOE plans to dispose of at WIPP and within the 168,500 m^3 (220,400 yd^3) limit for WIPP (DOE 1997d:3-3). Impacts of disposal of TRU waste at WIPP are described in the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

LLW includes used equipment, wipes, protective clothing, and solidified inorganic solutions. It is likely that the LLW generated during operations would originate from activities in the processing areas containing the glovebox lines but not from operations within the gloveboxes. Operations within the gloveboxes are likely to generate mostly TRU waste. LLW would be treated, packaged, certified, and accumulated at the new facility before being transferred for additional treatment and/or disposal in existing onsite facilities (UC 1998h). A total of 940 m^3 (1,230 yd^3) of LLW would be generated over the operation period. LLW generation for this facility is estimated to be 1 percent of existing annual site waste generation, 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility, and 3 percent of the 30,500-m^3 (39,900-yd^3) capacity of the Low-Activity Waste Vaults. Using the 8,687-m^3/ha (4,598-yd^3/acre) disposal land usage factor for SRS published in the *Storage and Disposition PEIS* (DOE 1996a:E-9), 940 m^3 (1,230 yd^3) of waste would require less than 0.11 ha (0.27 acre) of disposal space at SRS. Therefore, management of this additional LLW at SRS should have no major impact.

Mixed LLW includes solvents contaminated with plutonium, and scintillation vials from the analytical laboratory (UC 1998h). Mixed LLW would be stabilized, packaged, and stored on the site for treatment and offsite disposal in a manner consistent with the site treatment plan for SRS. Mixed LLW generation for this facility is estimated to be less than 1 percent of existing annual site waste generation, and less than 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility. Over the operating life of this facility, the 30-m^3 (39-yd^3) mixed LLW generated would be 2 percent of the 1,900-m^3 (2,490-yd^3) capacity of the Mixed Waste Storage Buildings. Therefore, the management of this additional waste at SRS should not have a major impact on the mixed LLW management system.

Hazardous waste generated during operations includes spent cleaning solutions, lubricants, oils, film processing fluids, hydraulic fluids, antifreeze solutions, paints, chemicals, batteries, fluorescent light tubes, lead packaging, and contaminated rags or wipes. Hazardous waste would be packaged for treatment and disposal at a combination of onsite and offsite permitted facilities (UC 1998h). Assuming that all hazardous waste is managed on the site, hazardous waste generation for this facility is estimated to be 4 percent of existing annual site waste generation, less than 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility, and 1 percent of the 5,200-m^3 (6,800-yd^3) capacity of the hazardous waste storage building. The management of these additional hazardous wastes at SRS should not have a major impact on the hazardous waste management system.

Nonhazardous solid waste includes office garbage, machine shop waste, and other industrial wastes from utility and maintenance operations. Nonhazardous solid waste would be packaged in conformance with standard industrial practice. Recyclable solid wastes such as office paper, metal cans, and plastic and glass bottles would be sent off the site for recycling (UC 1998h). The remaining solid sanitary waste would be sent to the Three Rivers Landfill (DOE 1998a:3-42). Nonrecyclable, nonhazardous solid waste generated by this facility is estimated to be less than 7 percent of existing annual site waste generation. This additional waste load should not have a major impact on the nonhazardous solid waste management system at SRS.

Nonhazardous liquid waste includes sanitary waste from sinks, showers, urinals, and water closets; process wastewater from lab sinks and drains, mop water, cooling tower blowdown and steam condensate; and treated wastewater from the liquid effluent treatment system. Nonhazardous wastewater would be treated, if necessary, before being discharged to the F-Area sanitary sewer system that connects to the Central Sanitary Wastewater Treatment Facility (UC 1998h). Nonhazardous liquid waste generated for this facility is estimated to be 6 percent of the existing annual site waste generation, 10 percent of the 276,000-m^3/yr (361,000-yd^3/yr) capacity of the F-Area sanitary sewer, and 2 percent of the 1,449,050-m^3/yr (1,895,357-yd^3/yr) capacity of the Central Sanitary Wastewater Treatment Facility, and within the 1,032,950-m^3/yr (1,351,099-yd^3/yr) excess capacity of the Central Sanitary Wastewater Treatment Facility (Sessions 1997). Therefore, impacts on the system should not be major.

H.4.2.4 Pit Conversion and Immobilization Facilities

H.4.2.4.1 Construction of Pit Conversion and Immobilization Facilities

Table H–33 compares the expected construction waste generation rates for the facilities that may be constructed at SRS with the existing site waste generation rates. No radioactive waste would be generated during the 3-year construction period because this action involves new construction only (UC 1998g, 1999c, 1999d). In addition, no soil contaminated with hazardous or radioactive constituents would be generated during construction. However, if any were generated, the waste would be managed in accordance with site practice and all applicable Federal and State regulations. Construction waste generation would be the same for the ceramic and glass immobilization technologies and the 17-t (19-ton) and 50-t (55-ton) immobilization scenarios (UC 1999c, 1999d).

[Text deleted.]

Table H–33. Potential Waste Management Impacts of Construction of New Pit Conversion and Immobilization Facilities at SRS

	Estimated Waste Generation (m^3/yr)[b]		SiteWaste	Percent of Site Waste Generation		
Waste Type[a]	**Pit Conversion**	**Immobilization (Ceramic or Glass)**	**Generation (m^3/yr)[c]**	**Pit Conversion**	**Immobilization (Ceramic or Glass)**	**Both Facilities**
Hazardous	50	35	74	68	47	115
Nonhazardous						
Liquid	5,300	21,000	416,100	1	5	6
Solid	120	2,200	6,670	2	33	35

[a] See definitions in Appendix F.8.
[b] UC 1998g, 1999c, 1999d. Values rounded to two significant figures.
[c] From the waste management section in Chapter 3.
[Text deleted.]

[Text deleted.]

Hazardous waste generated during construction includes liquids such as spent cleaning solutions, oils, hydraulic fluids, antifreeze solutions, paints and chemicals, and rags or wipes contaminated with these materials. These wastes are typically generated during construction of an industrial facility. Any hazardous waste generated during construction would be packaged in DOT-approved containers and shipped off the site to permitted commercial treatment and disposal facilities (UC 1998g, 1999c, 1999d). Hazardous waste generation for construction of this combination of facilities is estimated to be 115 percent of existing annual site waste generation. Because these wastes would be treated and disposed at offsite commercial facilities, the additional waste load generated during construction should not have a major impact on the SRS hazardous waste management system.

Nonhazardous solid waste includes office garbage, scrap lumber, concrete and steel waste, and other construction trash. Nonhazardous solid waste would be packaged in conformance with standard industrial practice, and shipped to commercial or municipal facilities for recycling or disposal (UC 1998g, 1999c, 1999d). Waste metals would be sent off the site for recycling, and therefore were not included in the waste volumes. Nonhazardous-solid-waste generation during construction of this combination of facilities is estimated to be 35 percent of existing annual site waste generation. Because these wastes would be managed at commercial or municipal facilities, the additional waste load generated during construction should not have a major impact on the nonhazardous solid waste management system at SRS.

Nonhazardous liquid waste includes sanitary waste from sinks, showers, urinals, and water closets (UC 1998g, 1999c, 1999d). To be conservative, it was assumed that all nonhazardous liquid waste generated during construction would be managed at the Central Sanitary Wastewater Treatment Facility, even though it is likely that much of this waste would be collected in portable toilets and managed at offsite facilities. Nonhazardous liquid waste generated for construction of this combination of facilities is estimated to be 6 percent of existing annual site waste generation, 9 percent of the 276,000-m^3/yr (361,000-yd^3/yr) capacity of the F-Area sanitary sewer, 2 percent of the 1,449,050-m^3/yr (1,895,357-yd^3/yr) capacity of the Central Sanitary Wastewater Treatment Facility, and within the 1,032,950-m^3/yr (1,351,099-yd^3/yr) excess capacity of the Central Sanitary Wastewater Treatment Facility (Sessions 1997). Therefore, impacts on the system during construction should not be major.

H.4.2.4.2 Operation of Pit Conversion and Immobilization Facilities

The waste management facilities within the pit conversion and immobilization facilities would process, temporarily store, and ship all wastes generated. Table H–34 compares the expected waste generation rates from operating the new facilities at SRS with the existing site waste generation rates. Although HLW would be used in the immobilization process, no HLW would be generated by the facilities (UC 1998g, 1999c, 1999d). Depending in part on decisions in the RODs for the WM PEIS, wastes could be treated and disposed on the site or at other DOE sites or commercial facilities. Per the ROD for TRU waste issued on January 20, 1998, TRU and mixed TRU waste would be certified on the site to current WIPP waste acceptance criteria and shipped to WIPP for disposal. Per the ROD for hazardous waste issued on August 5, 1998, nonwastewater hazardous waste would continue to be treated on the site in the Consolidated Incineration Facility and treated and disposed of at offsite commercial facilities. The SPD EIS also assumes that LLW, mixed LLW, and nonhazardous waste would be treated, stored, and disposed in accordance with current site practices. Waste generation would be the same for the ceramic and glass immobilization technologies, although the amount of waste generated would vary between the 17-t (19-ton) and 50-t (55-ton) immobilization cases (UC 1999c, 1999d). Impacts of treatment, storage, and disposal of radioactive, hazardous, and mixed wastes at SRS are described in the *SRS Waste Management Final EIS* (DOE 1995b).

TRU wastes generated during operations include metal cladding from fuel elements, spent filters, contaminated beryllium pieces and cuttings, used containers and equipment, paper and cloth wipes, analytical and quality-control samples, and solidified inorganic solutions. Lead-lined gloves are likely to be managed as mixed TRU waste. It is anticipated that all TRU waste would be contact-handled waste. TRU wastes would be treated, packaged, and certified to WIPP waste acceptance criteria at the new facilities (UC 1998g, 1999c, 1999d). Liquid TRU wastes would be evaporated or solidified before being packaged for storage. Drum-gas testing, real-time radiography, and loading the TRUPACT for shipment to WIPP would occur at the planned TRU

Table H–34. Potential Waste Management Impacts of Operation of New Pit Conversion and Immobilization Facilities at SRS

Waste Type[a]	Estimated Waste Generation (m^3/yr)[b] Pit Conversion	Immobilization 17 t	Immobilization 50 t	Site Waste Generation (m^3/yr)[c]	Percent of Site Waste Generation Pit Conversion	Immobilization 17 t	Immobilization 50 t	Both Facilities
TRU[d]	18	95	130	427	4	22	30	26 to 34
LLW	60	81	110	10,043	1	1	1	1 to 2
Mixed LLW	1	1	1	1,135	<1	<1	<1	<1
Hazardous	2	89	89	74	3	120	120	123
Nonhazardous								
Liquid	25,000	55,000	57,000	416,100	6	13	14	19 to 20
Solid	1,800	850	850	6,670	27	13	13	40

[a] See definitions in Appendix F.8.

[b] UC 1998g, 1999c, 1999d. Values rounded to two significant figures.

[c] From the waste management section in Chapter 3.

[d] Includes mixed TRU waste.

Key: LLW, low-level waste; TRU, transuranic.

Waste Characterization and Certification Facility at SRS. Impacts from the treatment of TRU waste to WIPP waste acceptance criteria are described in the WM PEIS (DOE 1997b) and the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

TRU waste generation for this combination of facilities is estimated to be 26 to 34 percent of existing annual site waste generation and 7 to 8 percent of the 1,720-m^3/yr (2,250-yd^3/yr) planned capacity of the TRU Waste Characterization and Certification Facility. A total of 1,130 to 1,480 m^3 (1,478 to 1,936 yd^3) of TRU waste would be generated over the 10-year operation period. This would be 16 to 21 percent of the 6,977 m^3 (9,126 yd^3) of contact-handled TRU waste currently in storage, and 3 to 4 percent of the 34,400-m^3 (44,995-yd^3) storage capacity available at SRS. Assuming that the waste were stored in 208-l (55-gal) drums each with a capacity of 0.21 m^3 (0.27 yd^3), about 5,400 to 6,900 drums would be required to store this waste. Assuming that these drums can be stacked two high, that each drum occupies an area of 0.4 m^2 (4 ft^2), and adding a 50 percent factor for aisle space, a storage area of about 1,600 to 2,100 m^2 (1,910 to 2,510 yd^2) would be required. Impacts of the storage of additional quantities of TRU waste on 0.16 to 0.21 ha (0.40 to 0.52 acre) of land at SRS should not be major.

The 1,130 to 1,480 m^3 (1,478 to 1,936 yd^3) of TRU waste generated by these facilities would be approximately 1 percent of the 143,000 m^3 (187,000 yd^3) of contact-handled TRU waste that DOE plans to dispose of at WIPP and within the 168,500 m^3 (220,400 yd^3) limit for WIPP (DOE 1997d:3-3). Impacts of disposal of TRU waste at WIPP are described in the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

LLW includes used equipment, wipes, protective clothing, solidified inorganic solutions, and tritium. It is likely that the LLW generated during operations would originate from activities in the processing areas containing the glovebox lines but not from operations within the gloveboxes. Operations within the gloveboxes are likely to generate mostly TRU waste. LLW would be treated, packaged, certified, and accumulated at the new facilities before being transferred for additional treatment and/or disposal in existing onsite facilities (UC 1998g, 1999c, 1999d). Tritium recovered from pit disassembly would be disposed of as LLW (UC 1999d). A total of 1,410 to 1,700-m^3 (1,844 to 2,220-yd^3) LLW would be generated over the operation period. LLW generation for this combination of facilities is estimated to be 1 to 2 percent of existing annual site waste generation, 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility, and 5 to 6 percent of the 30,500-m^3 (39,900-yd^3) capacity of the Low-Activity Waste Vaults. Using the 8,687-m^3/ha (4,598-yd^3/acre) disposal land usage factor for SRS published in the *Storage and Disposition PEIS* (DOE 1996a:E-9), 1,410 to

1,700 m^3 (1,844 to 2,220 yd^3) of waste would require 0.16 to 0.19 ha (0.40 to 0.47 acre) of disposal space at SRS. Therefore, impacts of the management of this additional LLW at SRS should not be major.

Mixed LLW includes leaded shielding, solvents contaminated with plutonium, scintillation vials from the analytical laboratory, and hazardous constituents that were introduced as part of the incoming pits (UC 1998g, 1999c, 1999d). Mixed LLW would be stabilized, packaged, and stored on the site for treatment and offsite disposal in a manner consistent with the site treatment plan for SRS. Mixed LLW generation for this combination of facilities is estimated to be less than 1 percent of existing annual site waste generation, and less than 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility. Over the operating life of these facilities, the 20 m^3 (26 yd^3) of mixed LLW generated would be 1 percent of the 1,900-m^3 (2,490-yd^3) capacity of the Mixed Waste Storage Buildings. Therefore, the management of this additional waste at SRS should not have a major impact on the mixed LLW management system.

Hazardous waste generated during operations includes spent cleaning solutions, vacuum pump oils, film processing fluids, hydraulic fluids, antifreeze solutions, paints, chemicals, batteries, fluorescent light tubes, lead packaging, and contaminated rags or wipes. Hazardous waste would be packaged for treatment and disposal at a combination of onsite and offsite permitted facilities (UC 1998g, 1999c, 1999d). Assuming that all hazardous waste is managed on the site, hazardous waste generation for this combination of facilities is estimated to be 123 percent of existing annual site waste generation, but only 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility, and 18 percent of the 5,200-m^3 (6,800-yd^3) capacity of the hazardous waste storage building. The management of these additional hazardous wastes at SRS should not have a major impact on the hazardous waste management system.

Nonhazardous solid waste includes office garbage, coal ash, machine shop waste, and other industrial wastes from utility and maintenance operations. Nonhazardous solid waste would be packaged in conformance with standard industrial practice. Recyclable solid wastes such as office paper, metal cans, and plastic and glass bottles would be sent off the site for recycling (UC 1998g, 1999c, 1999d). Ash from the coal-fired steam generating plant would be disposed of in the onsite ash disposal landfills (UC 1999c, 1999d). The remaining solid sanitary waste would be sent to the Three Rivers Landfill (DOE 1998a:3-42). Nonrecyclable, nonhazardous solid waste generated by this combination of facilities is estimated to be 40 percent of existing annual site waste generation. This additional waste load should not have a major impact on the nonhazardous solid waste management system at SRS.

Nonhazardous liquid waste includes sanitary waste from sinks, showers, urinals, and water closets and process wastewater from lab sinks and drains, mop water, cooling tower blowdown, and steam condensate. Nonhazardous wastewater would be treated, if necessary, before being discharged to the F-Area sanitary sewer system that connects to the Central Sanitary Wastewater Treatment Facility (UC 1998g, 1999c, 1999d). Nonhazardous liquid waste generated for this combination of facilities is estimated to be 19 to 20 percent of the existing annual site waste generation, 29 to 30 percent of the 276,000-m^3/yr (361,000-yd^3/yr) capacity of the F-Area sanitary sewer, and 6 percent of the 1,449,050-m^3/yr (1,895,357-yd^3/yr) capacity of the Central Sanitary Wastewater Treatment Facility, and within the 1,032,950-m^3/yr (1,351,099-yd^3/yr) excess capacity of the Central Sanitary Wastewater Treatment Facility (Sessions 1997). Therefore, impacts on the system should not be major.

H.4.2.5 Pit Conversion and MOX Facilities

H.4.2.5.1 Construction of Pit Conversion and MOX Facilities

Table H–35 compares the expected construction waste generation rates for the facilities that may be constructed at SRS with the existing site waste generation rates. No radioactive waste would be generated because all construction would involve new buildings (UC 1998g, 1998h). In addition, no soil contaminated with hazardous or radioactive constituents would be generated during the 3-year construction period. However, if any were generated, the waste would be managed in accordance with site practice and all applicable Federal and State regulations.

Table H–35. Potential Waste Management Impacts of Construction of New Pit Conversion and MOX Facilities at SRS

Waste Type[a]	Estimated Waste Generation (m^3/yr)[b] Pit Conversion	Estimated Waste Generation (m^3/yr)[b] MOX	Site Waste Generation (m^3/yr)[c]	Percent of Site Waste Generation Pit Conversion	Percent of Site Waste Generation MOX	Percent of Site Waste Generation Both Facilities
Hazardous	50	19	74	68	26	94
Nonhazardous						
Liquid	5,300	20,000	416,100	1	5	6
Solid	120	8,600	6,670	2	128	130

[a] See definitions in Appendix F.8.
[b] DOE 1999a; UC 1998g, 1998h. Values rounded to two significant figures.
[c] From the waste management section in Chapter 3.

Hazardous waste generated during construction includes liquids such as spent cleaning solutions, oils, hydraulic fluids, antifreeze solutions, paints and chemicals, and rags or wipes contaminated with these materials. These wastes are typically generated during construction of an industrial facility. Any hazardous waste generated during construction would be packaged in DOT-approved containers and shipped off the site to permitted commercial treatment and disposal facilities (UC 1998g, 1998h). Hazardous waste generation for construction of this combination of facilities is estimated to be 94 percent of existing annual site waste generation. Because these wastes would be treated and disposed at offsite commercial facilities, the additional waste load generated during construction should not have a major impact on the SRS hazardous waste management system.

Nonhazardous solid waste includes office garbage, scrap lumber, concrete and steel waste, and other construction trash. Nonhazardous solid waste would be packaged in conformance with standard industrial practice, and shipped to commercial or municipal facilities for recycling or disposal (UC 1998g, 1998h). Waste metals would be sent off the site for recycling and, therefore, were not included in the waste volumes. Nonhazardous-solid-waste generation during construction of this combination of facilities is estimated to be 130 percent of existing annual site waste generation. Because these wastes would be managed at commercial or municipal facilities, the additional waste load generated during construction should not have a major impact on the nonhazardous solid waste management system at SRS.

Nonhazardous liquid waste includes sanitary waste from sinks, showers, urinals, and water closets and wastewater from dewatering (UC 1998g, 1998h). To be conservative, it was assumed that all nonhazardous liquid waste generated during construction would be managed at the Central Sanitary Wastewater Treatment Facility, even though it is likely that much of this waste would be collected in portable toilets and managed at offsite facilities. Nonhazardous-liquid-waste generation for construction of this combination of facilities is estimated to be 6 percent of existing annual site waste generation, 9 percent of the 276,000-m^3/yr (361,000-yd^3/yr) capacity of the F-Area sanitary sewer, 2 percent of the 1,449,050-m^3/yr (1,895,357-yd^3/yr) capacity of the Central Sanitary Wastewater Treatment Facility, and within the 1,032,950-m^3/yr (1,351,099-yd^3/yr) excess capacity of the Central Sanitary Wastewater Treatment Facility (Sessions 1997). Therefore, impacts on the system during construction should not be major.

H.4.2.5.2 Operation of Pit Conversion and MOX Facilities

The waste management facilities within the pit conversion and MOX facilities would process, temporarily store, and ship all wastes generated. Table H–36 compares the expected waste generation rates from operating the new facilities at SRS with the existing site waste generation rates. No HLW would be generated by the facilities (UC 1998g, 1998h). Depending in part on decisions in the RODs for the WM PEIS, wastes could be treated and disposed of on the site or at other DOE sites or commercial facilities. Per the ROD for TRU waste issued on January 20, 1998, TRU and mixed TRU waste would be certified on the site to current WIPP waste acceptance criteria and shipped to WIPP for disposal. Per the ROD for hazardous waste issued on August 5, 1998, nonwastewater hazardous waste would continue to be treated on the site in the Consolidated Incineration Facility and treated and disposed of at offsite commercial facilities. The SPD EIS also assumes that LLW, mixed LLW, and nonhazardous waste would be treated, stored, and disposed in accordance with current site practices. Impacts of treatment, storage, and disposal of radioactive, hazardous, and mixed wastes at SRS are described in the *SRS Waste Management Final EIS* (DOE 1995b).

Table H–36. Potential Waste Management Impacts of Operation of New Pit Conversion and MOX Facilities at SRS

Waste Type[a]	Estimated Waste Generation (m^3/yr)[b] Pit Conversion	Estimated Waste Generation (m^3/yr)[b] MOX	Site Waste Generation (m^3/yr)[c]	Percent of Site Waste Generation Pit Conversion	Percent of Site Waste Generation MOX	Percent of Site Waste Generation Both Facilities
TRU[d]	18	68	427	4	16	20
LLW	60	94	10,043	1	1	2
Mixed LLW	1	3	1,135	<1	<1	<1
Hazardous	2	3	74	3	4	7
Nonhazardous						
Liquid	25,000	26,000	416,100	6	6	12
Solid	1,800	440	6,670	27	7	34

[a] See definitions in Appendix F.8.
[b] DOE 1999a; UC 1998g, 1998h. Values rounded to two significant figures.
[c] From the waste management section in Chapter 3.
[d] Includes mixed TRU waste.
Key: LLW, low-level waste; TRU, transuranic.

TRU wastes generated during operations include spent filters, contaminated beryllium pieces and cuttings, used containers and equipment, paper and cloth wipes, analytical and quality-control samples, solidified inorganic solutions, and dirty plutonium oxide scrap. Lead-lined gloves are likely to be managed as mixed TRU waste. It is anticipated that all TRU waste would be contact-handled waste. TRU wastes would be treated, packaged, and certified to WIPP waste acceptance criteria at the new facilities (UC 1998g, 1998h). Liquid TRU wastes would be evaporated or solidified before being packaged for storage. Drum-gas testing, real-time radiography, and loading the TRUPACT for shipment to WIPP would occur at the planned TRU Waste Characterization and Certification Facility at SRS. Impacts from the treatment of TRU waste to WIPP waste acceptance criteria are described in the WM PEIS (DOE 1997b) and the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

TRU waste generation for this combination of facilities is estimated to be 20 percent of existing annual site waste generation, and 5 percent of the 1,720-m^3/yr (2,250-yd^3/yr) planned capacity of the TRU Waste Characterization and Certification Facility. A total of 860 m^3 (1,120 yd^3) of TRU waste would be generated over the 10-year operation period. This would be 12 percent of the 6,977 m^3 (9,126 yd^3) of contact-handled TRU waste currently in storage, and 2 percent of the 34,400-m^3 (44,995-yd^3) storage capacity available at SRS. Assuming that the waste were stored in 208-l (55-gal) drums each with a capacity of 0.21 m^3 (0.27 yd^3), about 4,100 drums would be required to store this waste. Assuming that these drums can be stacked two high, that each drum occupies an area of 0.4 m^2 (4 ft^2), and adding a 50 percent factor for aisle space, a storage area of about 1,200 m^2 (1,440 yd^2) would be required. Impacts of the storage of additional quantities of TRU waste on 0.12 ha (0.30 acre) of land at SRS should not be major.

The 860 m^3 (1,120 yd^3) of TRU waste generated by these facilities would be 1 percent of the 143,000 m^3 (187,000 yd^3) of contact-handled TRU waste that DOE plans to dispose of at WIPP and within the 168,500 m^3 (220,400 yd^3) limit for WIPP (DOE 1997d:3-3). Impacts of disposal of TRU waste at WIPP are described in the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

LLW includes used equipment, wipes, protective clothing, solidified inorganic solutions, and tritium. It is likely that the LLW generated during operations would originate from activities in the processing areas containing the glovebox lines but not from operations within the gloveboxes. Operations within the gloveboxes are likely to generate mostly TRU waste. LLW would be treated, packaged, certified, and accumulated at the new facilities before being transferred for additional treatment and/or disposal in existing onsite facilities (UC 1998g, 1998h). Tritium recovered from pit disassembly would be disposed of as LLW (UC 1998g). A total of 1,540-m^3 (2,014-yd^3) LLW would be generated over the operation period. LLW generation for this combination of facilities is estimated to be 2 percent of existing annual site waste generation, 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility, and 5 percent of the 30,500-m^3 (39,900-yd^3) capacity of the Low-Activity Waste Vaults. Using the 8,687-m^3/ha (4,598-yd^3/acre) disposal land usage factor for SRS published in the *Storage and Disposition PEIS* (DOE 1996a:E-9), 1,540 m^3 (2,014 yd^3) of waste would require 0.18 ha (0.44 acre) of disposal space at SRS. Therefore, the management of this additional LLW at SRS should have no major impact.

Mixed LLW includes leaded shielding, solvents contaminated with plutonium, scintillation vials from the analytical laboratory, and hazardous constituents that were introduced as part of the incoming pits (UC 1998g, 1998h). Mixed LLW would be stabilized, packaged, and stored on the site for treatment and offsite disposal in a manner consistent with the site treatment plan for SRS. Mixed LLW generation for this combination of facilities is estimated to be less than 1 percent of existing annual site waste generation, and less than 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility. Over the operating life of these facilities, the 40 m^3 (52 yd^3) of mixed LLW generated would be 2 percent of the 1,900-m^3 (2,490-yd^3) capacity of the Mixed Waste Storage Buildings. Therefore, the management of this additional waste at SRS should not have a major impact on the mixed LLW management system.

Hazardous waste generated during operations includes spent cleaning solutions, vacuum pump oils, film processing fluids, hydraulic fluids, antifreeze solutions, paints, chemicals, batteries, fluorescent light tubes, lead packaging, and contaminated rags or wipes. Hazardous waste would be packaged for treatment and disposal at a combination of onsite and offsite facilities (UC 1998g, 1998h). Assuming that all hazardous waste is managed on the site, hazardous waste generation for this combination of facilities is estimated to be 7 percent of existing annual site waste generation, less than 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility, and 1 percent of the 5,200-m^3 (6,800-yd^3) capacity of the hazardous waste storage building. The management of these additional hazardous wastes at SRS should not have a major impact on the hazardous waste management system.

Nonhazardous solid waste includes office garbage, coal ash, machine shop waste, and other industrial wastes from utility and maintenance operations. Nonhazardous solid waste would be packaged in conformance with standard industrial practice. Recyclable solid wastes such as office paper, metal cans, and plastic and glass bottles would be sent off the site for recycling (UC 1998g, 1998h). The remaining solid sanitary waste would be sent to the Three Rivers Landfill (DOE 1998a:3-42). Nonrecyclable, nonhazardous solid waste generated by this combination of facilities is estimated to be less than 34 percent of existing annual site waste generation. This additional waste load should not have a major impact on the nonhazardous solid waste management system at SRS.

Nonhazardous liquid waste includes sanitary waste from sinks, showers, urinals, and water closets; process wastewater from lab sinks and drains, mop water, cooling tower blowdown, and steam condensate; and treated wastewater from the liquid effluent treatment system. Nonhazardous wastewater would be treated, if necessary, before being discharged to the F-Area sanitary sewer system that connects to the Central Sanitary Wastewater Treatment Facility (UC 1998g, 1998h). Nonhazardous liquid waste generated for this combination of facilities is estimated to be 12 percent of the existing annual site waste generation, 19 percent of the 276,000-m^3/yr (361,000-yd^3/yr) capacity of the F-Area sanitary sewer, 4 percent of the 1,449,050-m^3/yr (1,895,357-yd^3/yr) capacity of the Central Sanitary Wastewater Treatment Facility, and within the 1,032,950-m^3/yr (1,351,099-yd^3/yr) excess capacity of the Central Sanitary Wastewater Treatment Facility (Sessions 1997). Therefore, the management of this additional waste should not have a major impact on the system.

H.4.2.6 Immobilization and MOX Facilities

H.4.2.6.1 Construction of Immobilization and MOX Facilities

Table H–37 compares the expected construction waste generation rates for the facilities that may be constructed at SRS with the existing site waste generation rates. No radioactive waste would be generated during the 3-year construction period because this action involves new construction only (UC 1998h, 1999c, 1999d). In addition, no soil contaminated with hazardous or radioactive constituents would be generated during construction. However, if any were generated, the waste would be managed in accordance with site practice and all applicable Federal and State regulations. Construction waste generation would be the same for the ceramic and glass immobilization technologies (UC 1999c, 1999d).

Table H–37. Potential Waste Management Impacts of Construction of New Immobilization and MOX Facilities at SRS

	Estimated Waste Generation (m^3/yr)[b]			Percent of Site Waste Generation		
Waste Type[a]	Immobilization (Ceramic or Glass)	MOX	Site Waste Generation (m^3/yr)[c]	Immobilization (Ceramic or Glass)	MOX	Both Facilities
Hazardous	35	19	74	47	26	73
Nonhazardous						
Liquid	21,000	20,000	416,100	5	5	10
Solid	2,200	8,600	6,670	33	128	161

[a] See definitions in Appendix F.8.

[b] DOE 1999a; UC 1998h, 1999c, 1999d. Values rounded to two significant figures.

[c] From the waste management section in Chapter 3.

[Text deleted.]

[Text deleted.]

Hazardous waste generated during construction includes liquids such as spent cleaning solutions, oils, hydraulic fluids, antifreeze solutions, paints and chemicals, and rags or wipes contaminated with these materials. These wastes are typically generated during construction of an industrial facility. Any hazardous waste generated during construction would be packaged in DOT-approved containers and shipped off the site to permitted commercial treatment and disposal facilities (UC 1998h, 1999c, 1999d). Hazardous waste generation for construction of this combination of facilities is estimated to be 73 percent of existing annual site waste generation. Because these wastes would be treated and disposed at offsite commercial facilities, the additional waste load generated during construction should not have a major impact on the SRS hazardous waste management system.

Nonhazardous solid waste includes office garbage, scrap lumber, concrete and steel waste, and other construction trash. Nonhazardous solid waste would be packaged in conformance with standard industrial practice, and shipped to commercial or municipal facilities for recycling or disposal (UC 1998h, 1999c, 1999d). Waste metals would be sent off the site for recycling and, therefore, were not included in the waste volumes. Nonhazardous-solid-waste generation during construction of this combination of facilities is estimated to be 161 percent of existing annual site waste generation. Because these wastes would be managed at commercial or municipal facilities, the additional waste load generated during construction should not have a major impact on the nonhazardous solid waste management system at SRS.

Nonhazardous liquid waste includes sanitary waste from sinks, showers, urinals, and water closets and wastewater from dewatering (UC 1998h, 1999c, 1999d). To be conservative, it was assumed that all nonhazardous liquid waste generated during construction would be managed at the Central Sanitary Wastewater Treatment Facility, even though it is likely that much of this waste would be collected in portable toilets and managed at offsite facilities. Nonhazardous liquid waste generated for construction of this combination of facilities is estimated to be 10 percent of existing annual site waste generation, 15 percent of the 276,000-m^3/yr (361,000-yd^3/yr) capacity of the F-Area sanitary sewer, 3 percent of the 1,449,050-m^3/yr (1,895,357-yd^3/yr) capacity of the Central Sanitary Wastewater Treatment Facility, and within the 1,032,950-m^3/yr (1,351,099-yd^3/yr) excess capacity of the Central Sanitary Wastewater Treatment Facility (Sessions 1997). Therefore, impacts on the system during construction should not be major.

H.4.2.6.2 Operation of Immobilization and MOX Facilities

The waste management facilities within the immobilization and MOX facilities would process, temporarily store, and ship all wastes generated. Table H–38 compares the expected waste generation rates from operating the new facilities at SRS with the existing site waste generation. Although HLW would be used in the immobilization process, no HLW would be generated by the facilities (UC 1998h, 1999c, 1999d). Depending in part on decisions in the RODs for the WM PEIS, wastes could be treated and disposed of on the site or at other DOE sites or commercial facilities. Per the ROD for TRU waste issued on January 20, 1998, TRU and mixed TRU waste would be certified on the site to current WIPP waste acceptance criteria and shipped to WIPP for disposal. Per the ROD for hazardous waste issued on August 5, 1998, nonwastewater hazardous waste would continue to be treated on the site in the Consolidated Incineration Facility and treated and disposed of at offsite commercial facilities. The SPD EIS also assumes that LLW, mixed LLW, and nonhazardous waste would be treated, stored, and disposed in accordance with current site practices. Waste generation would be the same for the ceramic and glass immobilization technologies (UC 1999c, 1999d). Impacts of treatment, storage, and disposal of radioactive, hazardous, and mixed wastes at SRS are described in the *SRS Waste Management Final EIS* (DOE 1995b).

TRU wastes generated during operations include metal cladding from fuel elements, spent filters, used containers and equipment, paper and cloth wipes, analytical and quality-control samples, solidified inorganic solutions, and dirty plutonium oxide scrap. Lead-lined gloves are likely to be managed as mixed TRU waste.

Table H–38. Potential Waste Management Impacts of Operation of New Immobilization and MOX Facilities at SRS

Waste Type[a]	Estimated Waste Generation (m^3/yr)[b] Immobilization (Ceramic or Glass)	Estimated Waste Generation (m^3/yr)[b] MOX	Site Waste Generation (m^3/yr)[c]	Percent of Site Waste Generation Immobilization (Ceramic or Glass)	Percent of Site Waste Generation MOX	Percent of Site Waste Generation Both Facilities
TRU[d]	95	68	427	22	16	38
LLW	81	94	10,043	1	1	2
Mixed LLW	1	3	1,135	<1	<1	<1
Hazardous	89	3	74	120	4	124
Nonhazardous						
Liquid	55,000	26,000	416,100	13	6	20
Solid	850	440	6,670	13	7	19

[a] See definitions in Appendix F.8.
[b] DOE 1999a; UC 1998h, 1999c, 1999d. Values rounded to two significant figures.
[c] From the waste management section in Chapter 3.
[d] Includes mixed TRU waste.
Key: LLW, low-level waste; TRU, transuranic.

It is anticipated that all TRU waste would be contact-handled waste. TRU wastes would be treated, packaged, and certified to WIPP waste acceptance criteria at the new facilities (UC 1998h, 1999c, 1999d). Liquid TRU wastes would be evaporated or solidified before being packaged for storage. Drum-gas testing, real-time radiography, and loading the TRUPACT for shipment to WIPP would occur at the planned TRU Waste Characterization and Certification Facility at SRS. Impacts from the treatment of TRU waste to WIPP waste acceptance criteria are described in the WM PEIS (DOE 1997b) and the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

TRU waste generation for this combination of facilities is estimated to be 38 percent of existing annual site waste generation and 9 percent of the 1,720-m^3/yr (2,250-yd^3/yr) planned capacity of the TRU Waste Characterization and Certification Facility. A total of 1,630 m^3 (2,132 yd^3) of TRU waste would be generated over the 10-year operation period. This would be 23 percent of the 6,977 m^3 (9,126 yd^3) of contact-handled TRU waste currently in storage, and 5 percent of the 34,400-m^3 (44,995-yd^3) storage capacity available at SRS. Assuming that the waste were stored in 208-l (55-gal) drums each with a capacity of 0.21 m^3 (0.27 yd^3), about 7,700 drums would be required to store this waste. Assuming that these drums can be stacked two high, that each drum occupies an area of 0.4 m^2 (4 ft^2), and adding a 50 percent factor for aisle space, a storage area of about 2,300 m^2 (2,750 yd^2) would be required. Impacts of the storage of additional quantities of TRU waste on 0.23 ha (0.57 acre) of land at SRS should not be major.

The 1,630 m^3 (2,132 yd^3) of TRU waste generated by these facilities would be 1 percent of the 143,000 m^3 (187,000 yd^3) of contact-handled TRU waste that DOE plans to dispose of at WIPP and within the 168,500 m^3 (220,400 yd^3) limit for WIPP (DOE 1997d:3-3). Impacts of disposal of TRU waste at WIPP are described in the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

LLW includes used equipment, wipes, protective clothing, and solidified inorganic solutions. It is likely that the LLW generated during operations would originate from activities in the processing areas containing the glovebox lines but not from operations within the gloveboxes. Operations within the gloveboxes are likely to generate mostly TRU waste. LLW would be treated, packaged, certified, and accumulated at the new facilities before being transferred for additional treatment and/or disposal in existing onsite facilities (UC 1998h, 1999c, 1999d). A total of 1,750-m^3 (2,289-yd^3) LLW would be generated over the operation period. LLW generation for this combination of facilities is estimated to be 2 percent of existing annual site waste generation, 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility, and 6 percent of the 30,500-m^3

(39,900-yd^3) capacity of the Low-Activity Waste Vaults. Using the 8,687-m^3/ha (4,598-yd^3/acre) disposal land usage factor for SRS published in the *Storage and Disposition PEIS* (DOE 1996a:E-9), 1,750-m^3 (2,289-yd^3) waste would require 0.2 ha (0.49 acre) of disposal space at SRS. Therefore, impacts of the management of this additional LLW at SRS should not be major.

Mixed LLW includes lead shielding, solvents contaminated with plutonium, and scintillation vials from the analytical laboratory (UC 1998h, 1999c, 1999d). Mixed LLW would be stabilized, packaged, and stored on the site for treatment and offsite disposal in a manner consistent with the site treatment plan for SRS. Mixed LLW generation for this combination of facilities is estimated to be less than 1 percent of existing annual site waste generation, and less than 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility. Over the operating life of these facilities, the 40-m^3 (52-yd^3) mixed LLW generated would be 2 percent of the 1,900-m^3 (2,490-yd^3) capacity of the Mixed Waste Storage Buildings. Therefore, the management of this additional waste at SRS should not have a major impact on the mixed LLW management system.

Hazardous waste generated during operations includes spent cleaning solutions, lubricants, oils, film processing fluids, hydraulic fluids, antifreeze solutions, paints, chemicals, batteries, fluorescent light tubes, lead packaging, and contaminated rags or wipes. Hazardous waste would be packaged for treatment and disposal at a combination of onsite and offsite permitted facilities (UC 1998h, 1999c, 1999d). Assuming that all hazardous waste is managed on the site, hazardous waste generation for this combination of facilities is estimated to be 124 percent of existing annual site waste generation, but only 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility, and 18 percent of the 5,200-m^3 (6,800-yd^3) capacity of the hazardous waste storage buildings. The management of these additional hazardous wastes at SRS should not have a major impact on the hazardous waste management system.

Nonhazardous solid waste includes office garbage, coal ash, machine shop waste, and other industrial wastes from utility and maintenance operations. Nonhazardous solid waste would be packaged in conformance with standard industrial practice. Recyclable solid wastes such as office paper, metal cans, and plastic and glass bottles would be sent off the site for recycling (UC 1998h, 1999c, 1999d). Ash from the coal-fired steam generating plant would be disposed of in the onsite ash disposal landfills (UC 1999c, 1999d). The remaining solid sanitary waste would be sent to the Three Rivers Landfill (DOE 1998a:3-42). Nonrecyclable, nonhazardous solid waste generated by this combination of facilities is estimated to be less than 19 percent of existing annual site waste generation. This additional waste load should not have a major impact on the nonhazardous solid waste management system at SRS.

Nonhazardous liquid waste includes sanitary waste from sinks, showers, urinals, and water closets; process wastewater from lab sinks and drains, mop water, cooling tower blowdown, and steam condensate; and treated wastewater from the liquid effluent treatment system. Nonhazardous wastewater would be treated, if necessary, before being discharged to the F-Area sanitary sewer system that connects to the Central Sanitary Wastewater Treatment Facility (UC 1998h, 1999c, 1999d). Nonhazardous liquid waste generated for this combination of facilities is estimated to be 20 percent of the existing annual site waste generation, 29 percent of the 276,000-m^3/yr (361,000-yd^3/yr) capacity of the F-Area sanitary sewer, 6 percent of the 1,449,050-m^3/yr (1,895,357-yd^3/yr) capacity of the Central Sanitary Wastewater Treatment Facility, and within the 1,032,950-m^3/yr (1,351,099-yd^3/yr) excess capacity of the Central Sanitary Wastewater Treatment Facility (Sessions 1997). Therefore the management of this additional waste should not have a major impact on the system.

H.4.2.7 Pit Conversion, Immobilization, and MOX Facilities

H.4.2.7.1 Construction of Pit Conversion, Immobilization, and MOX Facilities

Table H–39 compares the expected construction waste generation rates for the facilities that may be constructed at SRS with the existing site waste generation rates. No radioactive waste would be generated during the 3-year construction period because this action involves new construction only (UC 1998g, 1998h, 1999c, 1999d). In addition, no soil contaminated with hazardous or radioactive constituents would be generated during construction. However, if any were generated, the waste would be managed in accordance with site practice and all applicable Federal and State regulations. Construction waste generation would be the same for the ceramic and glass immobilization technologies (UC 1999c, 1999d).

Table H–39. Potential Waste Management Impacts of Construction of New Pit Conversion, Immobilization, and MOX Facilities at SRS

	Estimated Waste Generation (m^3/yr)[b]			Site Waste Generation (m^3/yr)[c]	Percent of Site Waste Generation			
Waste Type[a]	PCF	IF (Ceramic or Glass)	MOX		PCF	IF (Ceramic or Glass)	MOX	All Facilities
Hazardous	50	35	19	74	68	47	26	141
Nonhazardous								
Liquid	5,300	21,000	20,000	416,100	1	5	5	11
Solid	120	2,200	8,600	6,670	2	33	128	163

[a] See definitions in Appendix F.8.

[b] DOE 1999a; UC 1998g, 1998h, 1999c, 1999d. Values rounded to two significant figures.

[c] From the waste management section in Chapter 3.

[Text deleted.]

Key: IF, immobilization facility; PCF, pit conversion facility.

[Text deleted.]

Hazardous waste generated during construction includes liquids such as spent cleaning solutions, lubricants, oils, hydraulic fluids, antifreeze solutions, paints and chemicals, and rags or wipes contaminated with these materials. These wastes are typically generated during construction of an industrial facility. Any hazardous waste generated during construction would be packaged in DOT-approved containers and shipped off the site to permitted commercial treatment and disposal facilities (UC 1998g, 1999c, 1999d). Hazardous waste generation for construction of this combination of facilities is estimated to be 141 percent of existing annual site waste generation. Because these wastes would be treated and disposed at offsite commercial facilities, the additional waste load generated during construction should not have a major impact on the SRS hazardous waste management system.

Nonhazardous solid waste includes office garbage, scrap lumber, concrete and steel waste, and other construction trash. Nonhazardous solid waste would be packaged in conformance with standard industrial practice and shipped to commercial or municipal facilities for recycling or disposal (UC 1998g, 1999c, 1999d). Waste metals would be sent off the site for recycling, and therefore were not included in the waste volumes. Nonhazardous-solid-waste generation during construction of these facilities is estimated to be 163 percent of existing annual site waste generation. Because these wastes would be managed at commercial or municipal facilities, the additional waste load generated during construction should not have a major impact on the nonhazardous solid waste management system at SRS.

Nonhazardous liquid waste includes sanitary waste from sinks, showers, urinals, and water closets and wastewater from dewatering (UC 1998g, 1999c, 1999d). To be conservative, it was assumed that all nonhazardous liquid waste generated during construction would be managed at the Central Sanitary Wastewater Treatment Facility, even though it is likely that much of this waste would be collected in portable toilets and managed at offsite facilities. Nonhazardous liquid waste generated during construction of these facilities is estimated to be 11 percent of existing annual site waste generation, 17 percent of the 276,000-m^3/yr (361,000-yd^3/yr) capacity of the F-Area sanitary sewer, 3 percent of the 1,449,050-m^3/yr (1,895,357-yd^3/yr) capacity of the Central Sanitary Wastewater Treatment Facility, and within the 1,032,950-m^3/yr (1,351,099-yd^3/yr) excess capacity of the Central Sanitary Wastewater Treatment Facility (Sessions 1997). Therefore the management of this additional waste should not have a major impact on the system.

H.4.2.7.2 Operation of Pit Conversion, Immobilization, and MOX Facilities

The waste management facilities within the pit conversion, immobilization, and MOX facilities would process, temporarily store, and ship all wastes generated. Table H–40 compares the expected waste generation rates from operating the new facilities at SRS with the existing site waste generation rates. Although HLW would be used in the immobilization process, no HLW would be generated by the facilities (UC 1998g, 1998h, 1999c, 1999d). Depending in part on decisions in the RODs for the WM PEIS, wastes could be treated and disposed on the site or at other DOE sites or commercial facilities. Per the ROD for TRU waste issued on January 20, 1998, TRU and mixed TRU waste would be certified on the site to current WIPP waste acceptance criteria and shipped to WIPP for disposal. Per the ROD for hazardous waste issued on August 5, 1998, nonwastewater hazardous waste would continue to be treated on the site in the Consolidated Incineration Facility and treated and disposed of at offsite commercial facilities. The SPD EIS also assumes that the LLW, mixed LLW, and nonhazardous waste would be treated, stored, and disposed of in accordance with current site practices. Waste generation would be the same for the ceramic and glass immobilization technologies (UC 1999c, 1999d). Impacts of treatment, storage, and disposal of radioactive, hazardous, and mixed wastes at SRS are described in the *SRS Waste Management Final EIS* (DOE 1995b).

Table H–40. Potential Waste Management Impacts of Operation of New Pit Conversion, Immobilization, and MOX Facilities at SRS

	Estimated Waste Generation (m^3/yr)[b]			Site Waste	Percent of Site Waste Generation			
Waste Type[a]	PCF	Immobilization (Ceramic or Glass)	MOX	Generation (m^3/yr)[c]	PCF	Immobilization (Ceramic or Glass)	MOX	All Facilities
TRU[d]	18	95	68	427	4	22	16	42
LLW	60	81	94	10,043	1	1	1	2
Mixed LLW	1	1	3	1,135	<1	<1	<1	<1
Hazardous	2	89	3	74	3	120	4	127
Nonhazardous								
Liquid	25,000	55,000	26,000	416,100	6	13	6	26
Solid	1,800	850	440	6,670	27	13	7	46

[a] See definitions in Appendix F.8.
[b] DOE 1999a; UC 1998g, 1998h, 1999c, 1999d. Values rounded to two significant figures.
[c] From the waste management section in Chapter 3.
[d] Includes mixed TRU waste.

Key: LLW, low-level waste; PCF, pit conversion facility; TRU, transuranic.

TRU wastes generated during operations include metal cladding from fuel elements, spent filters, contaminated beryllium pieces and cuttings, used containers and equipment, paper and cloth wipes, analytical and quality-control samples, solidified inorganic solutions, and dirty plutonium oxide scrap. Lead-lined gloves are likely to be managed as mixed TRU waste. It is anticipated that all TRU waste would be contact-handled waste. TRU wastes would be treated, packaged, and certified to WIPP waste acceptance criteria at the new facilities (UC 1998g, 1998h, 1999c, 1999d). Liquid TRU wastes would be evaporated or solidified before being packaged for storage. Drum-gas testing, real-time radiography, and loading the TRUPACT for shipment to WIPP would occur at the planned TRU Waste Characterization and Certification Facility at SRS. Impacts from the treatment of TRU waste to WIPP waste acceptance criteria are described in the WM PEIS (DOE 1997b) and the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

TRU waste generation for this combination of facilities is estimated to be 42 percent of existing annual site waste generation and 10 percent of the 1,720-m^3/yr (2,250-yd^3/yr) planned capacity of the TRU Waste Characterization and Certification Facility. A total of 1,810 m^3 (2,367 yd^3) of TRU waste would be generated over the 10-year operation period. This would be 26 percent of the 6,977 m^3 (9,126 yd^3) of contact-handled TRU waste currently in storage, and 5 percent of the 34,400-m^3 (44,995-yd^3) storage capacity available at SRS. Assuming that the waste were stored in 208-l (55-gal) drums each with a capacity of 0.21 m^3 (0.27 yd^3), about 8,600 drums would be required to store this waste. Assuming that these drums can be stacked two high, that each drum occupies an area of 0.4 m^2 (4 ft^2), and adding a 50 percent factor for aisle space, a storage area of about 2,600 m^2 (3,110 yd^2) would be required. Impacts of the storage of additional quantities of TRU waste on 0.26 ha (0.64 acre) of land at SRS should not be major.

The 2,600 m^3 (3,110 yd^3) of TRU waste generated by these facilities would be 1 percent of the 143,000 m^3 (187,000 yd^3) of contact-handled TRU waste that DOE plans to dispose of at WIPP and within the 168,500 m^3 (220,400 yd^3) limit for WIPP (DOE 1997d:3-3). Impacts of disposal of TRU waste at WIPP are described in the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

LLW includes used equipment, wipes, protective clothing, solidified inorganic solutions, and tritium. It is likely that the LLW generated during operations would originate from activities in the processing areas containing the glovebox lines but not from operations within the gloveboxes. Operations within the gloveboxes are likely to generate mostly TRU waste. LLW would be treated, packaged, certified, and accumulated at the new facilities before being transferred for additional treatment and/or disposal in existing onsite facilities (UC 1998g, 1998h, 1999c, 1999d). Tritium recovered from pit disassembly would be disposed of as LLW (UC 1998g). A total of 2,350-m^3 (3,074-yd^3) LLW would be generated over the operation period. LLW generation for this combination of facilities is estimated to be 2 percent of existing annual site waste generation, 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility, and 8 percent of the 30,500-m^3 (39,900-yd^3) capacity of the Low-Activity Waste Vaults. Using the 8,687-m^3/ha (4,598-yd^3/acre) disposal land usage factor for SRS published in the *Storage and Disposition PEIS* (DOE 1996a:E-9), 2,350 m^3 (3,074 yd^3) of waste would require 0.27 ha (0.67 acre) of disposal space at SRS. Therefore, the management of this additional LLW at SRS should have no major impact.

Mixed LLW includes leaded shielding, solvents contaminated with plutonium, scintillation vials from the analytical laboratory, and hazardous constituents that were introduced as part of the incoming pits (UC 1998g, 1998h, 1999c, 1999d). Mixed LLW would be stabilized, packaged, and stored on the site for treatment and offsite disposal in a manner consistent with the site treatment plan for SRS. Mixed LLW generation for this combination of facilities is estimated to be less than 1 percent of existing annual site waste generation, and less than 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility. Over the operating life of these facilities, the 50 m^3 (65 yd^3) of mixed LLW generated would be 3 percent of the 1,900-m^3 (2,490-yd^3) capacity of the Mixed Waste Storage Buildings. Therefore, the management of this additional waste at SRS should not have a major impact on the mixed LLW management system.

Hazardous waste generated during operations includes spent cleaning solutions, vacuum pump oils, film processing fluids, hydraulic fluids, antifreeze solutions, paints, chemicals, batteries, fluorescent light tubes, lead packaging, and contaminated rags or wipes. Hazardous waste would be packaged for treatment and disposal at a combination of onsite and offsite permitted facilities (UC 1998g, 1998h, 1999c, 1999d). Assuming that all hazardous waste is managed on the site, hazardous waste generation for this combination of facilities is estimated to be 127 percent of existing annual site waste generation, but only 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility, and 18 percent of the 5,200-m^3 (6,800-yd^3) capacity of the hazardous waste storage buildings. The management of these additional hazardous wastes at SRS should not have a major impact on the hazardous waste management system.

Nonhazardous solid waste includes office garbage, coal ash, machine shop waste, and other industrial wastes from utility and maintenance operations. Nonhazardous solid waste would be packaged in conformance with standard industrial practice. Recyclable solid wastes such as office paper, metal cans, and plastic and glass bottles would be sent off the site for recycling (UC 1998g, 1998h, 1999c, 1999d). Ash from the coal-fired steam generating plant would be disposed of in the onsite ash disposal landfills (UC 1999c, 1999d). The remaining solid sanitary waste would be sent to the Three Rivers Landfill (DOE 1998a:3-42). Nonrecyclable, nonhazardous solid waste generated by this combination of facilities is estimated to be 46 percent of existing annual site waste generation. Because most of this waste would be managed at commercial or municipal facilities, this additional waste load should not have a major impact on the nonhazardous solid waste management system at SRS.

Nonhazardous liquid waste includes sanitary waste from sinks, showers, urinals, and water closets; process wastewater from lab sinks and drains, mop water, cooling tower blowdown, and steam condensate; and treated wastewater from the liquid effluent treatment system. Nonhazardous wastewater would be treated, if necessary, before being discharged to the F-Area sanitary sewer system that connects to the Central Sanitary Wastewater Treatment Facility (UC 1998g, 1998h, 1999c, 1999d). Nonhazardous liquid waste generated for this combination of facilities is estimated to be 26 percent of the existing annual site waste generation, 40 percent of the 276,000-m^3/yr (361,000-yd^3/yr) capacity of the F-Area sanitary sewer, 8 percent of the 1,449,050-m^3/yr (1,895,357-yd^3/yr) capacity of the Central Sanitary Wastewater Treatment Facility, and within the 1,032,950-m^3/yr (1,351,099-yd^3/yr) excess capacity of the Central Sanitary Wastewater Treatment Facility (Sessions 1997). Therefore, impacts on the system should not be major.

H.5 LEAD ASSEMBLY FABRICATION

This section describes the impacts on the waste management infrastructure that may occur if lead assembly fabrication were to occur at ANL–W, Hanford, LLNL, LANL, or SRS. For each site, separate sections are presented for construction and operations.

H.5.1 ANL–W

H.5.1.1 Construction

Wastes would be generated during modification of the Fuel Manufacturing Facility (FMF) and the Zero Power Physics Reactor (ZPPR) for lead assembly fabrication. Table H–41 compares the expected waste generation rates for the modification of facilities at ANL–W with the existing generation rates for INEEL waste. LLW would be generated during modification of contaminated areas of FMF and ZPPR, although no TRU waste, mixed waste, or hazardous wastes should be generated (O'Connor et al. 1998a).

Table H–41. Potential Waste Management Impacts of Modification of Facilities for Lead Assembly Fabrication at ANL–W

Waste Type[a]	Estimated Waste Generation (m^3/yr)[b]	Site Waste Generation (m^3/yr)[c]	Percent of Site Waste Generation
LLW	18	2,624	1
Nonhazardous			
Liquid	37	2,000,000	<1
Solid	11	62,000	<1

[a] See definitions in Appendix F.8.
[b] O'Connor et al. 1998a. Values rounded to two significant figures.
[c] From the waste management section in Chapter 3; waste generation rates for INEEL.
Key: ANL–W, Argonne National Laboratory–West; LLW, low-level waste.

LLW generated during modification of the FMF and ZPPR buildings would include used equipment, decontamination wastes, and protective clothing (O'Connor et al. 1998a). A total of 36 m^3 (47 yd^3) of LLW would be generated during the 2-year modification period. LLW generation for these activities is estimated to be 1 percent of existing annual waste generation, less than 1 percent of the 112,400-m^3 (147,000-yd^3) storage capacity at the RWMC, and less than 1 percent of the 37,700-m^3/yr (49,300-yd^3/yr) disposal capacity of the RWMC. Using the 6,264-m^3/ha (3,315-yd^3/acre) disposal land usage factor for the RWMC published in the *Storage and Disposition PEIS* (DOE 1996a:E-9), 36 m^3 (47 yd^3) of waste would require less than 0.1 ha (0.25 acre) of disposal space at INEEL. Therefore, impacts of the management of this additional LLW at ANL–W and INEEL should not be major.

Nonhazardous solid waste would include office garbage, construction debris, scrap lumber, concrete and steel waste, and other construction trash. Nonhazardous solid waste would be packaged in conformance with standard industrial practice, and would be disposed of in the onsite CFA landfill complex or shipped to offsite facilities for recycling. Nonrecyclable nonhazardous solid waste generated during modification is estimated to be less than 1 percent of existing annual site waste generation and less than 1 percent of the 48,000-m^3/yr (62,800-yd^3/yr) capacity of the CFA landfill complex. The additional waste load generated during the modification period should not have a major impact on the nonhazardous solid waste management system at ANL–W or INEEL.

Nonhazardous liquid waste would include sanitary waste from sinks, showers, urinals, and water closets. To be conservative, it was assumed that all nonhazardous liquid waste generated during modification would be managed at the ANL–W sanitary wastewater treatment facility. Nonhazardous liquid waste generated for modification is estimated to be less than 1 percent of the existing annual waste generation for the INEEL, and 1 percent of the 6,057-m^3/yr (7,923-yd^3/yr) capacity of the ANL–W sanitary wastewater treatment facility. Therefore, this waste load should not have a major impact on the ANL–W sanitary wastewater treatment system.

H.5.1.2 Operations

Table H–42 compares the expected waste generation rates from lead assembly fabrication at ANL–W with the existing INEEL waste generation rates. No HLW would be generated by the proposed activities. Depending in part on decisions in the RODs for the WM PEIS, wastes could be treated and disposed of on the site or at other DOE sites or commercial facilities. Per the ROD for TRU waste issued on January 20, 1998, TRU and mixed TRU waste would be certified on the site to current WIPP waste acceptance criteria and shipped to WIPP for disposal. Per the ROD for hazardous waste issued on August 5, 1998, nonwastewater hazardous waste would continue to be treated and disposed of at offsite commercial facilities. This SPD EIS also assumes that LLW, mixed LLW, and nonhazardous waste would be treated, stored, and disposed of in accordance with current site practices. Impacts of treatment, storage, and disposal of radioactive, hazardous, and mixed wastes at ANL–W and INEEL are described in the *DOE Programmatic Spent Nuclear Fuel Management and INEL Environmental Restoration and Waste Management Final EIS* (DOE 1995a).

Table H–42. Potential Waste Management Impacts of Operation of Facilities for Lead Assembly Fabrication at ANL–W

Waste Type[a]	Estimated Waste Generation (m^3/yr)[b]	Site Waste Generation (m^3/yr)[c]	Percent of Site Waste Generation
TRU[d]	41	NA	NA
LLW	200	2,624	8
Mixed LLW	1	180	1
Hazardous	<1	835	<1
Nonhazardous			
Liquid	1,600	2,000,000	<1
Solid	1,300	62,000	2

[a] See definitions in Appendix F.8.
[b] O'Connor et al. 1998a. Values rounded to two significant figures.
[c] From the waste management section in Chapter 3; waste generation rates for INEEL.
[d] Includes mixed TRU waste.
Key: ANL–W, Argonne National Laboratory–W; LLW, low-level waste; NA, not applicable; TRU, transuranic.

TRU wastes generated during lead assembly fabrication would include glovebox gloves, spent filters, used containers and equipment, paper and cloth wipes, analytical and quality control samples, metallography waste, and sludges (O'Connor et al. 1998a). It is anticipated that all TRU waste would be contact-handled waste. Liquid TRU wastes would be evaporated or solidified before being packaged for storage. Long-term storage, drum-gas testing, real-time radiography, and loading the TRUPACT for shipment to WIPP would occur at the planned Waste Characterization Facility at INEEL. TRU waste is not routinely generated at INEEL. Impacts from the treatment of TRU waste to WIPP waste acceptance criteria are described in the WM PEIS (DOE 1997b) and the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

TRU waste generation for these activities at ANL–W is estimated to be 41 m^3/yr (54 yd^3/yr), or 1 percent of the 6,500-m^3/yr (8,500-yd^3/yr) capacity of the planned Advanced Mixed Waste Treatment Project. A total of 132 m^3 (173 yd^3) of waste would be generated over the 3-year operation period. This would be less than 1 percent of the 39,300 m^3 (51,404 yd^3) of contact-handled TRU waste currently in storage, and less than 1 percent of the 177,300-m^3 (231,908-yd^3) storage capacity available at INEEL.

The 132 m^3 (173 yd^3) of TRU waste generated by these activities would be less than 1 percent of the 143,000 m^3 (187,000 yd^3) of contact-handled TRU waste that DOE plans to dispose of at WIPP and within the 168,500-m^3 (220,400-yd^3) limit for WIPP (DOE 1997d:3-3). Impacts of disposal of TRU waste at WIPP are described in the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

LLW may include room trash (e.g., blotter paper, wipes, mop heads); protective clothing; solidified sludges; ion exchange resins; metal cans and rods; and wastewater from the laundry, analytical laboratory, and decontamination process (O'Connor et al. 1998a). LLW would be packaged, certified, and accumulated before being transferred for treatment and disposal in existing onsite facilities. A total of 700 m^3 (916 yd^3) of LLW would be generated over the 3-year operation period. LLW generation for these activities is estimated to be 8 percent of existing annual site waste generation, less than 1 percent of the 49,610-m^3/yr (64,880-yd^3/yr) capacity of the WERF, 1 percent of the 112,400-m^3 (147,000-yd^3) storage capacity at the the RWMC, and 1 percent of the 37,700-m^3/yr (49,300-yd^3/yr) disposal capacity of the RWMC. Using the 6,264-m^3/ha (3,315-yd^3/acre) disposal land usage factor for the RWMC published in the *Storage and Disposition Final PEIS* (DOE 1996a:E-9), 700 m^3 (916 yd^3) of waste would require 0.11 ha (0.27 acre) of disposal space at INEEL. Therefore, impacts of the management of this additional LLW at ANL–W and INEEL should not be major.

Mixed LLW may include sludges, cleaning solvents, and analytical waste (O'Connor et al. 1998a). Mixed LLW will be stabilized, packaged, and stored on the site for treatment and disposal in a manner consistent with the site treatment plan for ANL–W. INEEL currently treats mixed LLW onsite and ships some mixed LLW to Envirocare of Utah. Onsite disposal is planned in a new mixed LLW disposal facility. These facilities or other treatment or disposal facilities that meet DOE criteria would be used. Mixed LLW generation for these activities is estimated to be 1 percent of existing annual waste generation and less than 1 percent of the 6,500-m^3/yr (8,500-yd^3/yr) planned capacity of the Advanced Mixed Waste Treatment Project. The 4 m^3 (5.2 yd^3) of mixed LLW expected to be generated would be less than 1 percent of the 112,400-m^3 (147,000-yd^3) storage capacity at the RWMC. Therefore, the management of this additional waste at ANL–W and INEEL should not have a major impact on the mixed LLW management system.

Hazardous waste generated during operations would include small quantities of process ends. Hazardous waste would be packaged for treatment and disposal at offsite permitted commercial facilities (O'Connor et al. 1998a). Hazardous waste generation for these activities is estimated to be less than 1 percent of existing annual waste generation and less than 1 percent of the 1,600-m^3 (2,090-yd^3) onsite storage capacity, and therefore should not have a major impact on the hazardous waste management system at ANL–W or INEEL.

Nonhazardous solid waste would include office and lunch room garbage, packaging materials, sewage sludges, and other industrial wastes from utility and maintenance operations (O'Connor et al. 1998a). Nonhazardous solid waste would be packaged in conformance with standard industrial practice. Recyclable solid wastes such as office paper, metal cans, and plastic and glass bottles would be sent off the site for recycling. The remaining solid sanitary waste would be sent off the site for disposal in the Bonneville County landfill. Nonrecyclable, nonhazardous solid waste generated by these activities is estimated to be 2 percent of existing annual site waste generation. It is unlikely that this additional waste load would have a major impact on the nonhazardous solid waste management system at ANL–W or INEEL.

Nonhazardous liquid waste would include sanitary waste from sinks, showers, urinals and water closets, and wastewater from cooling tower blowdown (O'Connor et al. 1998a). Nonhazardous liquid waste generated for these activities is estimated to be less than 1 percent of the existing annual waste generation for INEEL and 26 percent of the 6,057-m^3/yr (7,923-yd^3/yr) capacity of the ANL–W sanitary wastewater treatment facility. Therefore, this additional waste should not have a major impact on the ANL–W sanitary wastewater treatment system.

H.5.2 Hanford

H.5.2.1 Construction

Table H–43 compares the expected waste generation rates for the modification of Hanford facilities for lead assembly fabrication with the existing generation rates for Hanford waste. No radioactive waste would be generated during modification because this action involves modification of uncontaminated buildings only (O'Connor et al. 1998b).

Table H–43. Potential Waste Management Impacts of Modification of Facilities for Lead Assembly Fabrication at Hanford

Waste Type[a]	Estimated Waste Generation (m^3/yr)[b]	Site Waste Generation (m^3/yr)[c]	Percent of Site Waste Generation
Nonhazardous			
Liquid	15	200,000	<1
Solid	50	43,000	<1

[a] See definitions in Appendix F.8.

[b] O'Connor et al. 1998b. Values rounded to two significant figures.

[c] From the waste management section in Chapter 3.

Nonhazardous solid waste includes office garbage, construction debris, scrap lumber, concrete and steel waste, and other construction trash. Nonhazardous solid waste would be packaged in conformance with standard industrial practice and shipped to offsite facilities for recycling or disposal. Waste metals and other recyclable solid wastes would be sent off the site for recycling, and therefore were not included in the waste volumes. Nonrecyclable solid sanitary waste would be sent off the site and would likely be disposed of in the Richland Sanitary Landfill. Nonrecyclable nonhazardous solid waste generated during modification is estimated to be less than 1 percent of existing annual waste generation. The additional waste load generated during the 2-year modification period should not have a major impact on the nonhazardous solid waste management system at Hanford.

Nonhazardous liquid waste includes sanitary waste from sinks, showers, urinals, and water closets. To be conservative, it was assumed that all nonhazardous liquid waste generated during modification would be managed at onsite facilities. Nonhazardous liquid waste generated during modification is estimated to be less than 1 percent of existing annual site waste generation, less than 1 percent of the 235,000-m^3/yr (307,000-yd^3/yr) capacity of the 400 Area sanitary sewer, and less than 1 percent of the 235,000-m^3/yr (307,000-yd^3/yr) capacity of the Energy Northwest (formerly WPPSS) Sewage Treatment Facility. Therefore, this waste load is unlikely to have a major impact on the system during the modification period.

H.5.2.2 Operations

Table H–44 compares the expected waste generation rates from lead assembly fabrication at Hanford with the existing site waste generation rates. No HLW would be generated during lead assembly fabrication. Depending in part on decisions in the RODs for the WM PEIS, wastes could be treated and disposed of on the site or at other DOE sites or commercial facilities. Per the ROD for TRU waste issued on January 20, 1998,

Table H–44. Potential Waste Management Impacts of Operation of Facilities for Lead Assembly Fabrication at Hanford

Waste Type[a]	Estimated Waste Generation (m^3/yr)[b]	Site Waste Generation (m^3/yr)[c]	Percent of Site Waste Generation
TRU[d]	41	450	9
LLW	200	3,902	5
Mixed LLW	1	847	<1
Hazardous	<1	560	<1
Nonhazardous			
Liquid	1,600	200,000	1
Solid	1,300	43,000	3

[a] See definitions in Appendix F.8.
[b] O'Connor et al. 1998b. Values rounded to two significant figures.
[c] From the waste management section in Chapter 3.
[d] Includes mixed TRU waste

Key: LLW, low-level waste; TRU, transuranic.

TRU and mixed TRU waste would be certified on the site to current WIPP waste acceptance criteria and shipped to WIPP for disposal. Per the ROD for hazardous waste issued on August 5, 1998, nonwastewater hazardous waste would continue to be treated and disposed of at offsite commercial facilities. The SPD EIS also assumes that LLW, mixed LLW, and nonhazardous waste would be treated, stored, and disposed of in accordance with current site practices. Impacts of treatment, storage, and disposal of radioactive, hazardous, and mixed wastes at Hanford are being evaluated in the *Hanford Site Solid (Radioactive and Hazardous) Waste Program EIS* that is being prepared by the DOE Richland Operations Office (DOE 1997c).

TRU wastes generated during operations would include glovebox gloves, spent filters, used containers and equipment, paper and cloth wipes, analytical and quality control samples, metallography waste, and sludges (O'Connor et al. 1998b). It is anticipated that all TRU waste would be contact-handled waste. Liquid TRU wastes would be evaporated or solidified before being packaged for storage. Drum-gas testing, real-time radiography, and loading the TRUPACT for shipment to WIPP would occur at the Waste Receiving and Processing Facility at Hanford. Impacts from the treatment of TRU waste to WIPP waste acceptance criteria are described in the WM PEIS (DOE 1997b) and the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

TRU waste generation for these activities is estimated to be 9 percent of existing annual site waste generation and 2 percent of the 1,820-m^3/yr (2,380-yd^3/yr) planned capacity of the Waste Receiving and Processing Facility. A total of 132 m^3 (173 yd^3) of TRU waste would be generated over the 3-year operation period. This would be 1 percent of the 11,450 m^3 (14,977 yd^3) of contact-handled TRU waste currently in storage and 1 percent of the 17,000-m^3 (22,200-yd^3) storage capacity available at Hanford.

The 132 m^3 (173 yd^3) of TRU waste generated by these activities would be less than 1 percent of the 143,000 m^3 (187,000 yd^3) of contact-handled TRU waste that DOE plans to dispose of at WIPP and within the 168,500-m^3 (220,400-yd^3) limit for WIPP (DOE 1997d:3-3). Impacts of disposal of TRU waste at WIPP are described in the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

LLW may include room trash (e.g., blotter paper, wipes, mop heads); protective clothing; solidified sludges; ion exchange resins; metal cans and rods; and wastewater from the laundry, analytical laboratory, and decontamination process (O'Connor et al. 1998b). LLW would be packaged, certified, and accumulated before being transferred for treatment and disposal in existing onsite facilities. A total of 700 m^3 (916 yd^3) of LLW would be generated over the 3-year operation period. LLW generation for these activities is estimated to be 5 percent of existing annual site waste generation, less than 1 percent of the 1,740,000-m^3 (2,280,000-yd^3) disposal capacity of the LLW Burial Grounds, and less than 1 percent of the 230,000-m^3 (301,000-yd^3) capacity of the Grout Vaults. Using the 3,480-m^3/ha (1,842-yd^3/acre) disposal land usage factor for Hanford published in the *Final Storage and Disposition PEIS* (DOE 1996a:E-9), 700 m^3 (916 yd^3) of waste would require 0.2 ha (0.49 acre) of disposal space at Hanford. Therefore, impacts of the management of this additional LLW at Hanford should not be major.

Mixed LLW may include sludges, cleaning solvents, and analytical waste (O'Connor et al. 1998b). Mixed LLW will be stabilized, packaged, and stored on the site for treatment and disposal in a manner consistent with the site treatment plan for Hanford. Mixed LLW generation for these activities is estimated to be less than 1 percent of existing annual waste generation and less than 1 percent of the 1,820-m^3/yr (2,380-yd^3/yr) capacity of the Waste Receiving and Processing Facility. Over the operating life of this facility, the 4 m^3 (5.2 yd^3) of mixed LLW expected to be generated would be less than 1 percent of the 16,800-m^3 (21,970-yd^3) storage capacity of the Central Waste Complex and less than 1 percent of the 14,200 m^3 (18,600-yd^3) disposal capacity in the Radioactive Mixed Waste Disposal Facility. Therefore, the management of this additional waste at Hanford should not have a major impact on the mixed LLW management system.

Hazardous waste generated during operations would include small quantities of process ends. Hazardous waste would be packaged for treatment and disposal at offsite permitted commercial facilities (O'Connor et al. 1998b). Hazardous waste generation for these activities is estimated to be less than 1 percent of existing annual waste generation. These wastes should not have a major impact on the hazardous waste management system at Hanford.

Nonhazardous solid waste would include office and lunch room garbage, packaging materials, sewage sludges, and other industrial wastes from utility and maintenance operations (O'Connor et al. 1998b). Nonhazardous solid waste would be packaged in conformance with standard industrial practice. Recyclable solid wastes such as office paper, metal cans, and plastic and glass bottles would be sent off the site for recycling. The remaining solid sanitary waste would be sent off the site for disposal in the Richland Sanitary Landfill. Nonrecyclable, nonhazardous solid waste generated by these activities is estimated to be 3 percent of existing annual site waste generation. It is unlikely that this additional waste load would have a major impact on the nonhazardous solid waste management system at Hanford.

Nonhazardous liquid waste would include sanitary waste from sinks, showers, urinals and water closets, and wastewater from cooling tower blowdown (O'Connor et al. 1998b). Nonhazardous liquid waste generated for these activities is estimated to be 1 percent of the existing annual site waste generation, 1 percent of the 235,000-m^3/yr (307,000-yd^3/yr) capacity of the 400 Area sanitary sewer, and 1 percent of the 235,000-m^3/yr (307,000-yd^3/yr) capacity of the Energy Northwest (formerly WPPSS) Sewage Treatment Facility. Therefore, this additional waste load should not have a major impact on the system.

H.5.3 LLNL

H.5.3.1 Construction

Table H–45 compares the expected waste generation rates for the modification of LLNL facilities for lead assembly fabrication with the existing generation rates for LLNL waste. No radioactive waste would be generated during modification because this action involves modification of uncontaminated buildings only (O'Connor et al. 1998c).

Table H–45. Potential Waste Management Impacts of Modification of Facilities for Lead Assembly Fabrication at LLNL

WasteType[a]	Estimated Waste Generation (m^3/yr) [b]	Site Waste Generation (m^3/yr)[c]	Percent of Site Waste Generation
Nonhazardous			
Liquid	17	456,000	<1
Solid	12	4,282	<1

[a] See definitions in Appendix F.8.

[b] O'Connor et al. 1998c. Values rounded to two significant figures.

[c] From the waste management section in Chapter 3.

Nonhazardous solid waste includes office garbage, construction debris, scrap lumber, concrete and steel waste, and other construction trash. Nonhazardous solid waste would be packaged in conformance with standard industrial practice and shipped to offsite facilities for recycling or disposal. Waste metals and other recyclable solid wastes would be sent off the site for recycling, and therefore were not included in the waste volumes. Nonrecyclable solid sanitary waste would be sent off the site and would likely be disposed of in the Vasco Road Landfill. Nonrecyclable nonhazardous solid waste generated during modification is estimated to be 1 percent of existing annual waste generation. The additional waste load generated during the 2-year modification period should not have major impact on the nonhazardous solid waste management system at LLNL.

Nonhazardous liquid waste includes sanitary waste from sinks, showers, urinals, and water closets. To be conservative, it was assumed that all nonhazardous liquid waste generated during modification would be discharged to the LLNL sewer system. Nonhazardous liquid waste generated during modification is estimated to be less than 1 percent of existing annual site waste generation and less than 1 percent of the 2,327,800-m^3/yr (3,044,762-yd^3/yr) capacity of the LLNL sanitary sewer, and therefore is unlikely to have a major impact on the LLNL sewer system or the city of Livermore Water Reclamation Plant during the modification period.

H.5.3.2 Operations

Table H–46 compares the expected waste generation rates from lead assembly fabrication at LLNL with the existing site waste generation rates. No HLW would be generated during lead assembly fabrication. Depending in part on decisions in the RODs for the WM PEIS, wastes could be treated and disposed of on the site or at other DOE sites or commercial facilities. Per the ROD for TRU waste issued on January 20, 1998, TRU and mixed TRU waste would be certified on the site to current WIPP waste acceptance criteria and shipped to WIPP for disposal. Per the ROD for hazardous waste issued on August 5, 1998, nonwastewater hazardous waste would continue to be treated and disposed of at offsite commercial facilities. The SPD EIS also assumes that LLW, mixed LLW, and nonhazardous waste would be treated, stored, and disposed of in accordance with current site practices. Impacts of treatment and storage of radioactive, hazardous, and mixed wastes at LLNL are described in the *Final EIS for Continued Operation of LLNL and SNL, Livermore* (DOE 1992).

TRU wastes generated during operations would include glovebox gloves, spent filters, used containers and equipment, paper and cloth wipes, analytical and quality control samples, metallography waste, and sludges (O'Connor et al. 1998c). It is anticipated that all TRU waste would be contact-handled waste. Liquid TRU wastes would be evaporated or solidified before being packaged for storage. It is likely that drum-gas testing, real-time radiography, and loading the TRUPACT for shipment to WIPP would occur at the planned Decontamination and Waste Treatment Facility. Impacts from the treatment of TRU waste to WIPP waste acceptance criteria are described in the WM PEIS (DOE 1997b) and the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

Table H–46. Potential Waste Management Impacts of Operation of Facilities for Lead Assembly Fabrication at LLNL

Waste Type[a]	Estimated Waste Generation (m^3/yr)[b]	Site Waste Generation (m^3/yr)[c]	Percent of Site Waste Generation
TRU[d]	41	27	152
LLW	200	124	161
Mixed LLW	1	353	<1
Hazardous	<1	579	<1
Nonhazardous			
Liquid	1,600	456,000	<1
Solid	1,300	4,282	30

[a] See definitions in Appendix F.8.

[b] O'Connor et al. 1998c. Values rounded to two significant figures.

[c] From the waste management section in Chapter 3.

[d] Includes mixed TRU waste

Key: LLW, low-level waste; TRU, transuranic.

TRU waste generation for these activities is estimated to be 152 percent of existing annual site waste generation. A total of 132 m^3 (173 yd^3) of TRU waste would be generated over the 3-year operation period. This would be 51 percent of the 257 m^3 (336 yd^3) of contact-handled TRU waste currently in storage, and 4 percent of the 3,335 m^3 (4,362 yd^3) of onsite storage capacity. Assuming that the waste is stored in 208-l (55-gal) drums each with a capacity of 0.21 m^3 (0.27 yd^3), about 630 drums would be needed to store this waste. Assuming that these drums can be stacked two high, each drum occupies an area of 0.4 m^2 (4 ft^2), and adding a 50 percent factor for aisle space and shipping and receiving space, a storage area of about 190 m^2 (227 yd^2) would be required. Impacts of the storage of additional quantities of TRU waste on less than 0.1 ha (0.25 acre) of land at LLNL should not be major.

The 132 m^3 (173 yd^3) of TRU waste generated by these activities would be less than 1 percent of the 143,000 m^3 (187,000 yd^3) of contact-handled TRU waste that DOE plans to dispose of at WIPP and within the 168,500-m^3 (220,400-yd^3) limit for WIPP (DOE 1997d:3-3). Impacts of disposal of TRU waste at WIPP are described in the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

LLW may include room trash (e.g., blotter paper, wipes, mop heads); protective clothing; solidified sludges; ion exchange resins; metal cans and rods; and wastewater from the laundry, analytical laboratory, and decontamination process (O'Connor et al. 1998c). LLW would be packaged, certified, and accumulated before being transferred for treatment and storage in existing facilities on the site. LLW generation for these activities is estimated to be 161 percent of existing annual site waste generation and 26 percent of the 771-m^3/yr (1,008-yd^3/yr) capacity of the size reduction facility. A total of 700 m^3 (916 yd^3) of LLW would be generated over the 3-year operation period. This would be 13 percent of the 5,255-m^3 (6,874-yd^3) onsite storage capacity, and would not be expected to require LLNL to build additional storage capacity because this waste would be shipped to a disposal facility on a routine basis. If additional storage space were required, and assuming that the waste is stored in 208-l (55-gal) drums each with a capacity of 0.21 m^3 (0.27 yd^3), about 3,300 drums would be needed to store this waste. Assuming that these drums can be stacked two high, each drum occupies an area of 0.4 m^2 (4 ft^2), and adding a 50 percent factor for aisle space and shipping and receiving space, a storage area of about 1,000 m^2 (1,196 yd^2) would be required. Impacts of the storage of additional quantities of LLW on 0.1 ha (0.25 acre) of land at LLNL should not be major.

LLW from LLNL is currently shipped to NTS for disposal. The additional LLW from conduct of lead assembly fabrication at LLNL would be 4 percent of the 20,000 m^3 (26,000 yd^3) of LLW disposed at NTS in 1995 and less than 1 percent of the 500,000-m^3 (650,000-yd^3) disposal capacity at NTS. Using the 6,085-m^3/ha (3,221-yd^3/acre) disposal land usage factor for NTS published in the *Final Storage and Disposition PEIS* (DOE 1996a:E-9), 700 m^3 (916 yd^3) of waste would require 0.12 ha (0.30 acre) of disposal space at NTS or a similar facility. Therefore, impacts of the management of this additional LLW at the disposal site should not be major. Impacts of disposal of LLW at NTS are described in the *Final EIS for the NTS and Off-Site Locations in the State of Nevada* (DOE 1996c).

Mixed LLW may include sludges, cleaning solvents, and analytical waste (O'Connor et al. 1998c). Mixed LLW will be stabilized, packaged, and stored on the site for treatment and disposal in a manner consistent with the site treatment plan for LLNL. Mixed LLW disposal would occur off the site. Mixed LLW generation for these activities is estimated to be less than 1 percent of existing annual waste generation and less than 1 percent of the 2,012-m^3/yr (2,632-yd^3/yr) capacity of the Building 513 and 514 Waste Treatment Facility. Over the operating life of this facility, the 4 m^3 (5.2 yd^3) of mixed LLW expected to be generated would be less than 1 percent of the 2,825-m^3 (3,695-yd^3) onsite storage capacity. Therefore, the management of this additional waste at LLNL should not have a major impact on the mixed LLW management system.

Hazardous waste generated during operations would include small quantities (< 1 m^3/yr [< 1.3 yd^3/yr]) of process ends. Hazardous waste would be packaged for treatment and disposal at offsite permitted commercial facilities (O'Connor et al. 1998c). Hazardous waste generated by these activities is estimated to be less than 1 percent of existing annual waste generation and less than 1 percent of the 2,825-m^3 (3,695-yd^3) hazardous waste storage capacity. Because the additional waste load is very small, management of this waste should not have a major impact on the hazardous waste management system at LLNL.

Nonhazardous solid waste would include office and lunch room garbage, packaging materials, sewage sludges, and other industrial wastes from utility and maintenance operations (O'Connor et al. 1998c). Nonhazardous solid waste would be packaged in conformance with standard industrial practice. Recyclable solid wastes such as office paper, metal cans, and plastic and glass bottles would be sent off the site for recycling. The remaining solid sanitary waste would be sent off the site for disposal in the Vasco Road Landfill. Nonrecyclable, nonhazardous solid waste generated by these activities is estimated to be 30 percent of existing annual site waste generation. It is unlikely that this additional waste load would have a major impact on the nonhazardous solid waste management system at LLNL.

Nonhazardous liquid waste would include sanitary waste from sinks, showers, urinals and water closets, and wastewater from cooling tower blowdown (O'Connor et al. 1998c). After monitoring to ensure that the wastewater meets discharge limits, sanitary wastewaters from lead assembly fabrication along with other sanitary wastewaters from LLNL and Sandia National Laboratory–Livermore, would be routed to the city of Livermore Water Reclamation Plant. Nonhazardous liquid waste generated for these activities is estimated to be less than 1 percent of the existing annual site waste generation, and less than 1 percent of the 2,327,800-m^3/yr (3,044,762-yd^3/yr) capacity of the LLNL sanitary sewer and therefore should not have a major impact on LLNL and the city of Livermore sanitary wastewater treatment systems.

H.5.4 LANL

H.5.4.1 Construction

Table H–47 compares the expected waste generation rates for the modification of LANL facilities for lead assembly fabrication with the existing generation rates for LANL waste. TRU waste and LLW would be generated during modification of the glovebox line in Building PF–4, although no mixed waste or hazardous wastes would be generated (O'Connor et al. 1998d).

Table H–47. Potential Waste Management Impacts of Modification of Facilities for Lead Assembly Fabrication at LANL

Waste Type[a]	Estimated Waste Generation (m^3/yr)[b]	Site Waste Generation (m^3/yr)[c]	Percent of Site Waste Generation
TRU[d]	3	262	1
LLW	3	1,585	<1
Nonhazardous			
Liquid	10	692,857	<1

[a] See definitions in Appendix F.8.
[b] O'Connor et al. 1998d:33. Values rounded to two significant figures.
[c] From the waste management section in Chapter 3.
[d] Includes mixed TRU waste.
Key: LLW, low-level waste; TRU, transuranic.

TRU wastes generated during modification of Building PF–4 would include contaminated equipment and gloveboxes. It is anticipated that all TRU waste would be contact-handled waste. No liquid TRU waste is anticipated (O'Connor et al. 1998d). Drum-gas testing, real-time radiography, and loading the TRUPACT for shipment to WIPP would occur at the Radioactive Materials Research, Operations and Demonstration (RAMROD) Facility and the Radioactive Assay and Nondestructive Test (RANT) Facility (DOE 1999b:2-108, 2-112, 2-113). Impacts from the treatment of TRU waste to WIPP waste acceptance criteria are described in the WM PEIS (DOE 1997b).

TRU waste generation for modification of Building PF–4 is estimated to be 1 percent of existing annual site waste generation, and less than 1 percent of the 1,050-m^3/yr (1,373-yd^3/yr) TRU-waste-processing capacity of the RAMROD and RANT facilities. A total of 5 m^3 (6.5 yd^3) of TRU waste would be generated over the 2-year modification period. This would be less than 1 percent of the 11,262 m^3 (14,731 yd^3) of contact-handled TRU waste currently in storage, and less than 1 percent of the 24,355-m^3 (31,856-yd^3) storage capacity available at LANL.

In addition, the 5 m^3 (6.5 yd^3) of TRU waste generated by modification of this building would be less than 1 percent of the 143,000 m^3 (187,000 yd^3) of contact-handled TRU waste that DOE plans to dispose of at WIPP and within the 168,500-m^3 (220,400-yd^3) limit for WIPP (DOE 1997d:3-3). Impacts of disposal of TRU waste at WIPP are described in the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

LLW generated during modification of Building PF–4 would include decontamination wastes and protective clothing. It is expected that no radioactive liquid LLW would be generated (O'Connor et al. 1998d). A total of 5 m^3 (6.5 yd^3) of LLW would be generated during the modification period. LLW generation for these activities is estimated to be less than 1 percent of existing annual waste generation, 1 percent of the 663-m^3 (867-yd^3) LLW storage capacity, and less than 1 percent of the 252,000-m^3 (329,616-yd^3) capacity of the TA–54 LLW disposal area. Using the 12,562-m^3/ha (6,649-yd^3/acre) disposal land usage factor for LANL published in the *Final Stockpile Stewardship and Management PEIS* (SSM PEIS) (DOE 1996d:H-9), 5 m^3 (6.5 yd^3) of waste would require less than 0.1 ha (0.25 acre) of disposal space at LANL. Therefore, impacts of the management of this additional LLW at LANL should not be major.

Nonhazardous liquid waste would include sanitary waste from sinks, showers, urinals, and water closets. To be conservative, it was assumed that all nonhazardous liquid waste generated during modification would be managed at the LANL sanitary wastewater treatment plant. Nonhazardous liquid waste generated for modification is estimated to be less than 1 percent of the existing annual waste generation, less than 1 percent of the 1,060,063-m^3/yr (1,386,562-yd^3/yr) capacity of the sanitary wastewater treatment plant, and less than 1 percent of the 567,750-m^3/yr (742,617-yd^3/yr) capacity of the sanitary tile fields. Therefore, this waste load would not have a major impact on the LANL sanitary wastewater treatment system.

H.5.4.2 Operations

Table H–48 compares the expected waste generation rates from lead assembly fabrication at LANL with the existing site waste generation rates. No HLW would be generated during lead assembly fabrication. Depending in part on decisions in the RODs for the WM PEIS, wastes could be treated and disposed of on the site or at other DOE sites or commercial facilities. Per the ROD for TRU waste issued on January 20, 1998,TRU and mixed TRU waste would be certified on the site to current WIPP waste acceptance criteria and shipped to WIPP for disposal. Per the ROD for hazardous waste issued on August 5, 1998, nonwastewater hazardous waste would continue to be treated and disposed of at offsite commercial facilities. The SPD EIS also assumes that LLW, mixed LLW, and nonhazardous waste would be treated, stored, and disposed of in accordance with current site practices. Impacts of treatment, storage, and disposal of waste at LANL, including expansion of the LLW disposal facility, are evaluated in the *Site-Wide EIS for Continued Operation of LANL* (DOE 1999b).

Table H–48. Potential Waste Management Impacts of Operation of Facilities for Lead Assembly Fabrication at LANL

Waste Type[a]	Estimated Waste Generation (m^3/yr)[b]	Site Waste Generation (m^3/yr)[c]	Percent of Site Waste Generation
TRU[d]	41	262	16
LLW	200	1,585	13
Mixed LLW	1	90	1
Hazardous	<1	942	<1
Nonhazardous			
Liquid	1,600	692,857	<1
Solid	1,300	5,453	24

[a] See definitions in Appendix F.8.

[b] O'Connor et al. 1998d:34. Values rounded to two significant figures.

[c] From the waste management section in Chapter 3.

[d] Includes mixed TRU waste.

Key: LLW, low-level waste; TRU, transuranic.

TRU wastes generated during operations would include glovebox gloves, spent filters, used containers and equipment, paper and cloth wipes, analytical and quality control samples, metallography waste, and sludges (O'Connor et al.1998d). It is anticipated that all TRU waste would be contact-handled waste. Liquid TRU wastes would be evaporated or solidified before being packaged for storage. Drum-gas testing, real-time radiography, and loading the TRUPACT for shipment to WIPP would occur at the RAMROD and RANT facilities (DOE 1999:2-108, 2-112, 2-113). Impacts from the treatment of TRU waste to WIPP waste acceptance criteria are described in the WM PEIS (DOE 1997b) and the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

TRU waste generation for these activities is estimated to be 16 percent of existing annual site waste generation and 4 percent of the 1,050 m^3/yr (1,373-yd^3/yr) TRU-waste-processing capacity of the RAMROD and RANT facilities. A total of 132 m^3 (173 yd^3) of TRU waste would be generated over the 3-year operation period. This would be 1 percent of the 11,262 m^3 (14,731 yd^3) of contact-handled TRU waste currently in storage, and less than 1 percent of the 24,355-m^3 (31,856-yd^3) storage capacity available at LANL.

The 132 m^3 (173 yd^3) of TRU waste generated by these activities would be less than 1 percent of the 143,000 m^3 (187,000 yd^3) of contact-handled TRU waste that DOE plans to dispose of at WIPP and within the 168,500-m^3 (220,400-yd^3) limit for WIPP (DOE 1997d:3-3). Impacts from disposal of TRU waste at WIPP are described in the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

LLW may include room trash (e.g., blotter paper, wipes, mop heads); protective clothing; solidified sludges; ion exchange resins; metal cans and rods; and wastewater from the laundry, analytical laboratory, and decontamination process (O'Connor et al. 1998d). LLW would be packaged, certified, and accumulated before being transferred for treatment and disposal in existing onsite facilities. A total of 700 m^3 (916 yd^3) of LLW would be generated over the 3-year operation period. LLW generation for these activities is estimated to be 13 percent of existing annual site waste generation, 106 percent of the 663-m^3 (867-yd^3) LLW storage capacity, and less than 1 percent of the 252,000-m^3 (329,616-yd^3) capacity of the TA–54 LLW disposal area. Because the waste would be sent for disposal on a regular basis, storage should not be a problem. Using the 12,562-m^3/ha (6,649-yd^3/acre) disposal land usage factor for LANL published in the SSM PEIS (DOE 1996d:H-9), 700 m^3 (916 yd^3) of waste would require 0.1 ha (0.25 acre) of disposal space at LANL. It is estimated that without any waste contribution from lead assembly fabrication, the existing disposal space in the TA–54 LLW disposal facility will be exhausted within the next 10 years. Expansion of the LLW disposal capacity at LANL is evaluated in the *Site-Wide EIS for Continued Operation of LANL* (DOE 1999b). Impacts from the management of the additional SPD LLW at LANL should not be major.

Mixed LLW may include sludges, cleaning solvents, and analytical waste (O'Connor et al. 1998d). Mixed LLW will be stabilized, packaged, and stored on the site for treatment and disposal in a manner consistent with the site treatment plan for LANL. Mixed LLW disposal would occur off the site. Mixed LLW generation for these activities is estimated to be 1 percent of existing annual waste generation, and 1 percent of the 583-m^3 (762.6-yd^3) mixed LLW storage capacity. Therefore, the management of this additional waste at LANL should not have a major impact on the mixed LLW management system.

Hazardous waste generated during operations would include small quantities of process ends. Hazardous waste would be packaged for treatment and disposal at offsite permitted commercial facilities (O'Connor et al. 1998d). Hazardous waste generation for these activities is estimated to be less than 1 percent of existing annual waste generation and less than 1 percent of the 1,864-m^3 (2,438-yd^3) hazardous waste storage capacity. These wastes should not have a major impact on the hazardous waste management system at LANL.

Nonhazardous solid waste would include office and lunch room garbage, packaging materials, sewage sludges, and other industrial wastes from utility and maintenance operations (O'Connor et al. 1998d). Nonhazardous solid waste would be packaged in conformance with standard industrial practice. Recyclable solid wastes such as office paper, metal cans, and plastic and glass bottles would be sent off the site for recycling. The remaining solid sanitary waste would be disposed of in the Los Alamos County Landfill. Nonrecyclable, nonhazardous solid waste generated by these activities is estimated to be 24 percent of existing annual site waste generation. It is unlikely that this additional waste load would have a major impact on the nonhazardous solid waste management system at LANL.

Nonhazardous liquid waste would include sanitary waste from sinks, showers, urinals and water closets, and wastewater from cooling tower blowdown (O'Connor et al. 1998d). Nonhazardous liquid waste generated for these activities is estimated to be less than 1 percent of the existing annual site waste generation, less than 1 percent of the 1,060,063-m^3/yr (1,386,562-yd^3/yr) capacity of the sanitary wastewater treatment plant, and less than 1 percent of the 567,750-m^3/yr (742,617-yd^3/yr) capacity of the sanitary tile fields, and therefore should not have a major impact on the system.

H.5.5 SRS

H.5.5.1 Construction

Table H–49 compares the expected waste generation rates for the modification of facilities at SRS with the existing generation rates for SRS waste. No radioactive or mixed waste would be generated during modification because the areas of the buildings that will be modified are uncontaminated.

Table H–49. Potential Waste Management Impacts of Modification of Facilities for Lead Assembly Fabrication at SRS

Waste Type[a]	Estimated Waste Generation (m^3/yr)[b]	Site Waste Generation (m^3/yr)[c]	Percent of Site Waste Generation
Hazardous	1	74	1
Nonhazardous			
Liquid	2,400	416,100	1
Solid	19	6,670	<1

[a] See definitions in Appendix F.8.
[b] O'Connor et al. 1998e:35. Values rounded to two significant figures.
[c] From the waste management section in Chapter 3.

The small amount of hazardous waste generated during building modification would include batteries, fluorescent light tubes, and liquids such as cleaning solutions, lubricants, oils, and hydraulic fluids (O'Connor et al. 1998e). These wastes are typical of those generated during construction of an industrial facility. Any hazardous waste generated during modification would be packaged in DOT-approved containers and shipped off the site to permitted commercial treatment and disposal facilities. Hazardous waste generationfor modification of this facility is estimated to be 1 percent of existing annual site waste generation. The additional waste load generated during the 2-year modification period should not have a major impact on the SRS hazardous waste management system.

Nonhazardous solid waste would include office garbage, construction debris, scrap lumber, concrete and steel waste, and other construction trash. Nonhazardous solid waste would be packaged in conformance with standard industrial practice and shipped to commercial facilities for recycling or disposal. Waste metals would be sent off the site for recycling, and therefore, were not included in the waste volumes. Nonhazardous-solid-waste generation during modification of this facility is estimated to be less than 1 percent of existing annual site waste generation. The additional waste load generated during the modification period should not have a major impact on the nonhazardous solid waste management system at SRS.

Nonhazardous liquid waste would include sanitary waste from any sinks, showers, urinals, and water closets. To be conservative, it was assumed that all nonhazardous liquid waste generated during modification would be managed at the Central Sanitary Wastewater Treatment Facility. Nonhazardous liquid waste generated for modification of this facility is estimated to be 1 percent of existing annual site waste generation, 2 percent of the 136,274-m^3/yr (178,246-yd^3/yr) capacity of the H-Area sanitary sewer, less than 1 percent of the 1,449,050-m^3/yr (1,895,357-yd^3/yr) capacity of the Central Sanitary Wastewater Treatment Facility, and within the 1,032,950-m^3/yr (1,351,099-yd^3/yr) excess capacity of the Central Sanitary Wastewater Treatment Facility (Sessions 1997). Therefore, the management of this additional waste should not have a major impact on the system during the modification period.

H.5.5.2 Operations

Table H–50 compares the expected waste generation rates from lead assembly fabrication at SRS with the existing site waste generation rates. No HLW would be generated during lead assembly fabrication. Depending in part on decisions in the RODs for the WM PEIS, wastes could be treated and disposed of on the site or at other DOE sites or commercial facilities. Per the ROD for TRU waste issued on January 20, 1998, TRU and mixed TRU waste would be certified on the site to current WIPP waste acceptance criteria and shipped to WIPP for disposal. Per the ROD for hazardous waste issued on August 5, 1998, nonwastewater hazardous waste would continue to be treated on the site in the Consolidated Incineration Facility and treated and disposed of at offsite commercial facilities. This EIS also assumes that LLW, mixed LLW, and nonhazardous waste would be treated, stored, and disposed of in accordance with current site practices. Impacts from treatment, storage, and disposal of radioactive, hazardous, and mixed wastes at SRS are described in the *SRS Waste Management Final EIS* (DOE 1995b).

Table H–50. Potential Waste Management Impacts of Operation of Facilities for Lead Assembly Fabrication at SRS

Waste Type[a]	Estimated Waste Generation (m^3/yr)[b]	Site Waste Generation (m^3/yr)[c]	Percent of Site Waste Generation
TRU[d]	41	427	10
LLW	200	10,043	2
Mixed LLW	1	1,135	<1
Hazardous	<1	74	<1
Nonhazardous			
Liquid	1,600	416,100	<1
Solid	1,300	6,670	19

[a] See definitions in Appendix F.8.
[b] O'Connor et al. 1998e:38. Values rounded to two significant figures.
[c] From the waste management section in Chapter 3.
[d] Includes mixed TRU waste.
Key: LLW, low-level waste; TRU, transuranic.

TRU wastes generated during operations would include glovebox gloves, spent filters, used containers and equipment, paper and cloth wipes, analytical and quality control samples, metallography waste, and sludges (O'Connor et al. 1998e). It is anticipated that all TRU waste would be contact-handled waste. Liquid TRU wastes would be evaporated or solidified before being packaged for storage. Drum-gas testing, real-time radiography, and loading the TRUPACT for shipment to WIPP would occur at the planned TRU Waste Characterization and Certification Facility at SRS. Impacts from the treatment of TRU waste to WIPP waste acceptance criteria are described in the WM PEIS (DOE 1997b) and the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

TRU waste generation for these activities is estimated to be 10 percent of existing annual site waste generation, and 2 percent of the 1,720-m^3/yr (2,250-yd^3/yr) planned capacity of the TRU Waste Characterization and Certification Facility. A total of 132 m^3 (173 yd^3) of TRU waste would be generated over the 3-year operation period. This would be 2 percent of the 6,977 m^3 (9,125 yd^3) of contact-handled TRU waste currently in storage, and less than 1 percent of the 34,400-m^3 (44,995-yd^3) storage capacity available at SRS.

The 132 m^3 (173 yd^3) of TRU waste generated by these activities would be less than 1 percent of the 143,000 m^3 (187,000 yd^3) of contact-handled TRU waste that DOE plans to dispose of at WIPP, and within the 168,500-m^3

(220,400-yd^3) limit for WIPP (DOE 1997d:3-3). Impacts from disposal of TRU waste at WIPP are described in the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

LLW may include room trash (e.g., blotter paper, wipes, mop heads); protective clothing; solidified sludges; ion exchange resins; metal cans and rods; and wastewater from the laundry, analytical laboratory, and decontamination process (O'Connor et al. 1998e). LLW would be packaged, certified, and accumulated before being transferred for treatment and disposal in existing onsite facilities. A total of 700 m^3 (916 yd^3) of LLW would be generated over the 3-year operation period. LLW generation for these activities is estimated to be 2 percent of existing annual site waste generation, 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility, and 2 percent of the 30,500-m^3 (39,900-yd^3) capacity of the Low-Activity Waste Vaults. Using the 8,687-m^3/ha (4,598-yd^3/acre) disposal land usage factor for SRS published in the *Final Storage and Disposition PEIS* (DOE 1996a:E-9), 700 m^3 (916 yd^3) of waste would require 0.1 ha (0.25 acre) of disposal space at SRS. Therefore, impacts from the management of this additional LLW at SRS should not be major.

Mixed LLW may include sludges, cleaning solvents, and analytical waste (O'Connor et al. 1998e). Mixed LLW will be stabilized, packaged, and stored on the site for treatment and offsite disposal in a manner consistent with the site treatment plan for SRS. Mixed LLW generation for these activities is estimated to be less than 1 percent of existing annual site waste generation and less than 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility. Over the operating life of this facility, the 4 m^3 (5.2 yd^3) of mixed LLW expected to be generated would be less than 1 percent of the 1,900-m^3 (2,490-yd^3) capacity of the Mixed Waste Storage Buildings. Therefore, the management of this additional waste at SRS should not have a major impact on the mixed LLW management system.

Hazardous waste generated during operations would include small quantities of process ends (O'Connor et al. 1998e). Hazardous waste would be packaged for treatment and disposal at a combination of onsite and offsite permitted facilities. Assuming that all hazardous waste is managed on the site, hazardous waste generation for these activities is estimated to be less than 1 percent of existing annual site waste generation, less than 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility, and less than 1 percent of the 5,200-m^3 (6,800-yd^3) capacity of the hazardous waste storage buildings. The management of these additional hazardous wastes at SRS should not have a major impact on the hazardous waste management system.

Nonhazardous solid waste would include office and lunch room garbage, packaging materials, sewage sludges, and other industrial wastes from utility and maintenance operations (O'Connor et al. 1998e). Nonhazardous solid waste would be packaged in conformance with standard industrial practice. Recyclable solid wastes such as office paper, metal cans, and plastic and glass bottles would be sent off the site for recycling. The remaining solid sanitary waste would be sent to the Three Rivers Landfill (DOE 1998a:3-42). Nonrecyclable, nonhazardous solid waste generated by these activities is estimated to be 19 percent of existing annual site waste generation. It is unlikely that this additional waste load would have a major impact on the nonhazardous solid waste management system at SRS.

Nonhazardous liquid waste includes sanitary waste from sinks, showers, urinals and water closets, and wastewater from cooling tower blowdown (O'Connor et al. 1998e). Nonhazardous liquid waste generated for these activities is estimated to be less than 1 percent of the existing annual site waste generation, 1 percent of the 136,274-m^3/yr (178,246-yd^3/yr) capacity of the H-Area sanitary sewer, less than 1 percent of the 1,449,050-m^3/yr (1,895,357-yd^3/yr) capacity of the Central Sanitary Wastewater Treatment Facility, and within the 1,032,950-m^3/yr (1,351,099-yd^3/yr) excess capacity of the Central Sanitary Wastewater Treatment Facility (Sessions 1997). Therefore, impacts on the system should not be major.

H.6 POSTIRRADIATION EXAMINATION

This section describes the impacts on the waste management infrastructure that may occur if postirradiation examination were to occur at ANL–W or ORNL. For each site, separate sections are presented for construction and operations.

H.6.1 ANL–W

H.6.1.1 Construction

It is expected that postirradiation examination could be performed at ANL–W without the need for facility modifications that would generate waste (O'Connor et al. 1998a). Therefore, there would be no construction waste to impact the waste management infrastructure.

H.6.1.2 Operations

The waste management facilities within the postirradiation examination facilities would process, temporarily store, and ship all wastes generated. Table H–51 compares the expected waste generation rates from postirradiation examination at ANL–W with the existing generation rates for INEEL. No HLW would be generated by the postirradiation examination facilities. Depending in part on decisions in the RODs for the WM PEIS, wastes could be treated on the site or at other DOE sites or commercial facilities. Per the ROD for TRU waste issued on January 20, 1998, TRU and mixed TRU waste would be certified on the site to current WIPP waste acceptance criteria and shipped to WIPP for disposal. Per the ROD for hazardous waste issued on August 5, 1998, nonwastewater hazardous waste would continue to be treated and disposed of at offsite commercial facilities. The SPD EIS also assumes that LLW, mixed LLW, and nonhazardous waste would be treated, stored, and disposed of in accordance with current site practices. Impacts of the treatment, storage and disposal of radioactive, hazardous, and mixed wastes at INEEL are described in the *DOE Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final EIS* (DOE 1995a).

Table H–51. Potential Waste Management Impacts at INEEL of Conducting Postirradiation Examination at ANL–W

Waste Type[a]	Estimated Waste Generation (m^3/yr)[b]	Site Waste Generation (m^3/yr)[c]	Percent of Site Waste Generation
TRU[d]	3	0[e]	NA
LLW	35	2,624	1
Mixed LLW	<1	181	<1
Hazardous	<1	835	<1
Nonhazardous			
Liquid	380	2,000,000	<1
Solid	51	62,000	<1

[a] See definitions in Appendix F.8.
[b] O'Connor et al. 1998a. Values rounded to two significant figures.
[c] From the INEEL section of Chapter 3.
[d] Includes mixed TRU waste.
[e] In 1997, 2 m^3 (2.6 yd^3) of TRU wastes were generated at ANL–W (DOE 1998b:A-4).
Key: LLW, low-level waste; NA, not applicable; TRU, transuranic.

TRU wastes generated during operations would include used containers, paper and cloth wipes, fuel debris, clad pieces, and radiochemical solutions. Mixed TRU waste would include oil, solvents, and lead shielding contaminated with TRU materials (O'Connor et al. 1998a). TRU wastes would be treated, packaged, and certified to WIPP waste acceptance criteria at the postirradiation examination facilities. Liquid TRU wastes would be evaporated or solidified before being packaged for storage. Drum-gas testing, real-time radiography, and loading of the TRUPACT for shipment to WIPP would occur at the planned Waste Characterization Facility at INEEL (UC 1998c). Impacts from the treatment of TRU waste to WIPP waste acceptance criteria are described in the WM PEIS (DOE 1997b) and the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

TRU waste generation for postirradiation examination is estimated to be 3 m^3/yr (3.9 yd^3/yr), less than 1 percent of the 6,500-m^3/yr (8,500-yd^3/yr) capacity of the planned Advanced Mixed Waste Treatment Project. A total of 11 m^3 (14.4 yd^3) of waste is expected to be generated over the operations period. This would be less than 1 percent of the 177,300-m^3 (231,900-yd^3) storage capacity of the RWMC, and less than 1 percent of the 39,300 m^3 (51,404 yd^3) of contact-handled TRU waste currently in storage at INEEL. Assuming that the waste were stored in 208-l (55-gal) drums, each with a capacity of 0.21 m^3 (0.27 yd^3), approximately 52 drums would be required. Assuming that these drums can be stacked two high, and that each drum occupies an area of 0.4 m^2 (4 ft^2), and adding a 50 percent factor for aisle space, a storage area of approximately 16 m^2 (19 yd^2) would be required. Impacts of the storage of these additional quantities of TRU waste on less than 0.1 ha (0.25 acre) of land at INEEL should not be major.

The 11 m^3 (14.4 yd^3) of TRU waste generated by postirradiation examination activities would be less than 1 percent of the 143,000 m^3 (187,000 yd^3) of contact-handled TRU waste that DOE plans to dispose of at WIPP and within the 168,500-m^3 (220,400-yd^3) limit for this facility (DOE 1997d:3-3). Impacts of disposal of TRU waste at WIPP are described in the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

LLW may include wipes, used containers and equipment, clad pieces, and protective clothing (O'Connor et al. 1998a). LLW would be packaged, certified, and accumulated before being transferred for treatment or disposal in existing onsite facilities. A total of 140 m^3 (183 yd^3) of LLW would be generated over the operations period. LLW generation for these activities is estimated to be 1 percent of existing annual INEEL waste generation, less than 1 percent of the 49,610-m^3/yr (64,880-yd^3/yr) capacity of WERF, less than 1 percent of the 112,400-m^3 (146,500-yd^3) storage capacity at the RWMC, and less than 1 percent of the 37,700-m^3/yr (49,300-yd^3/yr) disposal capacity of the RWMC.

Using the 6,264-m^3/ha (3,315-yd^3/acre) disposal land usage factor for the RWMC published in the *Storage and Disposition PEIS* (DOE 1996a:E-9), 140 m^3 (183 yd^3) of waste would require less than 0.1 ha (0.25 acre) of disposal space at INEEL. Therefore, impacts of the management of this additional LLW at ANL–W and INEEL are not expected to be major. Impacts of the disposal of LLW at INEEL are described in the *DOE Programmatic Spent Nuclear Fuel Management and INEL Environmental Restoration and Waste Management Programs Final EIS* (DOE 1995a).

Mixed LLW may include small quantities of oils, solvents, and lead shielding contaminated with fission products (O'Connor et al. 1998a). Mixed LLW would be treated and disposed of in a manner consistent with the site treatment plan for ANL–W and INEEL. INEEL currently treats mixed LLW on the site and ships some mixed LLW to Envirocare of Utah. Onsite disposal is planned in a new mixed LLW disposal facility. These facilities or other treatment or disposal facilities that meet DOE criteria would be used. Mixed LLW generation for these activities is estimated to be less than 1 percent of existing annual INEEL waste generation, and less than 1 percent of the planned 6,500-m^3/yr (8,500-yd^3/yr) capacity of the Advanced Mixed Waste Treatment Project. The 1 m^3 (1.3 yd^3) of mixed LLW expected to be generated would be less than 1 percent of the 112,400-m^3 (146,500-yd^3) storage capacity of the RWMC. Therefore, the management of this additional waste would not be expected to have major impacts on the mixed LLW management systems at ANL–W or INEEL.

Hazardous waste generated during operations would include small quantities of used oils, solvents, resins, glues, and contaminated containers (O'Connor et al. 1998a). Hazardous waste would be packaged for treatment and disposal at offsite facilities. Hazardous waste generation for these activities is estimated to be less than 1 percent of existing annual INEEL waste generation, and less than 1 percent of the 1,600-m^3 (2,100-yd^3) onsite storage capacity. Therefore, impacts on the hazardous waste management systems at ANL–W or INEEL should not be major.

Nonhazardous solid waste would include paper, plastic, and metal garbage; oils; cleaners; and scrap wood and metal (O'Connor et al. 1998a). Nonhazardous solid waste would be packaged in conformance with standard industrial practice and shipped to onsite and offsite disposal and recycling facilities. Recyclable solid wastes such as office paper, metal cans, and plastic and glass bottles would be sent off the site for recycling. The remaining solid sanitary waste would be sent offsite for disposal in the Bonneville County landfill. Nonrecyclable, nonhazardous solid waste generated by these activities is estimated to be 2 percent of existing annual INEEL waste generation. This additional waste load should not have a major impact on the nonhazardous solid waste management systems at ANL–W or INEEL.

Nonhazardous liquid waste would include sanitary waste from sinks, showers, urinals, and water closets (O'Connor et al. 1998a). Nonhazardous liquid waste generation for these activities is estimated to be less than 1 percent of the existing annual INEEL waste generation, and 6 percent of the 6,057-m^3/yr (7,923-yd^3/yr) capacity of the ANL–W sewage treatment facility, and therefore would not be expected to have major impacts.

H.6.2 ORNL

H.6.2.1 Construction

It is expected that postirradiation examination could be performed at ORNL without the need for facility modifications that would generate waste (O'Connor et al. 1998a). Therefore, there would be no construction waste to impact the waste management infrastructure.

H.6.2.2 Operations

The waste management facilities within the postirradiation examination facilities would process, temporarily store, and ship all wastes generated. Table H–52 compares the expected waste generation rates from postirradiation examination at ORNL with the existing generation rates for ORR. No HLW would be generated by the postirradiation examination facilities. Depending in part on decisions in the RODs for the WM PEIS, wastes could be treated on the site or at other DOE sites or commercial facilities. Per the ROD for TRU waste issued on January 20, 1998, TRU and mixed TRU waste would be certified on the site to current WIPP waste acceptance criteria and shipped to WIPP for disposal. Per the ROD for hazardous waste issued on August 5, 1998, nonwastewater hazardous waste would continue to be treated at the TSCA Incinerator, and treated and disposed of at offsite commercial facilities. The SPD EIS also assumes that LLW, mixed LLW, and nonhazardous waste would be treated, stored, and disposed of in accordance with current site practices.

TRU wastes generated during operations would include used containers, paper and cloth wipes, fuel debris, clad pieces, and radiochemical solutions. Mixed TRU waste would include oil, solvents, and lead shielding contaminated with TRU materials. (O'Connor et al. 1998a). TRU wastes would be treated, packaged, and certified to WIPP waste acceptance criteria at the postirradiation examination facilities. Liquid TRU wastes would be evaporated or solidified before being packaged for storage. Drum-gas testing, real-time radiography, and loading of the TRUPACT for shipment to WIPP would occur at the Waste Examination and Assay Facility or the planned Waste Handling and Packaging Plant (DOE 1996a;E-72). Impacts from the treatment of TRU

Table H–52. Potential Waste Management Impacts of Conducting Postirradiation Examination at ORNL

Waste Type[a]	Estimated Waste Generation (m^3/yr)[b]	Site Waste Generation (m^3/yr)[c]	Percent of Site Waste Generation
TRU[d]	3	9	30
LLW	35	5,181	1
Mixed LLW	<1	1,122	<1
Hazardous	<1	34,048	<1
Nonhazardous			
Liquid	380	2,406,300	<1
Solid	51	49,470	<1

[a] See definitions in Appendix F.8.
[b] O'Connor et al. 1998a. Values rounded to two significant figures.
[c] Includes ORNL, Y–12 and East Tennessee Technology Park (formerly K–25). Data for radioactive wastes from DOE 1996e:15, 16. Data for hazardous and nonhazardous wastes from DOE 1996a:3-220–3-225).
[d] Includes mixed TRU waste.

Key: LLW, low-level waste; TRU, transuranic.

waste to WIPP waste acceptance criteria are described in the WM PEIS (DOE 1997b) and the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

TRU waste generation for postirradiation examination is estimated to be 3 m^3/yr (3.9 yd^3/yr), 30 percent of existing ORR waste generation and less than 1 percent of the planned 620-m^3/yr (811-yd^3/yr) capacity of the TRU Waste Treatment Plant (DOE 1996a:E-86). A total of 11 m^3 (14.4 yd^3) of waste is expected to be generated over the operations period. This would be 1 percent of the 1,760 m^3 (2,302 yd^3) of the capacity of contact-handled TRU waste storage space (DOE 1996a:3-219). Assuming that the waste were stored in 208-l (55-gal) drums, each with a capacity of 0.21 m^3 (0.27 yd^3), approximately 52 drums would be required. Assuming that these drums can be stacked two high, and that each drum occupies an area of 0.4 m^2 (4 ft^2), and adding a 50 percent factor for aisle space, a storage area of approximately 16 m^2 (19 yd^2) would be required. Impacts of the storage of these additional quantities of TRU waste on less than 0.1 ha (0.25 acre) of land at the ORR should not be major.

The 11 m^3 (14.4 yd^3) of TRU waste generated by postirradiation examination activities would be less than 1 percent of the 143,000 m^3 (187,000 yd^3) of contact-handled TRU waste that DOE plans to dispose of at WIPP and within the 168,500-m^3 (220,400-yd^3) limit for this facility (DOE 1997d:3-3). Impacts of disposal of TRU waste at WIPP are described in the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997d).

LLW may include wipes, used containers and equipment, clad pieces, and protective clothing (O'Connor et al. 1998a). Wastes would be treated and stored on the site before being transferred for onsite or offsite disposal. LLW generation for these activities is estimated to be 1 percent of existing annual ORR waste generation, and less than 1 percent of the 11,300-m^3/yr (14,780-yd^3/yr) capacity of the Waste Compactor Facility (DOE 1996a:E-86).

LLW generated at ORR is currently disposed of on the site or stored for offsite disposal at DOE's NTS or commercial disposal facilities. If the shipment of LLW for disposal were delayed, a maximum of approximately 140 m^3 (183 yd^3) of LLW may have to be stored at ORR. This would be less than 1 percent of the 51,850 m^3 (67,820 yd^3) of LLW storage capacity at ORR (DOE 1996a:3-222, 3-224). Assuming that the waste were stored in 208-l (55-gal) drums, each with a capacity of 0.21 m^3 (0.27 yd^3), about 670 drums would be required. Assuming that these drums can be stacked two high, and that each drum occupies an area of 0.4 m^2 (4 ft^2), and adding a 50 percent factor for aisle space, a storage area of about 200 m^2 (239 yd^2) would be required. Impacts of the storage of additional quantities of LLW on less than 0.1 ha (0.25 acre) of land at ORR would not be major.

As stated above, a total of 140 m^3 (183 yd^3) of LLW would be generated over the operation period. Using the 6,085-m^3/ha (3,221-yd^3/acre) disposal land usage factor for NTS published in the *Storage and Disposition PEIS* (DOE 1996a:E-9), 140 m^3 (183 yd^3) of waste would require less than 0.1 ha (0.25 acre) of disposal space at NTS or some other similar facility. Impacts at the disposal site from the use of this small area for disposal should not be major. Impacts of disposal of LLW at NTS are described in the *Final EIS for the NTS and Off-Site Locations in the State of Nevada* (DOE 1996c).

Mixed LLW may include small quantities of oils, solvents, and lead shielding contaminated with fission products (O'Connor et al. 1998a). Mixed LLW would be treated and disposed of in a manner consistent with the site treatment plan for ORR. Mixed LLW generation for these activities is estimated to be less than 1 percent of existing annual ORR waste generation, and less than 1 percent of the 15,700-m^3/yr (20,536-yd^3/yr) capacity of the TSCA incinerator (DOE 1996a:E-90). The 1 m^3 (1.3 yd^3) of mixed LLW expected to be generated would be less than 1 percent of the 231,753-m^3 (303,133-yd^3) storage capacity at ORR (DOE 1996a:3-220, 3-222, 3-224). Therefore, the management of this additional waste at ORR would not be expected to have major impacts on the mixed LLW management system.

Hazardous waste generated during operations would include small quantities of used oils, solvents, resins, glues, and contaminated containers (O'Connor et al. 1998a). Hazardous waste would be packaged for treatment and disposal at onsite and offsite facilities. Hazardous waste generation for these activities is estimated to be less than 1 percent of existing annual ORR waste generation, and less than 1 percent of the 1,051-m^3 (1,375-yd^3) onsite storage capacity (DOE 1996a:3-220, 3-222). Assuming that all the hazardous waste were to be treated at the TSCA incinerator, this additional waste would be less than 1 percent of the 15,700-m^3/yr (20,536-yd^3/yr) capacity of the system (DOE 1996a:E-90), and therefore would not be expected to have major impacts on the hazardous waste management system at ORNL or ORR.

Nonhazardous solid waste would include paper, plastic, and metal garbage; oils; cleaners; and scrap wood and metal (O'Connor et al. 1998a). Nonhazardous solid waste would be packaged in conformance with standard industrial practice and shipped to onsite and offsite disposal and recycling facilities. Recyclable solid wastes such as office paper, metal cans, and plastic and glass bottles would be sent off the site for recycling. The remaining solid sanitary waste would be disposed of in the Industrial and Sanitary Landfill located at Y–12. Nonrecyclable, nonhazardous solid waste generated by these activities is estimated to be less than 1 percent of existing annual ORR waste generation, and less than 1 percent of the 1,100,000-m^3 (1,438,800-yd^3) capacity of the Industrial and Sanitary Landfill (DOE 1996a:3-220). It is unlikely that this small additional waste load would have major impacts on the nonhazardous solid waste management system at ORNL or ORR.

Nonhazardous liquid waste would include sanitary waste from sinks, showers, urinals, and water closets (O'Connor et al. 1998a). Nonhazardous liquid waste generation for these activities is estimated to be less than 1 percent of the existing annual ORR waste generation, and less than 1 percent of the 414,000-m^3/yr (541,512-yd^3/yr) capacity of the ORNL Sanitary Wastewater Treatment Facility (DOE 1996a:3-223), and therefore would not be expected to have major impacts.

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Appendix I
Socioeconomics

This appendix presents detailed information on the potential socioeconomic impacts associated with the influx of construction workers during the construction of the proposed surplus plutonium disposition facilities as well as the workers needed to operate the proposed facilities. This information supports the socioeconomic assessments described in Chapter 4. Site-specific input data used in the evaluation of these socioeconomic impacts are provided or referenced where appropriate, including projections for employment, unemployment, population, housing units, student enrollment, teachers employed, police officers, firefighters, hospital beds, and doctors. Tables I–1 through I–40 present data[1] for the four candidate U.S. Department of Energy sites: the Hanford Site (Hanford), Idaho National Engineering and Environmental Laboratory (INEEL), the Pantex Plant (Pantex), and the Savannah River Site (SRS).

I.1 HANFORD

Table I–1. Hanford Projected Site Employment

Year	Employment	Change From Previous (%)	Change From 1997 (%)
1997	12,882	–	–
2000	10,800	-16.16	-16.16
2005	11,000	1.85	-14.61
2010	20,600	87.27	59.91
2015	12,100	-41.26	-6.07
2020	11,900	-1.65	-7.62

Source: Mecca 1997a, 1997b:Teal memo.

Table I–2. Hanford Regional Economic Area Projected Employment and Economy, 1996–2010

Regional Economic Area	1996	2000	2005	2010
Civilian labor force	344,611	369,570	393,230	418,465
Total employment	306,396	328,709	349,790	372,278
Unemployment rate (%)	11.1	11.1	11.0	11.0

Source: DOL 1999; Washington State Office of Financial Management 1995.

Table I–3. Hanford Region of Influence Projected Population, 1996–2010

County	1996	2000	2005	2010
Benton	134,359	149,100	157,549	166,476
Franklin	45,590	50,683	54,562	58,738
ROI total	179,949	199,783	212,111	225,214

Source: DOC 1997; Washington State Office of Financial Management 1995.

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[1] Table totals may not add precisely due to rounding.

Table I–4. Hanford Region of Influence Projected Number of Owner and Renter Housing Units, 1990–2010

County	1990	1996	2000	2005	2010
Benton	44,877	52,462	58,217	61,516	65,002
Franklin	13,664	16,016	17,806	19,168	20,635
ROI total	58,541	68,478	76,023	80,684	85,637

Source: DOC 1994; Washington State Office of Financial Management 1995.

Table I–5. Hanford Region of Influence Projected Student Enrollment, 1997–2010

County	1997	Capacity (%)	2000	2005	2010
Benton County	28,142	90.7	30,427	32,151	33,973
Findley	1,130	100.0	1,222	1,291	1,364
Kennewick	13,462	83.0	14,555	15,380	16,251
Kiona-Benton	1,701	100.0	1,839	1,943	2,053
Patterson	73	80.0	79	83	88
Prosser	2,794	98.0	3,021	3,192	3,373
Richland	8,982	99.5	9,711	10,262	10,843
Franklin County	10,064	97.7	10,896	11,730	12,628
Kahlotus	98	85.0	106	114	123
North Franklin	1,905	90.0	2,062	2,220	2,390
Pasco	8,048	100.0	8,713	9,380	10,098
Star School	13	65.0	14	15	16
ROI total	38,206	92.5	41,323	43,881	46,601

Source: Nemeth 1997a; Washington State Office of Financial Management 1995.

Table I–6. Hanford Region of Influence Projected Number of Teachers, 1997–2010

County	1997	Student/Teacher Ratio	2000	2005	2010
Benton County	1,785	15.8	1,930	2,039	2,154
Findley	76	14.9	82	87	92
Kennewick	822	16.4	889	939	992
Kiona-Benton	94	18.1	102	107	113
Patterson	4.5	16.2	5	5	5
Prosser	164	17.0	177	187	198
Richland	624	14.4	675	713	753
Franklin County	598	16.8	647	697	750
Kahlotus	14	7.0	15	16	18
North Franklin	132	14.4	143	154	166
Pasco	450	17.9	487	524	565
Star School	2	6.5	2	2	3
ROI total	2,383	16.0	2,577	2,736	2,905

Source: Nemeth 1997a; Washington State Office of Financial Management 1995.

Table I–7. Hanford Region of Influence Projected Number of Sworn Police Officers, 1997–2010

County	1997	2000	2005	2010
Benton	208	225	238	251
Franklin	73	79	85	92
ROI total	281	304	323	343

Source: Nemeth 1997b; Washington State Office of Financial Management 1995.

Table I–8. Hanford Region of Influence Projected Number of Firefighters, 1997–2010

County	1997	2000	2005	2010
Benton	369	399	422	445
Franklin	247	267	288	310
ROI total	616	666	710	755

Source: Nemeth 1997b; Washington State Office of Financial Management 1995.

Table I–9. Hanford Region of Influence Projected Number of Hospital Beds, 1997–2010

County	1997	2000	2005	2010
Benton	251	271	287	303
Franklin	132	143	154	166
ROI total	383	414	441	469

Source: Nemeth 1997c; Washington State Office of Financial Management 1995.

Table I–10. Hanford Region of Influence Projected Number of Doctors, 1996–2010

County	1996	2000	2005	2010
Benton	208	225	238	251
Franklin	49	53	57	61
ROI total	257	278	295	313

Source: Randolph 1997; Washington State Office of Financial Management 1995.

I.2 INEEL

Table I–11. INEEL Projected Site Employment

Year	Employment	Change From Previous (%)	Change From 1997 (%)
1997	8,291	–	–
2000	7,250	-12.56	-12.56
2005	7,250	0.00	-12.56
2010	7,250	0.00	-12.56
2015	7,250	0.00	-12.56
2020	7,250	0.00	-12.56

Source: Abbott et al. 1997.

Table I–12. INEEL Regional Economic Area Projected Employment and Economy, 1996–2010

Regional Economic Area	1996	2000	2005	2010
Civilian labor force	150,403	161,149	168,979	177,199
Total employment	143,182	153,440	169,884	168,784
Unemployment rate (%)	4.8	4.8	4.8	4.7

Source: DOL 1999; Idaho Power 1996; State of Wyoming, Administration and Information 1996.

Table I–13. INEEL Region of Influence Projected Population, 1996–2010

County	1996	2000	2005	2010
Bannock	73,608	78,600	81,808	85,147
Bingham	41,366	44,426	46,236	48,120
Bonneville	79,670	85,650	89,154	92,802
Jefferson	18,903	20,609	21,646	22,736
ROI total	213,547	229,285	238,844	248,804

Source: DOC 1997; Idaho Power 1996; State of Wyoming, Administration and Information 1996.

Table I–14. INEEL Region of Influence Projected Number of Owner and Renter Housing Units, 1990–2010

County	1990	1996	2000	2005	2010
Bannock	25,694	28,352	30,275	31,510	32,796
Bingham	12,664	14,095	15,138	15,754	16,396
Bonneville	26,049	29,036	31,215	32,493	33,822
Jefferson	5,353	6,094	6,643	6,978	7,329
ROI total	69,760	77,576	83,271	86,735	90,344

Source: DOC 1994; Idaho Power 1996; State of Wyoming, Administration and Information 1996.

Table I–15. INEEL Region of Influence Projected Student Enrollment, 1997–2010

County	1997	Capacity (%)	2000	2005	2010
Bannock County	14,673	86.5	15,413	16,042	16,697
Marsh Valley	1,609	74.0	1,690	1,759	1,831
Pocatello	13,064	88.3	13,723	14,283	14,866
Bingham County	11,248	84.7	11,867	12,350	12,853
Aberdeen	1,019	90.0	1,075	1,119	1,164
Blackfoot	4,510	90.0	4,758	4,952	5,154
Firth	1,044	88.0	1,101	1,146	1,193
Shelley	2,300	100.0	2,426	2,525	2,628
Snake River	2,375	65.0	2,506	2,608	2,714
Bonneville County	18,737	91.8	19,782	20,592	21,434
Bonneville	7,750	95.0	8,182	8,517	8,866
Idaho Falls	10,927	90.0	11,536	12,009	12,500
Swan Valley	60	50.0	63	66	69
Jefferson County	5,510	90.6	5,879	6,175	6,486
Jefferson	4,033	90.0	4,303	4,520	4,747
Ririe	750	97.0	800	840	883
West Jefferson	727	88.0	776	815	856
ROI total	50,168	88.4	52,941	55,158	57,470

Source: Idaho Power 1996; Nemeth 1997a; State of Wyoming, Administration and Information 1996.

Table I–16. INEEL Region of Influence Projected Number of Teachers, 1997–2010

County	1997	Student/Teacher Ratio	2000	2005	2010
Bannock County	822	17.9	863	899	935
Marsh Valley	113	14.2	119	124	129
Pocatello	709	18.4	745	775	807
Bingham County	619	18.2	653	680	707
Aberdeen	61	16.7	64	67	70
Blackfoot	240	18.8	253	264	274
Firth	65	16.1	69	71	74
Shelley	121	19.0	128	133	138
Snake River	132	18.0	139	145	151
Bonneville County	930	20.1	982	1,022	1,064
Bonneville	425	18.2	449	467	486
Idaho Falls	500	21.9	528	549	572
Swan Valley	5	12.0	5	5	6
Jefferson County	299	18.4	319	335	352
Jefferson	212	19.0	226	238	250
Ririe	41	18.3	44	46	48
West Jefferson	46	15.8	49	52	54
ROI total	2,670	18.8	2,817	2,936	3,059

Source: Idaho Power 1996; Nemeth 1997a; State of Wyoming, Administration and Information 1996.

Table I–17. INEEL Region of Influence Projected Number of Sworn Police Officers, 1997–2010

County	1997	2000	2005	2010
Bannock	214	225	234	244
Bingham	53	56	58	61
Bonneville	181	191	199	207
Jefferson	27	29	30	32
ROI total	475	501	521	544

Source: Idaho Power 1996; Nemeth 1997b; State of Wyoming, Administration and Information 1996.

Table I–18. INEEL Region of Influence Projected Number of Firefighters, 1997–2010

County	1997	2000	2005	2010
Bannock	179	188	196	204
Bingham	144	152	158	165
Bonneville	149	157	164	170
Jefferson	88	94	99	104
ROI total	560	591	616	643

Source: Idaho Power 1996; Nemeth 1997b; State of Wyoming, Administration and Information 1996.

Table I–19. INEEL Region of Influence Projected Number of Hospital Beds, 1997–2010

County	1997	2000	2005	2010
Bannock	413	434	451	470
Bingham	254	268	279	290
Bonneville	312	329	343	357
Jefferson	–	–	–	–
ROI total	978	1,031	1,073	1,117

Source: Idaho Power 1996; Nemeth 1997c; State of Wyoming, Administration and Information 1996.

Table I–20. INEEL Region of Influence Projected Number of Doctors, 1996–2010

County	1996	2000	2005	2010
Bannock	139	146	152	158
Bingham	22	23	24	25
Bonneville	163	172	179	186
Jefferson	5	5	6	6
ROI total	329	347	361	375

Source: Idaho Power 1996; Randolph 1997; State of Wyoming, Administration and Information 1996.

I.3 PANTEX

Table I–21. Pantex Projected Site Employment

Year	Employment	Change From Previous (%)	Change From 1997 (%)
1997	2,944	–	–
2000	2,500	-15.08	-15.08
2005	1,750	-30.00	-40.56
2010	1,750	0.00	-40.56
2015	1,750	0.00	-40.56
2020	1,750	0.00	-40.56

Source: Mason & Hanger Corporation 1997.

Table I–22. Pantex Regional Economic Area Projected Employment and Economy, 1996–2010

Regional Economic Area	1996	2000	2005	2010
Civilian labor force	234,702	243,043	253,140	263,768
Total employment	223,237	231,799	241,453	251,614
Unemployment rate (%)	4.6	4.6	4.6	4.6

Source: DOC 1997; DOL 1999; Texas State Data Center 1996; University of New Mexico 1997.

Table I–23. Pantex Region of Influence Projected Population, 1996–2010

County	1996	2000	2005	2010
Carson	6,714	6,758	6,843	6,929
Potter	108,636	113,692	119,023	124,603
Randall	97,379	102,841	108,810	115,126
ROI total	212,729	223,291	234,676	246,658

Source: DOC 1997; Texas State Data Center 1996; University of New Mexico 1997.

Table I–24. Pantex Region of Influence Projected Number of Owner and Renter Housing Units, 1990–2010

County	1990	1996	2000	2005	2010
Carson	2,856	2,884	2,903	2,939	2,976
Potter	42,927	45,959	48,098	50,353	52,173
Randall	37,807	41,032	43,333	45,849	48,510
ROI total	83,590	89,875	94,334	99,141	104,200

Source: DOC 1994, 1997; Texas State Data Center 1996; University of New Mexico 1997.

Table I–25. Pantex Region of Influence Projected Student Enrollment, 1997–2010

County	1997	Capacity (%)	2000	2005	2010
Carson County	860	76.4	864	875	886
Groom	195	55.7	196	198	201
Panhandle	125	85.0	126	127	129
White Deer	540	86.0	543	549	556
Potter County	31,707	98.8	32,807	34,346	35,956
Amarillo	29,023	100.0	30,030	31,458	32,912
Bushland	447	85.1	463	484	507
Highland Park	787	85.0	814	852	892
River Road	1,450	90.0	1,500	1,571	1,644
Randall County	7,249	100.0	7,552	7,990	8,454
Canyon	7,249	100.0	7,552	7,990	8,454
ROI total	39,816	98.4	41,224	43,211	45,296

Source: DOC 1997; Nemeth 1997a; Texas State Data Center 1996; University of New Mexico 1997.

Table I–26. Pantex Region of Influence Projected Number of Teachers, 1997–2010

County	1997	Student/Teacher Ratio	2000	2005	2010
Carson County	106	8.2	108	111	115
Groom	20	10.0	20	20	20
Panhandle	59	2.1	61	64	67
White Deer	27	20.0	27	27	28
Potter County	2,122	14.9	2,196	2,299	2,406
Amarillo	1,913	15.2	1,979	2,072	2,169
Bushland	35	12.8	36	38	40
Highland Park	54	14.6	56	58	61
River Road	120	12.1	124	130	136
Randall County	436	16.6	454	481	508
Canyon	436	16.6	454	481	508
ROI total	2,664	14.9	2,758	2,890	3,030

Source: DOC 1997; Nemeth 1997a; Texas State Data Center 1996; University of New Mexico 1997.

Table I–27. Pantex Region of Influence Projected Number of Sworn Police Officers, 1997–2010

County	1997	2000	2005	2010
Carson	16	16	16	16
Potter	445	460	482	505
Randall	81	84	89	94
ROI total	542	560	587	615

Source: DOC 1997; Nemeth 1997b; Texas State Data Center 1996; University of New Mexico 1997.

Table I–28. Pantex Region of Influence Projected Number of Firefighters, 1997–2010

County	1997	2000	2005	2010
Carson	88	88	90	91
Potter	288	298	312	327
Randall	111	116	122	129
ROI total	487	502	524	547

Source: DOC 1997; Nemeth 1997b; Texas State Data Center 1996; University of New Mexico 1997.

Table I–29. Pantex Region of Influence Projected Number of Hospital Beds, 1997–2010

County	1997	2000	2005	2010
Carson	–	–	–	–
Potter	1,208	1,250	1,309	1,370
Randall	52	54	57	61
ROI total	1,260	1,304	1,366	1,431

Source: DOC 1997; Nemeth 1997c; Texas State Data Center 1996; University of New Mexico 1997.

Table I–30. Pantex Region of Influence Projected Number of Doctors, 1996–2010

County	1996	2000	2005	2010
Carson	–	–	–	–
Potter	515	533	558	584
Randall	16	17	18	19
ROI total	531	550	576	603

Source: DOC 1997; Randolph 1997; Texas State Data Center 1996; University of New Mexico 1997.

I.4 SRS

Table I–31. SRS Projected Employment

Year	Employment	Change From Previous (%)	Change From 1997 (%)
1997	15,032	–	–
2000	14,000	-6.87	-6.87
2005	12,000	-14.29	-20.17
2010	10,000	-16.67	-33.48
2015	10,000	0.00	-33.48
2020	10,000	0.00	-33.48

Source: Knox 1997.

Table I–32. SRS Regional Economic Area Projected Employment and Economy, 1996–2010

Regional Economic Area	1996	2000	2005	2010
Civilian labor force	257,101	272,378	287,049	302,663
Total employment	237,611	251,830	265,486	280,022
Unemployment rate (%)	7.6	7.5	7.5	7.5

Source: DOC 1997; DOL 1999; Georgia Institute of Technology 1997; South Carolina Budget & Control Board 1997.

Table I–33. SRS Region of Influence Projected Population, 1996–2010

County	1996	2000	2005	2010
Aiken	133,130	143,167	154,965	167,735
Barnwell	21,640	22,512	23,107	23,718
Columbia	86,173	97,936	104,636	111,795
Edgefield	19,051	19,786	20,318	20,864
Richmond	193,784	202,466	213,133	224,363
ROI total	453,778	485,867	516,159	548,475

Source: DOC 1997; Georgia Institute of Technology 1997; South Carolina Budget & Control Board 1997.

Table I–34. SRS Region of Influence Projected Number of Owner and Renter Housing Units, 1990–2010

County	1990	1996	2000	2005	2010
Aiken	49,266	54,941	59,083	63,952	69,222
Barnwell	7,854	8,334	8,669	8,899	9,134
Columbia	23,745	28,769	32,697	34,933	37,323
Edgefield	7,290	7,716	8,014	8,229	8,450
Richmond	77,288	82,540	86,238	90,781	95,564
ROI total	165,433	182,300	194,701	206,795	219,694

Source: DOC 1994, 1997; Georgia Institute of Technology 1997; South Carolina Budget & Control Board 1997.

Table I–35. SRS Region of Influence Projected Student Enrollment, 1997–2010

County	1997	Capacity (%)	2000	2005	2010
Aiken County	24,830	100.0	26,221	28,382	30,721
Barnwell County	5,055	92.6	5,207	5,345	5,486
District 45	2,770	99.0	2,854	2,929	3,007
District 19	1,230	85.0	1,267	1,300	1,335
District 29	1,055	87.0	1,087	1,115	1,145
Columbia County	18,178	100.0	20,009	21,378	22,840
Edgefield County	4,100	95.0	4,218	4,331	4,448
Richmond County	36,841	125.0	38,072	40,078	42,190
ROI total	89,004	108.2	93,728	99,514	105,685

Source: DOC 1997; Georgia Institute of Technology 1997; Nemeth 1997a; South Carolina Budget & Control Board 1997.

Table I–36. SRS Region of Influence Projected Number of Teachers, 1997–2010

County	1997	Student/Teacher Ratio	2000	2005	2010
Aiken County	1,343	18.5	1,418	1,535	1,662
Barnwell County	304	16.6	313	321	330
District 45	115	24.1	118	122	125
District 19	82	15.0	84	87	89
District 29	107	9.9	110	113	116
Columbia County	1,085	16.8	1,194	1,276	1,363
Edgefield County	312	13.1	321	330	338
Richmond County	2,159	17.1	2,231	2,349	2,472
ROI total	5,203	17.1	5,478	5,811	6,166

Source: DOC 1997; Georgia Institute of Technology 1997; Nemeth 1997a; South Carolina Budget & Control Board 1997.

Table I–37. SRS Region of Influence Projected Number of Sworn Police Officers, 1997–2010

County	1997	2000	2005	2010
Aiken	243	257	278	301
Barnwell	45	46	48	49
Columbia	170	187	200	214
Edgefield	43	44	45	47
Richmond	472	488	513	541
ROI total	973	1,022	1,084	1,150

Source: DOC 1997; Georgia Institute of Technology 1997; Nemeth 1997b; South Carolina Budget & Control Board 1997.

Table I–38. SRS Region of Influence Projected Number of Firefighters, 1997–2010

County	1997	2000	2005	2010
Aiken	875	924	1,000	1,083
Barnwell	130	134	137	141
Columbia	245	270	288	308
Edgefield	150	154	158	163
Richmond	312	322	339	357
ROI total	1,712	1,804	1,924	2,052

Source: DOC 1997; Georgia Institute of Technology 1997; Nemeth 1997b; South Carolina Budget & Control Board 1997.

Table I–39. SRS Region of Influence Projected Number of Hospital Beds, 1997–2010

County	1997	2000	2005	2010
Aiken	225	238	257	278
Barnwell	53	55	56	58
Columbia	–	–	–	–
Edgefield	40	41	42	43
Richmond	3,190	3,297	3,470	3,653
ROI total	3,508	3,630	3,826	4,032

Source: DOC 1997; Georgia Institute of Technology 1997; Nemeth 1997c; South Carolina Budget & Control Board 1997.

Table I–40. SRS Region of Influence Projected Number of Doctors, 1996–2010

County	1996	2000	2005	2010
Aiken	179	189	205	221
Barnwell	11	11	12	12
Columbia	297	327	349	373
Edgefield	13	13	14	14
Richmond	1,222	1,263	1,329	1,399
ROI total	1,722	1,803	1,909	2,020

Source: DOC 1997; Georgia Institute of Technology 1997; Randolph 1997; South Carolina Budget & Control Board 1997.

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Appendix J
Human Health Risks

This appendix presents detailed information on the potential impacts to humans associated with incident-free (normal) releases of radioactivity from the proposed surplus plutonium disposition facilities. This information supports the human health risk assessments described in Chapter 4. In addition, site-specific input data used in the evaluation of these human health impacts are also provided or referenced where appropriate. The proposed facilities would be at one or more of four candidate U.S. Department of Energy (DOE) sites: the Hanford Site (Hanford), Idaho National Engineering and Environmental Laboratory (INEEL), the Pantex Plant (Pantex), and the Savannah River Site (SRS). Information is also presented on the human health impacts of mixed oxide (MOX) fuel lead assembly fabrication activities at five potential DOE sites: Argonne National Laboratory–West (ANL–W) at INEEL, Hanford, Lawrence Livermore National Laboratory (LLNL), Los Alamos National Laboratory (LANL), and SRS.

J.1 HANFORD

J.1.1 Assessment Data

To perform the dose assessments for the *Surplus Plutonium Disposition Environmental Impact Statement* (SPD EIS), different types of data were collected and generated. In addition, calculational assumptions were made. Appendix F.10 provides a summary of the methods and tools (e.g., the GENII computer code) used for the assessments.

J.1.1.1 Meteorological Data

The meteorological data used for the Hanford dose assessments was in the form of a joint frequency data (JFD) file. A JFD file is a table that lists the percentages of time the wind blows in a certain direction, at a certain speed, and within a certain stability class. The JFD file was based on measurements taken over a period of several years at a specific location and height. Average annual meteorological conditions, averaged over the measurement period, were used for normal operations. Table J–1 presents the JFD used in the dose assessments for Hanford.

J.1.1.2 Population Data

The Hanford population distribution was based on the *1990 Census of Population and Housing Data* (DOC 1992). Projections were determined for the year 2010 (about midlife of operations) for areas within 80 km (50 mi) of the locations for the proposed surplus plutonium disposition facilities. The site population in 2010 was assumed to be representative of the population over the operational period evaluated. The population was spatially distributed on a circular grid with 16 directions and 10 radial distances out to an 80-km (50-mi) distance. The grid was centered at the Fuels and Materials Examination Facility (FMEF) in the 400 Area, the location from which radionuclides are assumed to be released during incident-free operations. Table J–2 presents the population data used for the dose assessments at Hanford.

J.1.1.3 Agricultural Data

The 1987 Census of Agriculture was the source used to generate site-specific data for food production. Food production was spatially distributed on a circular grid similar to that used for the population distribution described previously. This food grid (or wheel) was generated by combining the fraction of a county in each segment (e.g., south, southwest, north-northeast) and the county production of the eight food categories analyzed by GENII—leafy vegetables, root vegetables, fruits, grains, beef, poultry, milk, and eggs. Each

Table J–1. Hanford 1983–1991 Joint Frequency Distributions at 61-m Height

Wind Speed (m/s)	Stability Class	Wind Blows Toward															
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE
0.89	A	0.12	0.1	0.08	0.11	0.14	0.15	0.1	0.08	0.14	0.08	0.05	0.06	0.07	0.05	0.05	0.07
	B	0.05	0.05	0.05	0.05	0.06	0.05	0.04	0.03	0.07	0.03	0.02	0.02	0.03	0.02	0.03	0.03
	C	0.06	0.04	0.04	0.04	0.06	0.04	0.07	0.05	0.04	0.04	0.03	0.01	0.05	0.03	0.04	0.04
	D	0.32	0.23	0.2	0.18	0.25	0.26	0.24	0.28	0.36	0.26	0.19	0.15	0.22	0.19	0.22	0.21
	E	0.19	0.14	0.1	0.1	0.13	0.13	0.14	0.19	0.37	0.22	0.18	0.17	0.23	0.19	0.19	0.19
	F	0.22	0.14	0.1	0.09	0.13	0.11	0.15	0.2	0.34	0.2	0.2	0.12	0.2	0.14	0.16	0.16
	G	0.13	0.08	0.06	0.03	0.06	0.07	0.07	0.18	0.22	0.13	0.09	0.07	0.12	0.09	0.12	0.09
2.7	A	0.32	0.28	0.28	0.28	0.39	0.37	0.37	0.34	0.55	0.32	0.16	0.09	0.17	0.13	0.13	0.15
	B	0.12	0.09	0.08	0.06	0.12	0.07	0.1	0.11	0.15	0.12	0.05	0.05	0.05	0.04	0.06	0.07
	C	0.13	0.08	0.08	0.05	0.09	0.08	0.1	0.11	0.16	0.08	0.04	0.03	0.05	0.03	0.06	0.08
	D	0.58	0.41	0.37	0.26	0.38	0.33	0.46	0.59	0.85	0.49	0.25	0.15	0.33	0.36	0.47	0.41
	E	0.32	0.2	0.19	0.12	0.21	0.21	0.25	0.45	0.68	0.46	0.31	0.24	0.37	0.29	0.38	0.33
	F	0.35	0.23	0.15	0.07	0.12	0.09	0.18	0.36	0.64	0.31	0.23	0.16	0.18	0.18	0.23	0.22
	G	0.18	0.12	0.06	0.03	0.04	0.04	0.08	0.2	0.3	0.16	0.1	0.04	0.08	0.1	0.15	0.16
4.7	A	0.39	0.31	0.21	0.1	0.13	0.13	0.15	0.19	0.77	0.51	0.17	0.13	0.19	0.15	0.16	0.17
	B	0.14	0.09	0.06	0.04	0.04	0.04	0.04	0.07	0.2	0.16	0.06	0.04	0.03	0.02	0.06	0.06
	C	0.1	0.1	0.06	0.03	0.03	0.03	0.04	0.06	0.16	0.16	0.04	0.02	0.05	0.04	0.06	0.07
	D	0.59	0.38	0.26	0.14	0.16	0.14	0.32	0.55	0.97	0.75	0.27	0.15	0.34	0.46	0.63	0.55
	E	0.41	0.21	0.15	0.09	0.1	0.11	0.28	0.6	1.02	0.71	0.37	0.27	0.5	0.53	0.6	0.43
	F	0.37	0.22	0.11	0.06	0.07	0.06	0.17	0.48	0.73	0.44	0.21	0.11	0.16	0.2	0.37	0.29
	G	0.19	0.11	0.05	0.02	0.02	0.01	0.04	0.19	0.26	0.14	0.06	0.02	0.04	0.07	0.19	0.13
7.2	A	0.22	0.17	0.08	0.02	0.02	0.01	0.03	0.05	0.32	0.63	0.28	0.17	0.23	0.11	0.19	0.15
	B	0.07	0.05	0.01	0.01	0	0	0.02	0.01	0.1	0.22	0.06	0.05	0.05	0.03	0.07	0.03
	C	0.04	0.05	0.02	0.01	0	0.01	0.02	0.02	0.07	0.18	0.06	0.04	0.03	0.03	0.05	0.04
	D	0.27	0.19	0.09	0.04	0.02	0.04	0.1	0.25	0.65	0.86	0.37	0.2	0.29	0.5	0.75	0.4
	E	0.27	0.18	0.07	0.02	0.02	0.04	0.15	0.43	0.73	0.74	0.34	0.2	0.39	0.73	0.94	0.44
	F	0.21	0.14	0.06	0.02	0.02	0.01	0.09	0.33	0.52	0.39	0.14	0.07	0.09	0.16	0.45	0.26
	G	0.13	0.08	0.04	0.01	0.01	0.01	0.03	0.11	0.19	0.13	0.04	0.02	0.01	0.04	0.14	0.13

Table J–1. Hanford 1983–1991 Joint Frequency Distributions at 61-m Height (Continued)

Wind Speed (m/s)	Stability Class	Wind Blows Toward															
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE
9.8	A	0.05	0.05	0.03	0.01	0	0	0	0.01	0.08	0.29	0.21	0.12	0.12	0.08	0.12	0.04
	B	0.02	0.01	0.01	0	0	0	0	0	0.02	0.08	0.04	0.04	0.04	0.02	0.03	0.02
	C	0.02	0.02	0.01	0	0	0	0	0.01	0.02	0.08	0.06	0.03	0.03	0.03	0.03	0.01
	D	0.09	0.08	0.02	0.01	0	0.01	0.03	0.04	0.24	0.58	0.32	0.16	0.19	0.33	0.57	0.14
	E	0.1	0.12	0.04	0.01	0	0.01	0.06	0.17	0.37	0.51	0.26	0.13	0.17	0.43	0.73	0.22
	F	0.1	0.11	0.03	0.01	0.01	0	0.03	0.14	0.21	0.2	0.07	0.02	0.03	0.08	0.23	0.16
	G	0.05	0.04	0.02	0	0	0	0.01	0.07	0.09	0.05	0.03	0	0	0.02	0.1	0.07
13.0	A	0.01	0.02	0	0	0	0	0	0	0.02	0.09	0.1	0.1	0.08	0.03	0.07	0.01
	B	0	0.01	0	0	0	0	0	0	0.01	0.03	0.04	0.04	0.02	0.01	0.03	0.01
	C	0	0.01	0	0	0	0	0	0	0.01	0.02	0.04	0.02	0.02	0.01	0.02	0.01
	D	0.03	0.03	0.01	0	0	0	0.01	0.02	0.07	0.27	0.24	0.12	0.09	0.19	0.32	0.05
	E	0.04	0.08	0.03	0.01	0	0	0.02	0.05	0.13	0.32	0.25	0.1	0.07	0.2	0.33	0.07
	F	0.04	0.05	0.02	0.01	0	0	0.02	0.06	0.08	0.13	0.05	0.01	0.01	0.02	0.1	0.06
	G	0.01	0.01	0	0	0	0	0	0.02	0.02	0.03	0.01	0	0	0.01	0.05	0.04
16.0	A	0	0.01	0	0	0	0	0	0	0	0.02	0.06	0.03	0.02	0.01	0.01	0
	B	0	0.01	0	0	0	0	0	0	0	0.01	0.02	0.01	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0.01	0.02	0.01	0.01	0	0.01	0
	D	0.02	0.03	0.01	0.01	0	0	0	0.01	0.01	0.11	0.19	0.06	0.03	0.06	0.1	0.01
	E	0.01	0.04	0.03	0	0	0	0.01	0.02	0.05	0.16	0.16	0.04	0.02	0.04	0.09	0.01
	F	0.01	0.03	0	0	0	0	0	0.03	0.04	0.05	0.02	0	0.01	0	0.01	0.02
	G	0	0	0	0	0	0	0	0.02	0.02	0.02	0	0	0	0	0.02	0
19.0	A	0.02	0.03	0	0	0	0	0	0	0	0.01	0.05	0.01	0.01	0	0.01	0
	B	0	0.03	0	0	0	0	0	0	0	0	0.02	0	0	0	0	0
	C	0.01	0.02	0	0	0	0	0	0	0	0	0.03	0	0	0	0	0
	D	0.03	0.09	0	0	0	0	0	0	0	0.09	0.22	0.04	0.03	0.01	0.02	0
	E	0.03	0.1	0.02	0	0	0	0	0.02	0.02	0.1	0.14	0.02	0.01	0.01	0.01	0
	F	0.02	0.04	0.01	0	0	0	0	0.03	0.03	0.04	0.02	0	0	0	0.01	0
	G	0	0.01	0	0	0	0	0	0.02	0.02	0.02	0	0	0	0	0.01	0

Source: Neitzel 1996.

county's food production was assumed to be distributed uniformly over the given county's land area. These categorized food wheels were then used in the assessment of doses to the Hanford population from the ingestion pathway. The consumption rates used in the dose assessments were those for the maximally exposed individual (MEI) and average exposed individual. People living within the 80-km (50-mi) assessment area were assumed to consume only food grown in that area. Hanford food production and consumption data used for the dose assessments in the SPD EIS were obtained from the *Health Risk Data for Storage and Disposition Final PEIS* (HNUS 1996).

Table J–2. Projected Hanford Population Surrounding FMEF for Year 2010

Direction	Distance (mi)										Total
	0–1	**1–2**	**2–3**	**3–4**	**4–5**	**5–10**	**10–20**	**20–30**	**30–40**	**40–50**	
S	0	0	0	0	0	4,265	44,747	1,141	7,041	19,608	**76,802**
SSW	0	0	0	0	2	1,515	2,758	438	2,976	3,951	**11,640**
SW	0	0	0	0	42	1,388	4,788	316	227	2,047	**8,808**
WSW	0	0	0	0	0	54	2,387	17,154	3,588	325	**23,508**
W	0	0	0	0	0	0	766	6,201	28,142	15,966	**51,075**
WNW	0	0	0	0	0	0	5	879	1,233	9,074	**11,191**
NW	0	0	0	0	0	0	0	645	411	178	**12,34**
NNW	0	0	0	0	0	0	0	1,097	1,437	1,491	**4,025**
N	0	0	0	0	0	0	0	1,153	3,773	2,749	**7,675**
NNE	0	0	0	0	0	18	468	5,523	1,514	25,879	**33,402**
NE	0	0	0	0	0	95	827	7,348	3,019	1,256	**12,545**
ENE	0	0	0	0	0	345	1,544	3,737	423	446	**6,495**
E	0	0	0	0	0	425	948	451	351	327	**2,502**
ESE	0	0	0	0	0	434	655	347	266	326	**2,028**
SE	0	0	0	0	0	419	1,313	1,736	396	1,459	**5,323**
SSE	0	0	0	0	0	6,989	87,249	33,689	608	986	**129,521**
Total	**0**	**0**	**0**	**0**	**44**	**15,947**	**148,455**	**81,855**	**55,405**	**86,068**	**387,774**

Key: FMEF, Fuels and Materials Examination Facility.
Source: DOC 1992.

J.1.1.4 Source Term Data

Estimated incident-free radiological releases associated with the pit conversion, immobilization, and MOX facilities are presented in Tables J–3 through J–5. Stack heights and release locations are provided in the facility data reports (DOE 1999; UC 1998a, 1998b, 1999a, 1999b).

Table J–3. Estimated Incident-Free Annual Radiological Releases From the Pit Conversion Facility at Hanford

Isotope	(μCi/yr)
Plutonium 236	9.3×10^{-11}
Plutonium 238	0.065
Plutonium 239	0.69
Plutonium 240	0.18
Plutonium 241	0.69
Plutonium 242	4.8×10^{-5}
Americium 241	0.37
Hydrogen 3	1.1×10^{9}

Source: UC 1998a.

Table J–4. Estimated Incident-Free Annual Radiological Releases From the Immobilization Facility at Hanford

Isotope	Ceramic (17 t) (μCi/yr)	Ceramic (50 t) (μCi/yr)	Glass (17 t) (μCi/yr)	Glass (50 t) (μCi/yr)
Plutonium 236	–	–	–	–
Plutonium 238	–	0.57	–	0.52
Plutonium 239	3.7	9.5	3.4	8.6
Plutonium 240	1.7	3.1	1.6	2.8
Plutonium 241	110	100	98	93
Plutonium 242	1.3×10^{-3}	1.6×10^{-3}	1.2×10^{-3}	1.5×10^{-3}
Americium 241	2.3	5.4	2.2	5.0
Uranium 234	–	–	–	–
Uranium 235	1.1×10^{-5}	4.5×10^{-5}	2.3×10^{-6}	2.3×10^{-6}
Uranium 238	8.8×10^{-5}	3.5×10^{-4}	1.9×10^{-5}	1.9×10^{-5}

Source: UC 1999a, 1999b.

Table J–5. Estimated Incident-Free Annual Radiological Releases From the MOX Facility at Hanford

Isotope	(μCi/yr)
Plutonium 236	1.3×10^{-8}
Plutonium 238	8.5
Plutonium 239	91
Plutonium 240	23
Plutonium 241	101
Plutonium 242	6.1×10^{-3}
Americium 241	48
Uranium 234	5.1×10^{-3}
Uranium 235	2.1×10^{-4}
Uranium 238	0.012

Source: UC 1998b.

J.1.1.5 Other Calculational Assumptions

To estimate radiological impacts of incident-free operation of the proposed facilities at Hanford, the following additional assumptions and factors were considered, in accordance with the guidelines established in U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide 1.109 (NRC 1977).

> Ground surfaces were assumed to have no previous deposition of radionuclides for the purposes of modeling the incremental radiological impacts associated with surplus plutonium disposition activities. However, doses associated with true instances of prior deposition are accounted for in the Affected Environment and Cumulative Impacts sections.
>
> The annual external exposure time to the plume and to soil contamination was 0.7 year for the MEI (NRC 1977).
>
> The annual external exposure time to the plume and to soil contamination was 0.5 year for the population (NRC 1977).

The annual inhalation exposure time to the plume was 1 year for the MEI and general population (NRC 1977).

The exposed individual or population was assumed to have the characteristics and habits (e.g., inhalation and ingestion rates) of the adult human.

A semi-infinite/finite plume model was used for air immersion doses. Other pathways evaluated were ground exposure, inhalation, ingestion of food crops, and ingestion of contaminated animal products. Drinking water, aquatic food ingestion, and any other pathway that may involve liquid exposure were not examined because all releases are to the air.

Reported stack heights were used for atmospheric releases. The resultant doses were conservative as use of the actual stack height instead of the effective stack height negates plume rise.

The calculated doses are 50-year committed doses from 1 year of intake.

J.1.2 Facilities

The following sections present all viable radiological impact scenarios that could be associated with different combinations of incident-free facility operations at Hanford.

J.1.2.1 Pit Conversion Facility

J.1.2.1.1 Construction of Pit Conversion Facility

No radiological risk would be incurred by members of the public from construction and modification of a pit conversion facility at Hanford. According to recent surveys conducted in the 400 Area, a construction worker would not be expected to receive any additional dose above natural background levels (Antonio 1998). Nonetheless, if deemed necessary, workers may be monitored (badged) as a precautionary measure.

J.1.2.1.2 Operation of Pit Conversion Facility

Tables J–6 and J–7 present the incident-free radiological impacts of the operation of a pit conversion facility at Hanford.

Table J–6. Potential Radiological Impacts on the Public of Operation of Pit Conversion Facility in FMEF at Hanford

Population within 80 km for year 2010	
Dose (person-rem)	6.9
Percent of natural background[a]	5.9×10^{-3}
10-year latent fatal cancers	0.034
Maximally exposed individual	
Annual dose (mrem)	0.017
Percent of natural background[a]	5.7×10^{-3}
10-year latent fatal cancer risk	8.5×10^{-8}
Average exposed individual within 80 km[b]	
Annual dose (mrem)	0.017
10-year latent fatal cancer risk	8.5×10^{-8}

[a] The annual natural background radiation level at Hanford is 300 mrem for the average individual; the population within 80 km (50 mi) in 2010 would receive 116,300 person-rem.

[b] Obtained by dividing the population dose by the number of people projected to live within 80 km (50 mi) of Hanford in 2010 (387,800).

Key: FMEF, Fuels and Materials Examination Facility.

Source: Model results.

Table J–7. Potential Radiological Impacts on Involved Workers of Operation of Pit Conversion Facility in FMEF at Hanford

Number of badged workers	383
Total dose (person-rem/yr)	192
10-year latent fatal cancers	0.77
Average worker dose (mrem/yr)	500
10-year latent fatal cancer risk	2.0×10^{-3}

Key: FMEF, Fuels and Materials Examination Facility.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995). However, the maximum dose to a worker involved in operations would be kept below the DOE administrative control level of 2,000 mrem/yr (DOE 1994). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

J.1.2.2 Immobilization Facility

J.1.2.2.1 Construction of Immobilization Facility

No radiological risk would be incurred by members of the public from the construction and modification of an immobilization (ceramic or glass) facility at Hanford. According to recent radiation surveys conducted in the 400 Area, a construction worker would not be expected to receive any additional dose above natural background levels (Antonio 1998). Nonetheless, if deemed necessary, workers may be monitored (badged) as a precautionary measure.

J.1.2.2.2 Operation of Immobilization Facility

Tables J–8 and J–9 present all possible incident-free radiological impact scenarios for the operation of a ceramic or glass immobilization facility at Hanford.

Table J–8. Potential Radiological Impacts on the Public of Operation of Immobilization Facility in FMEF at Hanford

Impact	17 t		50 t	
	Ceramic	Glass	Ceramic	Glass
Population within 80 km for year 2010				
Dose (person-rem)	7.8×10^{-3}	7.1×10^{-3}	0.016	0.015
Percent of natural background[a]	6.7×10^{-6}	6.1×10^{-6}	1.4×10^{-5}	1.3×10^{-5}
10-year latent fatal cancers	3.9×10^{-5}	3.6×10^{-5}	8.0×10^{-5}	7.5×10^{-5}
Maximally exposed individual				
Annual dose (mrem)	1.1×10^{-4}	9.7×10^{-5}	2.2×10^{-4}	2.0×10^{-4}
Percent of natural background[a]	3.7×10^{-5}	3.2×10^{-5}	7.3×10^{-5}	6.7×10^{-5}
10-year latent fatal cancer risk	5.5×10^{-10}	4.9×10^{-10}	1.1×10^{-9}	1.0×10^{-9}
Average exposed individual within 80 km[b]				
Annual dose (mrem)	2.0×10^{-5}	1.8×10^{-5}	4.1×10^{-5}	3.9×10^{-5}
10-year latent fatal cancer risk	1.0×10^{-10}	9.0×10^{-11}	2.1×10^{-10}	2.0×10^{-10}

[a] The annual natural background radiation level at Hanford is 300 mrem for the average individual; the population within 80 km (50 mi) in 2010 would receive 116,300 person-rem.

[b] Obtained by dividing the population dose by the number of people projected to live within 80 km (50 mi) of Hanford in 2010 (387,800).

Key: FMEF, Fuels and Materials Examination Facility.

Source: Model results.

Table J–9. Potential Radiological Impacts on Involved Workers of Operation of Immobilization Facility in FMEF at Hanford[a]

Impact	17 t		50 t	
	Ceramic	Glass	Ceramic	Glass
Number of badged workers	365	365	397	397
Total dose (person-rem/yr)	274	274	298	298
10-year latent fatal cancers	1.1	1.1	1.2	1.2
Average worker dose (mrem/yr)	750	750	750	750
10-year latent fatal cancer risk	3.0×10^{-3}	3.0×10^{-3}	3.0×10^{-3}	3.0×10^{-3}

[a] The presented values are representative of the largest possible number of workers regardless of collocation considerations.

Key: FMEF, Fuels and Materials Examination Facility.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995). However, the maximum dose to a worker involved in operations would be kept below the DOE administrative control level of 2,000 mrem/yr (DOE 1994). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: UC 1999a, 1999b.

J.1.2.3 MOX Facility

J.1.2.3.1 Construction of MOX Facility

No radiological risk would be incurred by members of the public from the construction and modification of a MOX facility at Hanford. According to recent radiation surveys conducted in the 400 Area, a construction worker would not be expected to receive any additional dose above natural background levels (Antonio 1998). Nonetheless, if deemed necessary, workers may be monitored (badged) as a precautionary measure.

J.1.2.3.2 Operation of MOX Facility

Tables J–10 and J–11 present the incident-free radiological impacts of the operation of a MOX facility at Hanford. The facility would either be located within the existing FMEF or a new facility would be built adjacent to FMEF.

Table J–10. Potential Radiological Impacts on the Public of Operation of MOX Facility in FMEF or New Construction at Hanford

Impact	FMEF[a]	New[a]
Population dose within 80 km for year 2010		
Dose (person-rem)	0.14	0.29
Percent of natural background[b]	1.2×10^{-4}	2.5×10^{-4}
10-year latent fatal cancers	6.9×10^{-4}	1.5×10^{-3}
Maximally exposed individual		
Annual dose (mrem)	1.8×10^{-3}	4.8×10^{-3}
Percent of natural background[b]	6.1×10^{-4}	1.6×10^{-3}
10-year latent fatal cancer risk	9.3×10^{-9}	2.4×10^{-8}
Average exposed individual within 80 km[c]		
Annual dose (mrem)	3.5×10^{-4}	7.5×10^{-4}
10-year latent fatal cancer risk	1.7×10^{-9}	3.7×10^{-9}

[a] The difference in impacts is attributable to different stack heights. As described in Section 4.26.1.2.2, Water Resources, no component was attributed to liquid pathways because it is not expected that significant contamination could reach these pathways given the site's groundwater and surface-water characteristics.

[b] The annual natural background radiation level at Hanford is 300 mrem for the average individual; the population within 80 km (50 mi) in 2010 would receive 116,300 person-rem.

[c] Obtained by dividing the population dose by the number of people projected to live within 80 km (50 mi) of Hanford in 2010 (387,800).

Key: FMEF, Fuels and Materials Examination Facility.

Source: Model results.

Table J–11. Potential Radiological Impacts on Involved Workers of Operation of MOX Facility in FMEF or New Construction at Hanford

Number of badged workers	331
Total dose (person-rem/yr)	22
10-year latent fatal cancers	0.088
Average worker dose (mrem/yr)	65
10-year latent fatal cancer risk	2.6×10^{-4}

Key: FMEF, Fuels and Materials Examination Facility.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995). However, the maximum dose to a worker involved in operations would be kept below the DOE administrative control level of 2,000 mrem/yr (DOE 1994). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1999; UC 1998b.

J.1.2.4 Pit Conversion and Immobilization Facilities

J.1.2.4.1 Construction of Pit Conversion and Immobilization Facilities

No radiological risk would be incurred by members of the public from the construction and modification of pit conversion and immobilization (ceramic or glass) facilities at Hanford. According to recent radiation surveys conducted in the 400 Area, a construction worker would not be expected to receive any additional dose above natural background levels (Antonio 1998). Nonetheless, if deemed necessary, workers may be monitored (badged) as a precautionary measure.

J.1.2.4.2 Operation of Pit Conversion and Immobilization Facilities

Tables J–12 and J–13 present all possible incident-free radiological impact scenarios for the operation of the pit conversion and immobilization facilities at Hanford.

Table J–12. Potential Radiological Impacts on the Public of Operation of Pit Conversion and Immobilization Facilities in FMEF at Hanford

Impact	Pit Conversion	Immobilization (50 t) Ceramic	Immobilization (50 t) Glass	Total[a]
Population within 80 km for year 2010				
Dose (person-rem)	6.9	0.016	0.015	6.9
Percent of natural background[b]	5.9×10^{-3}	1.4×10^{-5}	1.3×10^{-5}	5.9×10^{-3}
10-year latent fatal cancers	0.034	8.0×10^{-5}	7.5×10^{-5}	0.034
Maximally exposed individual				
Annual dose (mrem)	0.017	2.2×10^{-4}	2.0×10^{-4}	0.017
Percent of natural background[b]	5.7×10^{-3}	7.3×10^{-5}	6.7×10^{-5}	5.8×10^{-3}
10-year latent fatal cancer risk	8.5×10^{-8}	1.1×10^{-9}	1.0×10^{-9}	8.6×10^{-8}
Average exposed individual within 80 km[c]				
Annual dose (mrem)	0.017	4.1×10^{-5}	3.9×10^{-5}	0.017
10-year latent fatal cancer risk	8.5×10^{-8}	2.1×10^{-10}	2.0×10^{-10}	8.5×10^{-8}

[a] Totals represent the largest possible sums for each public category. Totals are additive in all cases because the same groups or individuals would receive doses from both facilities.

[b] The annual natural background radiation level at Hanford is 300 mrem for the average individual; the population within 80 km (50 mi) in 2010 would receive 116,300 person-rem.

[c] Obtained by dividing the population dose by the number of people projected to live within 80 km (50 mi) of Hanford in 2010 (387,800).

Key: FMEF, Fuels and Materials Examination Facility.

Source: Model results.

Table J–13. Potential Radiological Impacts on Involved Workers of Operation of Pit Conversion and Immobilization Facilities in FMEF at Hanford

Impact	Pit Conversion	Immobilization (50 t)[a] Ceramic or Glass	Total
Number of badged workers	383	397	780
Total dose (person-rem/yr)	192	298	490
10-year latent fatal cancers	0.77	1.2	2.0
Average worker dose (mrem/yr)	500	750	628[b]
10-year latent fatal cancer risk	2.0×10^{-3}	3.0×10^{-3}	2.5×10^{-3}

[a] The presented values are representative of the largest possible number of workers regardless of collocation considerations.

[b] Represents an average of the doses for both facilities.

Key: FMEF, Fuels and Materials Examination Facility.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995). However, the maximum dose to a worker involved in operations would be kept below the DOE administrative control level of 2,000 mrem/yr (DOE 1994). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: UC 1998a, 1999a, 1999b.

J.1.2.5 Pit Conversion and MOX Facilities

J.1.2.5.1 Construction of Pit Conversion and MOX Facilities

No radiological risk would be incurred by members of the public from the modification of FMEF for pit disassembly and conversion and MOX fuel fabrication or construction of new MOX facility at Hanford. According to recent radiation surveys conducted in the 400 Area, a construction worker would not be expected to receive any additional dose above natural background levels (Antonio 1998). Nonetheless, if deemed necessary, workers may be monitored (badged) as a precautionary measure.

J.1.2.5.2 Operation of Pit Conversion and MOX Facilities

Tables J–14 and J–15 present the incident-free radiological impacts of the operation of the pit conversion and MOX facilities at Hanford.

Table J–14. Potential Radiological Impacts on the Public of Operation of Pit Conversion and MOX Facilities in FMEF or New MOX Facility at Hanford

Impact	Pit Conversion	MOX[a] FMEF	MOX[a] New	Total[b]
Population within 80 km for year 2010				
Dose (person-rem)	6.9	0.14	0.29	7.2
Percent of natural background[c]	5.9×10^{-3}	1.2×10^{-4}	2.5×10^{-4}	6.2×10^{-3}
10-year latent fatal cancers	0.034	7.0×10^{-4}	1.5×10^{-3}	0.036
Maximally exposed individual				
Annual dose (mrem)	0.017	1.8×10^{-3}	4.8×10^{-3}	0.022
Percent of natural background[c]	5.7×10^{-3}	6.1×10^{-4}	1.6×10^{-3}	7.3×10^{-3}
10-year latent fatal cancer risk	8.5×10^{-8}	9.3×10^{-9}	2.4×10^{-8}	1.1×10^{-7}
Average exposed individual within 80 km[d]				
Annual dose (mrem)	0.017	3.5×10^{-4}	7.5×10^{-4}	0.018
10-year latent fatal cancer risk	8.5×10^{-8}	1.7×10^{-9}	3.7×10^{-9}	8.9×10^{-8}

[a] As described in Section 4.26.1.2.2, Water Resources, no component was attributed to liquid pathways because it is not expected that significant contamination could reach these pathways given the site's groundwater and surface-water characteristics.

[b] Totals represent the largest possible sums for each public category. Totals are additive in all cases because the same groups or individuals would receive doses from both facilities.

[c] The annual natural background radiation level at Hanford is 300 mrem for the average individual; the population within 80 km (50 mi) in 2010 would receive 116,300 person-rem.

[d] Obtained by dividing the population dose by the number of people projected to live within 80 km (50 mi) of Hanford in 2010 (387,800).

Key: FMEF, Fuels and Materials Examination Facility.

Source: Model results.

Table J–15. Potential Radiological Impacts on Involved Workers of Operation of Pit Conversion and MOX Facilities in FMEF or New MOX Facility at Hanford

Impact	Pit Conversion	MOX (FMEF or New)	Total
Number of badged workers	383	331	714
Total dose (person-rem/yr)	192	22	214
10-year latent fatal cancers	0.77	0.088	0.86
Average worker dose (mrem/yr)	500	65	300[a]
10-year latent fatal cancer risk	2.0×10^{-3}	2.6×10^{-4}	1.2×10^{-3}

[a] Represents an average of the doses for both facilities.

Key: FMEF, Fuels and Materials Examination Facility.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995). However, the maximum dose to a worker involved in operations would be kept below the DOE administrative control level of 2,000 mrem/yr (DOE 1994). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1999; UC 1998a, 1998b.

J.1.2.6 Immobilization and MOX Facilities

J.1.2.6.1 Construction of Immobilization and MOX Facilities

No radiological risk would be incurred by members of the public from the modification of FMEF for collocating plutonium conversion and immobilization (ceramic or glass) and MOX fuel fabrication or construction of a new MOX facility at Hanford. According to recent radiation surveys conducted in the 400 Area, a construction worker would not be expected to receive any additional dose above natural background levels (Antonio 1998). Nonetheless, if deemed necessary, workers may be monitored (badged) as a precautionary measure.

J.1.2.6.2 Operation of Immobilization and MOX Facilities

Tables J–16 and J–17 present the incident-free radiological impacts of the operation of the immobilization and MOX facilities at Hanford.

Table J–16. Potential Radiological Impacts on the Public of Operation of Collocating Immobilization and MOX Facilities in FMEF or New MOX Facility at Hanford

	Immobilization (17 t)		MOX[a]		
Impact	**Ceramic**	**Glass**	**FMEF**	**New**	**Total[b]**
Population within 80 km for year 2010					
Dose (person-rem)	7.8×10^{-3}	7.1×10^{-3}	0.14	0.29	0.30
Percent of natural background[c]	6.7×10^{-6}	6.1×10^{-6}	1.2×10^{-4}	2.5×10^{-4}	2.6×10^{-4}
10-year latent fatal cancers	3.9×10^{-5}	3.6×10^{-5}	6.9×10^{-4}	1.5×10^{-3}	1.5×10^{-3}
Maximally exposed individual					
Annual dose (mrem)	1.1×10^{-4}	9.7×10^{-5}	1.8×10^{-3}	4.8×10^{-3}	4.9×10^{-3}
Percent of natural background[c]	3.7×10^{-5}	3.2×10^{-5}	6.1×10^{-4}	1.6×10^{-3}	1.6×10^{-3}
10-year latent fatal cancer risk	5.5×10^{-10}	4.9×10^{-10}	9.3×10^{-9}	2.4×10^{-8}	2.5×10^{-8}
Average exposed individual within 80 km[d]					
Annual dose (mrem)	2.0×10^{-5}	1.8×10^{-5}	3.5×10^{-4}	7.5×10^{-4}	7.7×10^{-4}
10-year latent fatal cancer risk	1.0×10^{-10}	9.0×10^{-11}	1.7×10^{-9}	3.7×10^{-9}	3.9×10^{-9}

[a] As described in Section 4.26.1.2.2, Water Resources, no component was attributed to liquid pathways because it is not expected that significant contamination could reach these pathways given the site's groundwater and surface-water characteristics.

[b] Totals represent the largest possible sums for each public category. Totals are additive in all cases because the same groups or individuals would receive doses from both facilities.

[c] The annual natural background radiation level at Hanford is 300 mrem for the average individual; the population within 80 km (50 mi) in 2010 would receive 116,300 person-rem.

[d] Obtained by dividing the population dose by the number of people projected to live within 80 km (50 mi) of Hanford in 2010 (387,800).

Key: FMEF, Fuels and Materials Examination Facility.

Source: Model results.

Table J–17. Potential Radiological Impacts on Involved Workers of Operation of Collocating Immobilization and MOX Facilities in FMEF or New MOX Facility at Hanford

	Immobilization (17 t)[a]	MOX	
Impact	**Ceramic or Glass**	**(FMEF or New)**	**Total**
Number of badged workers	365	331	696
Total dose (person-rem/yr)	274	22	296
10-year latent fatal cancers	1.1	0.088	1.2
Average worker dose (mrem/yr)	750	65	425[b]
10-year latent fatal cancer risk	3.0×10^{-3}	2.6×10^{-4}	1.7×10^{-3}

[a] The presented values are representative of the largest possible number of workers regardless of collocation considerations.

[b] Represents an average of the doses for both facilities.

Key: FMEF, Fuels and Materials Examination Facility.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995). However, the maximum dose to a worker involved in operations would be kept below the DOE administrative control level of 2,000 mrem/yr (DOE 1994). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1999; UC 1998b, 1999a, 1999b.

J.1.2.7 Pit Conversion, Immobilization, and MOX Facilities

J.1.2.7.1 Construction of Pit Conversion, Immobilization, and MOX Facilities

No radiological risk would be incurred by members of the public from the modification of FMEF for pit disassembly and conversion and plutonium conversion and immobilization (ceramic or glass) and construction of a new MOX facility at Hanford. According to recent radiation surveys conducted at the 400 Area, a construction worker would not be expected to receive any additional dose above natural background levels (Antonio 1998). Nonetheless, if deemed necessary, workers may be monitored (badged) as a precautionary measure.

J.1.2.7.2 Operation of Pit Conversion, Immobilization, and MOX Facilities

Tables J–18 and J–19 present all possible incident-free radiological impact scenarios for operating all three facilities at Hanford.

Table J–18. Potential Radiological Impacts on the Public of Operation of Pit Conversion and Immobilization Facilities in FMEF and New MOX Facility at Hanford

Impact	Pit Conversion	Immobilization (17 t) Ceramic	Immobilization (17 t) Glass	MOX[a] FMEF	MOX[a] New	Total[b]
Population within 80 km for year 2010						
Dose (person-rem)	6.9	7.8×10^{-3}	7.1×10^{-3}	0.14	0.29	7.2
Percent of natural background[c]	5.9×10^{-3}	6.7×10^{-6}	6.1×10^{-6}	1.2×10^{-4}	2.5×10^{-4}	6.2×10^{-3}
10-year latent fatal cancers	0.034	3.9×10^{-5}	3.6×10^{-5}	6.9×10^{-4}	1.5×10^{-3}	0.036
Maximally exposed individual						
Annual dose (mrem)	0.017	1.1×10^{-4}	9.7×10^{-5}	1.8×10^{-3}	4.8×10^{-3}	0.022
Percent of natural background[c]	5.7×10^{-3}	3.7×10^{-5}	3.2×10^{-5}	6.1×10^{-4}	1.6×10^{-3}	7.3×10^{-3}
10-year latent fatal cancer risk	8.5×10^{-8}	5.5×10^{-10}	4.9×10^{-10}	9.3×10^{-9}	2.4×10^{-8}	1.1×10^{-7}
Average exposed individual within 80 km[d]						
Annual dose (mrem)	0.017	2.0×10^{-5}	1.8×10^{-5}	3.5×10^{-4}	7.5×10^{-4}	0.018
10-year latent fatal cancer risk	8.5×10^{-8}	1.0×10^{-10}	9.0×10^{-11}	1.7×10^{-9}	3.7×10^{-9}	8.9×10^{-8}

[a] As described in Section 4.26.1.2.2, Water Resources, no component was attributed to liquid pathways because it is not expected that significant contamination could reach these pathways given the site's groundwater and surface-water characteristics.

[b] Totals represent the largest possible sums for each public category. Totals are additive in all cases because the same groups or individuals would receive doses from all three facilities.

[c] The annual natural background radiation level at Hanford is 300 mrem for the average individual; the population within 80 km (50 mi) in 2010 would receive 116,300 person-rem.

[d] Obtained by dividing the population dose by the number of people projected to live within 80 km (50 mi) of Hanford in 2010 (387,800).

Key: FMEF, Fuels and Materials Examination Facility.

Source: Model results.

Table J–19. Potential Radiological Impacts on Involved Workers of Operation of Pit Conversion and Immobilization Facilities in FMEF and New MOX Facility at Hanford

Impact	Pit Conversion	Immobilization (17 t)[a] Ceramic or Glass	MOX (FMEF or New)	Total
Number of badged workers	383	365	331	1,079
Total dose (person-rem/yr)	192	274	22	488
10-year latent fatal cancers	0.77	1.1	0.088	2.0
Average worker dose (mrem/yr)	500	750	65	452[b]
10-year latent fatal cancer risk	2.0×10^{-3}	3.0×10^{-3}	2.6×10^{-4}	1.8×10^{-3}

[a] The presented values are representative of the largest possible number of workers regardless of collocation considerations.

[b] Represents an average of the doses for all three facilities.

Key: FMEF, Fuels and Materials Examination Facility.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995). However, the maximum dose to a worker involved in operations would be kept below the DOE administrative control level of 2,000 mrem/yr (DOE 1994). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1999; UC 1998b, 1999a, 1999b.

J.2 INEEL

J.2.1 Assessment Data

To perform the dose assessments for the SPD EIS, different types of data were collected and generated. In addition, calculational assumptions were made. Appendix F.10 provides a summary of the methods and tools (e.g., the GENII computer code) that were used for the assessments.

J.2.1.1 Meteorological Data

The meteorological data used for the INEEL dose assessments was in the form of JFD file. A JFD file is a table listing the percentages of time the wind blows in a certain direction, at a certain speed, and within a certain stability class. The JFD file was based on measurements taken over a period of several years at a specific location and height. Average annual meteorological conditions, averaged over the measurement period, were used for normal operations. Table J–20 presents the JFD used in the dose assessments for INEEL.

J.2.1.2 Population Data

The INEEL population distribution was based on the *1990 Census of Population and Housing Data* (DOC 1992). Projections were determined for the year 2010 (about midlife of operations) for areas within 80 km (50 mi) of the locations for the proposed surplus plutonium disposition facilities. The site population in 2010 was assumed to be representative of the population over the operational period evaluated. The population was spatially distributed on a circular grid with 16 directions and 10 radial distances out to an 80-km (50-mi) distance. The grid was centered at the Idaho Nuclear Technology and Engineering Center (INTEC), the location from which radionuclides are assumed to be released during incident-free operations. Table J–21 presents the population data used for the dose assessments at INEEL.

J.2.1.3 Agricultural Data

The 1987 Census of Agriculture was the source used to generate site-specific data for food production. Food production was spatially distributed on a circular grid similar to that used for the population distribution described previously. This food grid (or wheel) was generated by combining the fraction of a county in each segment (e.g., south, southwest, north-northeast) and the county production of the eight food categories analyzed by GENII–leafy vegetables, root vegetables, fruits, grains, beef, poultry, milk, and eggs. Each county's food production was assumed to be distributed uniformly over the given county's land area. These categorized food wheels were then used in the assessment of doses to the INEEL population from the ingestion pathway. The consumption rates used in the dose assessments were those for the MEI and average exposed individual. People living within the 80-km (50-mi) assessment area were assumed to consume only food grown in that area. INEEL food production and consumption data used for the dose assessments in the SPD EIS were obtained from the *Health Risk Data for Storage and Disposition Final PEIS* (HNUS 1996).

Table J–20. INEEL 1987–1991 Joint Frequency Distributions at 61-m Height

Wind Speed (m/s)	Stability Class	Wind Blows Toward															
		S	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**
1.0	A	0.2	0.31	0.28	0.21	0.2	0.19	0.24	0.22	0.17	0.16	0.11	0.11	0.1	0.11	0.09	0.15
	B	0.04	0.06	0.03	0.01	0.01	0.01	0.01	0.02	0.03	0.02	0.01	0.01	0.01	0	0	0.01
	C	0.04	0.07	0.07	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01
	D	0.15	0.26	0.15	0.08	0.03	0.05	0.04	0.07	0.07	0.07	0.04	0.05	0.05	0.05	0.05	0.08
	E	0.14	0.17	0.15	0.08	0.07	0.07	0.04	0.06	0.05	0.07	0.06	0.04	0.04	0.05	0.06	0.06
	F	0.4	0.46	0.44	0.3	0.23	0.2	0.16	0.18	0.13	0.16	0.15	0.16	0.17	0.16	0.18	0.27
2.5	A	0.25	0.45	0.58	0.49	0.4	0.34	0.31	0.49	0.63	0.66	0.57	0.32	0.24	0.14	0.18	0.18
	B	0.06	0.18	0.21	0.11	0.03	0.02	0.02	0.05	0.08	0.12	0.08	0.05	0.03	0.01	0.01	0.02
	C	0.15	0.35	0.4	0.09	0.02	0.01	0.02	0.05	0.11	0.1	0.12	0.03	0.04	0.02	0.01	0.03
	D	0.55	1.78	1.05	0.2	0.07	0.04	0.08	0.1	0.17	0.3	0.32	0.2	0.1	0.07	0.08	0.12
	E	0.32	0.75	0.52	0.15	0.07	0.04	0.06	0.09	0.09	0.17	0.15	0.18	0.07	0.06	0.07	0.09
	F	0.77	1.65	1.38	0.67	0.34	0.24	0.21	0.27	0.31	0.51	0.47	0.48	0.35	0.32	0.34	0.38
4.5	A	0.02	0.05	0.05	0.03	0.02	0.01	0.02	0.04	0.08	0.1	0.09	0.08	0.02	0.02	0.02	0.01
	B	0.07	0.12	0.16	0.09	0.04	0.03	0.04	0.12	0.2	0.39	0.4	0.2	0.1	0.05	0.08	0.06
	C	0.07	0.19	0.33	0.13	0.02	0.02	0.02	0.08	0.14	0.33	0.58	0.21	0.07	0.05	0.03	0.06
	D	0.45	2.59	2.36	0.33	0.07	0.05	0.08	0.22	0.36	0.91	1.18	0.7	0.22	0.12	0.12	0.21
	E	0.34	1.26	0.93	0.17	0.04	0.03	0.06	0.11	0.21	0.34	0.49	0.38	0.15	0.08	0.12	0.17
	F	0.35	1.2	1.25	0.37	0.12	0.06	0.04	0.15	0.17	0.33	0.43	0.34	0.18	0.08	0.12	0.16
6.9	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0
	C	0.06	0.07	0.08	0.03	0.02	0.01	0.02	0.07	0.1	0.23	0.46	0.27	0.1	0.04	0.05	0.04
	D	0.67	1.47	1.6	0.35	0.06	0.03	0.08	0.26	0.4	1.28	2.95	1.78	0.44	0.16	0.08	0.4
	E	0.15	0.8	0.8	0.16	0.03	0.01	0.06	0.13	0.13	0.33	0.88	0.69	0.11	0.02	0.01	0.08
	F	0.05	0.2	0.25	0.07	0.01	0.01	0	0.02	0.02	0.01	0.1	0.11	0.01	0.01	0	0.01
9.6	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01	0	0	0
	D	0.64	0.61	0.74	0.16	0.02	0.01	0.04	0.16	0.29	1.1	3.53	1.98	0.38	0.12	0.07	0.26
	E	0.03	0.12	0.17	0.07	0	0	0.01	0.03	0.03	0.06	0.37	0.28	0.04	0.01	0	0
	F	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0
13.2	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	D	0.25	0.25	0.18	0.05	0	0	0.02	0.08	0.16	0.55	2.88	2.13	0.18	0.11	0.01	0.05
	E	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0	0	0	0
	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table J–20. INEEL 1987–1991 Joint Frequency Distributions at 61-m Height (Continued)

Wind Speed (m/s)	Stability Class	Wind Blows Toward															
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE
19.0	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	D	0.01	0.05	0.01	0.01	0	0	0	0	0	0.04	0.47	0.48	0.01	0.01	0	0
	E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.0	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0
	E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: Sagendorf 1992.

Table J–21. Projected INEEL Population Surrounding INTEC for Year 2010

Direction	Distance (mi)										Total
	0–1	1–2	2–3	3–4	4–5	5–10	10–20	20–30	30–40	40–50	
S	0	0	0	0	0	32	204	340	1,222	3,624	**5,422**
SSW	0	0	0	0	0	22	92	182	335	445	**1,076**
SW	0	0	0	0	0	22	87	117	163	304	**693**
WSW	0	0	0	0	0	0	87	136	149	262	**634**
W	0	0	0	0	0	0	87	180	392	280	**939**
WNW	0	0	0	0	0	0	269	519	445	311	**1,544**
NW	0	0	0	0	0	6	384	620	772	720	**2,502**
NNW	0	0	0	0	0	6	96	97	315	173	**687**
N	0	0	0	0	0	0	25	45	77	100	**247**
NNE	0	0	0	0	0	0	25	48	170	161	**404**
NE	0	0	0	0	0	0	0	285	652	342	**1,279**
ENE	0	0	0	0	0	0	0	332	575	1,057	**1,964**
E	0	0	0	0	0	0	0	506	1,203	12,055	**13,764**
ESE	0	0	0	0	0	0	208	947	1,536	103,127	**105,818**
SE	0	0	0	0	0	0	219	374	16,764	11,931	**29,288**
SSE	0	0	0	0	0	20	212	346	7,427	8,500	**16,505**
Total	**0**	**0**	**0**	**0**	**0**	**108**	**1,995**	**5,074**	**32,197**	**143,392**	**182,766**

Key: INTEC, Idaho Nuclear Technology and Engineering Center.
Source: DOC 1992.

J.2.1.4 Source Term Data

Estimated incident-free radiological releases associated with the pit conversion and MOX facilities are presented in Tables J–22 and J–23. Stack heights and release locations are provided in the facility data reports (DOE 1999; UC 1998c, 1998d).

Table J–22. Estimated Incident-Free Annual Radiological Releases From the Pit Conversion Facility at INEEL

Isotope	(μCi/yr)
Plutonium 236	9.3×10^{-11}
Plutonium 238	0.065
Plutonium 239	0.69
Plutonium 240	0.18
Plutonium 241	0.69
Plutonium 242	4.8×10^{-5}
Americium 241	0.37
Hydrogen 3	1.1×10^{9}

Source: UC 1998c.

Table J–23. Estimated Incident-Free Annual Radiological Releases From the MOX Facility at INEEL

Isotope	(μCi/yr)
Plutonium 236	1.3×10^{-8}
Plutonium 238	8.5
Plutonium 239	91
Plutonium 240	23
Plutonium 241	101
Plutonium 242	6.1×10^{-3}
Americium 241	48
Uranium 234	5.1×10^{-3}
Uranium 235	2.1×10^{-4}
Uranium 238	0.012

Source: UC 1998d.

J.2.1.5 Other Calculational Assumptions

To estimate radiological impacts of incident-free operation of the proposed facilities at INEEL, the following additional assumptions and factors were considered, in accordance with the guidelines established in NRC Regulatory Guide 1.109 (NRC 1977).

> Ground surfaces were assumed to have no previous deposition of radionuclides for the purposes of modeling the incremental radiological impacts associated with surplus plutonium disposition activities. However, doses associated with true instances of prior deposition are accounted for in the Affected Environment and Cumulative Impacts sections.
>
> The annual external exposure time to the plume and to soil contamination was 0.7 year for the MEI (NRC 1977).

The annual external exposure time to the plume and to soil contamination was 0.5 year for the population (NRC 1977).

The annual inhalation exposure time to the plume was 1 year for the MEI and general population (NRC 1977).

The exposed individual or population was assumed to have the characteristics and habits (e.g., inhalation and ingestion rates) of the adult human.

A semi-infinite/finite plume model was used for air immersion doses. Other pathways evaluated were ground exposure, inhalation, ingestion of food crops, and ingestion of contaminated animal products. Drinking water, aquatic food ingestion, and any other pathway that may involve liquid exposure were not examined because all releases are to the air.

Reported stack heights were used for atmospheric releases. The resultant doses were conservative as use of the actual stack height instead of the effective stack height negates plume rise.

The calculated doses are 50-year committed doses from 1 year of intake.

J.2.2 Facilities

The following sections present all viable radiological impact scenarios that could be associated with different combinations of incident-free facility operations at INEEL.

J.2.2.1 Pit Conversion Facility

J.2.2.1.1 Construction of Pit Conversion Facility

No radiological risk would be incurred by members of the public from construction and modification of a pit conversion facility in the Fuel Processing Facility (FPF) at INEEL. According to a recent radiation survey (Mitchell et al. 1997) conducted in the INTEC area, a construction worker could receive about 5 mrem/yr above natural background levels from exposure to radiation deriving from other activities, past or present, at the site. Construction worker exposures would be kept as low as is reasonably achievable, and workers would be monitored (badged) as appropriate.

J.2.2.1.2 Operation of Pit Conversion Facility

Tables J–24 and J–25 present the incident-free radiological impacts of the operation of a pit conversion facility at INEEL.

Table J–24. Potential Radiological Impacts on the Public of Operation of Pit Conversion Facility in FPF at INEEL

Population within 80 km for year 2010	
Dose (person-rem)	2.2
Percent of natural background[a]	3.3×10^{-3}
10-year latent fatal cancers	0.011
Maximally exposed individual	
Annual dose (mrem)	0.015
Percent of natural background[a]	4.2×10^{-3}
10-year latent fatal cancer risk	7.5×10^{-8}
Average exposed individual within 80 km[b]	
Annual dose (mrem)	0.012
10-year latent fatal cancer risk	6.0×10^{-8}

[a] The annual natural background radiation level at INEEL is 361 mrem for the average individual; the population within 80 km (50 mi) in 2010 would receive 66,000 person-rem.

[b] Obtained by dividing the population dose by the number of people projected to live within 80 km (50 mi) of INEEL in 2010 (182,800).

Key: FPF, Fuel Processing Facility.

Source: Model results.

Table J–25. Potential Radiological Impacts on Involved Workers of Operation of Pit Conversion Facility in FPF at INEEL

Number of badged workers	341
Total dose (person-rem/yr)	170
10-year latent fatal cancers	0.68
Average worker dose (mrem/yr)	500
10-year latent fatal cancer risk	2.0×10^{-3}

Key: FPF, Fuel Processing Facility.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995). However, the maximum dose to a worker involved in operations would be kept below the DOE administrative control level of 2,000 mrem/yr (DOE 1994). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: UC 1998c.

J.2.2.2 MOX Facility

J.2.2.2.1 Construction of MOX Facility

No radiological risk would be incurred by members of the public from the construction of a new MOX facility at INEEL. According to a recent radiation survey (Mitchell et al. 1997) conducted in the INTEC area, a construction worker could receive about 5 mrem/yr above natural background levels from exposure to radiation deriving from other activities, past or present, at the site. Construction worker exposures would be kept as low as is reasonably achievable, and workers would be monitored (badged) as appropriate.

J.2.2.2.2 Operation of MOX Facility

Tables J–26 and J–27 present the incident-free radiological impacts of the operation of a new MOX facility at INEEL.

Table J–26. Potential Radiological Impacts on the Public of Operation of New MOX Facility at INEEL[a]

Population within 80 km for year 2010	
Dose (person-rem)	0.037
Percent of natural background[b]	5.6×10^{-5}
10-year latent fatal cancers	1.9×10^{-4}
Maximally exposed individual	
Annual dose (mrem)	3.2×10^{-3}
Percent of natural background[b]	8.8×10^{-4}
10-year latent fatal cancer risk	1.6×10^{-8}
Average exposed individual within 80 km[c]	
Annual dose (mrem)	2.1×10^{-4}
10-year latent fatal cancer risk	1.0×10^{-9}

[a] As described in Section 4.26.2.2.2, Water Resources, no component was attributed to liquid pathways because it is not expected that significant contamination could reach these pathways given the site's groundwater and surface-water characteristics.

[b] The annual natural background radiation level at INEEL is 361 mrem for the average individual; the population within 80 km (50 mi) in 2010 would receive 66,000 person-rem.

[c] Obtained by dividing the population dose by the number of people projected to live within 80 km (50 mi) of INEEL in 2010 (182,800).

Source: Model results.

Table J–27. Potential Radiological Impacts on Involved Workers of Operation of New MOX Facility at INEEL

Number of badged workers	331
Total dose (person-rem/yr)	22
10-year latent fatal cancers	0.088
Average worker dose (mrem/yr)	65
10-year latent fatal cancer risk	2.6×10^{-4}

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995). However, the maximum dose to a worker involved in operations would be kept below the DOE administrative control level of 2,000 mrem/yr (DOE 1994). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1999; UC 1998d.

J.2.2.3 Pit Conversion and MOX Facilities

J.2.2.3.1 Construction of Pit Conversion and MOX Facilities

No radiological risk would be incurred by members of the public from the construction and modification of a pit conversion facility in FPF and construction of a new MOX facility at INEEL. According to a recent radiation survey (Mitchell et al. 1997) conducted in the INTEC area, a construction worker could receive about 5 mrem/yr above natural background levels from exposure to radiation deriving from other activities, past or present, at the site. Construction worker exposures would be kept as low as is reasonably achievable, and workers would be monitored (badged) as appropriate.

J.2.2.3.2 Operation of Pit Conversion and MOX Facilities

Tables J–28 and J–29 present the incident-free radiological impacts of operation of pit conversion and MOX facilities at INEEL.

Table J–28. Potential Radiological Impacts on the Public of Operation of Pit Conversion Facility in FPF and New MOX Facility at INEEL

Impact	Pit Conversion	MOX[a]	Total[b]
Population within 80 km for year 2010			
Dose (person-rem)	2.2	0.037	2.2
Percent of natural background[c]	3.3×10^{-3}	5.6×10^{-5}	3.4×10^{-3}
10-year latent fatal cancers	0.011	1.9×10^{-4}	0.011
Maximally exposed individual			
Annual dose (mrem)	0.015	3.2×10^{-3}	0.018
Percent of natural background[c]	4.2×10^{-3}	8.8×10^{-4}	5.1×10^{-3}
10-year latent fatal cancer risk	7.5×10^{-8}	1.6×10^{-8}	9.1×10^{-8}
Average exposed individual within 80 km[d]			
Annual dose (mrem)	0.012	2.1×10^{-4}	0.012
10-year latent fatal cancer risk	6.0×10^{-8}	1.0×10^{-9}	6.1×10^{-8}

[a] As described in Section 4.26.2.2.2, Water Resources, no component was attributed to liquid pathways because it is not expected that significant contamination could reach these pathways given the site's groundwater and surface-water characteristics.

[b] Totals are additive in all cases because the same groups or individuals would receive doses from both facilities.

[c] The annual natural background radiation level at INEEL is 361 mrem for the average individual; the population within 80 km (50 mi) in 2010 would receive 66,000 person-rem.

[d] Obtained by dividing the population dose by the number of people projected to live within 80 km (50 mi) of INEEL in 2010 (182,800).

Key: FPF, Fuel Processing Facility.

Source: Model results.

Table J–29. Potential Radiological Impacts on Involved Workers of Operation of Pit Conversion Facility in FPF and New MOX Facility at INEEL

Impact	Pit Conversion	MOX	Total
Number of badged workers	341	331	672
Total dose (person-rem/yr)	170	22	192
10-year latent fatal cancers	0.68	0.088	0.77
Average worker dose (mrem/yr)	500	65	286[a]
10-year latent fatal cancer risk	2.0×10^{-3}	2.6×10^{-4}	1.1×10^{-3}

[a] Represents an average of the doses for both facilities.

Key: FPF, Fuel Processing Facility.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995). However, the maximum dose to a worker involved in operations would be kept below the DOE administrative control level of 2,000 mrem/yr (DOE 1994). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1999; UC 1998c, 1998d.

J.3 PANTEX

J.3.1 Assessment Data

To perform the dose assessments for the SPD EIS, different types of data were collected and generated. In addition, calculational assumptions were made. Appendix F.10 provides a summary of the methods and tools (e.g., the GENII computer code) that were used for the assessments.

J.3.1.1 Meteorological Data

The meteorological data used for the Pantex dose assessments was in the form of a JFD file. A JFD file is a table listing the percentages of time the wind blows in a certain direction, at a certain speed, and within a certain stability class. The JFD file was based on measurements taken over a period of several years at a specific location and height. Average annual meteorological conditions, averaged over the measurement period, were used for normal operations. Table J–30 presents the JFD used in the dose assessments for Pantex.

J.3.1.2 Population Data

The Pantex population distribution was based on the *1990 Census of Population and Housing Data* (DOC 1992). Projections were determined for the year 2010 (about midlife of operations) for areas within 80 km (50 mi) of the locations for the proposed plutonium disposition facilities. The site population in 2010 was assumed to be representative of the population over the operational period evaluated. The population was spatially distributed on a circular grid with 16 directions and 10 radial distances out to an 80-km (50-mi) distance. The grid was centered at Zone 4, the location from which radionuclides are assumed to be released during incident-free operations. Table J–31 presents the population data used for the dose assessments at Pantex.

J.3.1.3 Agricultural Data

The 1987 Census of Agriculture was the source used to generate site-specific data for food production. Food production was spatially distributed on a circular grid similar to that used for the population distribution described previously. This food grid (or wheel) was generated by combining the fraction of a county in each segment (e.g., south, southwest, north-northeast) and the county production of the eight food categories analyzed by GENII—leafy vegetables, root vegetables, fruits, grains, beef, poultry, milk, and eggs. Each county's food production was assumed to be distributed uniformly over the given county's land area. These categorized food wheels were then used in the assessment of doses to the Pantex population from the ingestion pathway. The consumption rates used in the dose assessments were those for the MEI and average exposed individual. People living within the 80-km (50-mi) assessment area were assumed to consume only food grown in that area. Pantex food production and consumption data used for the dose assessments in the SPD EIS were obtained from the *Health Risk Data for Storage and Disposition Final PEIS* (HNUS 1996).

Table J–30. 1985–1989 Joint Frequency Distributions at 7-m Height for Pantex[a]

Wind Speed (m/s)	Stability Class	Wind Blows Toward															
		S	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**
0.89	A	0.02	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01
	B	0.02	0.01	0.01	0.02	0.03	0.02	0.02	0.02	0.05	0.01	0.03	0.02	0.04	0.02	0.03	0.02
	C	0.02	0	0.01	0.01	0.01	0	0.01	0	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01
	D	0.03	0.01	0.03	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.01	0.02	0.03	0.02	0.02	0.03
	E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	F	0.12	0.04	0.04	0.05	0.04	0.04	0.07	0.08	0.17	0.11	0.16	0.09	0.13	0.13	0.11	0.08
2.5	A	0.03	0.01	0.02	0.02	0.03	0.02	0.02	0.01	0.02	0.02	0.01	0.03	0.02	0.02	0.02	0.01
	B	0.12	0.06	0.08	0.06	0.14	0.06	0.07	0.05	0.13	0.06	0.09	0.05	0.11	0.09	0.11	0.07
	C	0.12	0.05	0.07	0.07	0.06	0.05	0.04	0.05	0.12	0.11	0.09	0.11	0.13	0.13	0.15	0.09
	D	0.22	0.12	0.13	0.14	0.18	0.12	0.12	0.16	0.19	0.16	0.12	0.14	0.18	0.13	0.16	0.16
	E	0.23	0.1	0.09	0.1	0.12	0.14	0.16	0.14	0.31	0.21	0.23	0.18	0.21	0.15	0.19	0.12
	F	0.41	0.16	0.13	0.14	0.18	0.2	0.25	0.23	0.62	0.49	0.64	0.39	0.48	0.49	0.43	0.28
4.5	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	0.08	0.04	0.07	0.07	0.07	0.06	0.06	0.09	0.17	0.13	0.13	0.09	0.1	0.08	0.07	0.08
	C	0.45	0.21	0.18	0.2	0.27	0.16	0.22	0.22	0.63	0.45	0.54	0.39	0.47	0.37	0.48	0.32
	D	1.14	0.72	0.64	0.59	0.72	0.66	1.02	1.1	2.19	1.21	1	0.5	0.41	0.32	0.6	0.5
	E	0.72	0.33	0.28	0.27	0.41	0.39	0.79	1.16	2.75	1.85	1.83	0.93	0.55	0.56	0.79	0.38
	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.9	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	C	0.13	0.1	0.07	0.05	0.04	0.04	0.05	0.13	0.52	0.5	0.39	0.22	0.16	0.08	0.05	0.04
	D	3.07	1.76	1	0.67	0.9	0.83	1.73	2.59	7.3	4.2	3.32	1.83	1.19	0.57	0.89	0.95
	E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9.6	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	C	0.03	0.02	0.03	0.01	0	0.01	0.01	0.03	0.18	0.19	0.09	0.04	0.03	0.01	0	0.01
	D	1.49	0.82	0.29	0.13	0.11	0.13	0.33	0.48	2.24	1.48	1.01	0.76	0.49	0.12	0.15	0.34
	E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.1	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	C	0.01	0.01	0	0	0	0	0	0	0.04	0.01	0.01	0.02	0.01	0	0	0
	D	0.73	0.32	0.05	0.03	0.01	0.02	0.05	0.1	0.41	0.22	0.2	0.25	0.24	0.05	0.09	0.2
	E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

[a] Joint frequency distribution data was compiled by the National Weather Service Station at Amarillo Airport; it was assumed that this data satisfactorily represented the atmospheric conditions at the Pantex site.

Source: NWS 1997.

Table J–31. Projected Pantex Population Surrounding Zone 4 for Year 2010

	Distance (mi)										
Direction	**0–1**	**1–2**	**2–3**	**3–4**	**4–5**	**5–10**	**10–20**	**20–30**	**30–40**	**40–50**	**Total**
S	0	0	0	4	5	41	100	96	104	268	**618**
SSW	0	0	0	0	5	117	441	1,095	361	1,013	**3,032**
SW	0	0	0	3	3	901	18,330	14,816	13,199	1,137	**48,389**
WSW	0	0	3	2	3	49	88,209	65,959	1,189	528	**15,5942**
W	0	0	2	2	3	25	3,372	683	227	897	**5,211**
WNW	0	0	3	2	3	25	148	360	517	834	**1,892**
NW	0	2	3	3	3	25	98	253	547	542	**1,476**
NNW	0	2	3	4	5	30	88	344	519	16,924	**17,919**
N	0	2	3	4	5	41	151	5,476	176	225	**6,083**
NNE	0	2	3	4	5	41	162	18,764	2,998	233	**22,212**
NE	0	2	3	4	5	41	163	396	295	165	**1,074**
ENE	0	2	3	4	5	41	324	724	22,852	176	**24,131**
E	0	2	3	4	5	961	2,016	884	372	1,085	**5,332**
ESE	0	2	3	4	5	41	273	512	248	401	**1,489**
SE	0	0	3	4	5	41	303	370	115	2,182	**3,023**
SSE	0	0	0	4	5	41	677	311	69	109	**1,216**
Total	**0**	**16**	**35**	**52**	**70**	**2,461**	**114,855**	**111,043**	**43,788**	**26,719**	**299,039**

Source: DOC 1992.

J.3.1.4 Source Term Data

Estimated incident-free radiological releases associated with the new pit conversion and MOX facilities at Pantex are presented in Tables J–32 and J–33. Stack heights and release locations are provided in the facility data reports (DOE 1999; UC 1998e, 1998f).

Table J–32. Estimated Incident-Free Annual Radiological Releases From the New Pit Conversion Facility at Pantex

Isotope	**(μCi/yr)**
Plutonium 236	9.3×10^{-11}
Plutonium 238	0.065
Plutonium 239	0.69
Plutonium 240	0.18
Plutonium 241	0.69
Plutonium 242	4.8×10^{-5}
Americium 241	0.37
Hydrogen 3	1.1×10^{9}

Source: UC 1998e.

Table J–33. Estimated Incident-Free Annual Radiological Releases From the New MOX Facility at Pantex

Isotope	(μCi/yr)
Plutonium 236	1.3×10^{-8}
Plutonium 238	8.5
Plutonium 239	91
Plutonium 240	23
Plutonium 241	101
Plutonium 242	6.1×10^{-3}
Americium 241	48
Uranium 234	5.1×10^{-3}
Uranium 235	2.1×10^{-4}
Uranium 238	0.012

Source: UC 1998f.

J.3.1.5 Other Calculational Assumptions

To estimate radiological impacts of incident-free operation of the proposed facilities at Pantex, the following additional assumptions and factors were considered, in accordance with the guidelines established in NRC Regulatory Guide 1.109 (NRC 1977).

> Ground surfaces were assumed to have no previous deposition of radionuclides for the purposes of modeling the incremental radiological impacts associated with surplus plutonium disposition activities. However, doses associated with true instances of prior deposition are accounted for in the Affected Environment and Cumulative Impacts sections.
>
> The annual external exposure time to the plume and to soil contamination was 0.7 year for the MEI (NRC 1977).
>
> The annual external exposure time to the plume and to soil contamination was 0.5 year for the population (NRC 1977).
>
> The annual inhalation exposure time to the plume was 1 year for the MEI and general population (NRC 1977).
>
> The exposed individual or population was assumed to have the characteristics and habits (e.g., inhalation and ingestion rates) of the adult human.
>
> A semi-infinite/finite plume model was used for air immersion doses. Other pathways evaluated were ground exposure, inhalation, ingestion of food crops, and ingestion of contaminated animal products. Drinking water, aquatic food ingestion, and any other pathway that may involve liquid exposure were not examined because all releases were to the air.
>
> Reported stack heights were used for atmospheric releases. The resultant doses were conservative as use of the actual stack height instead of the effective sack height negates plume rise.
>
> The calculated doses are 50-year committed doses from 1 year of intake.

J.3.2 Facilities

The following sections present all viable radiological impact scenarios that could be associated with different combinations of incident-free facility operations at Pantex.

J.3.2.1 Pit Conversion Facility

J.3.2.1.1 Construction of Pit Conversion Facility

No radiological risk would be incurred by members of the public from the construction of a new pit conversion facility at Pantex. According to a recent radiation survey (DOE 1997) conducted in Zone 4, a construction worker would not be expected to receive any additional radiation exposure above natural background levels in the area. Nonetheless, construction workers may be monitored (badged) as a precautionary measure.

J.3.2.1.2 Operation of Pit Conversion Facility

Tables J–34 and J–35 present the incident-free radiological impacts of the operation of a new pit conversion facility at Pantex.

Table J–34. Potential Radiological Impacts on the Public of Operation of New Pit Conversion Facility at Pantex

Population within 80 km for year 2010	
Dose (person-rem)	0.58
Percent of natural background[a]	5.8×10^{-4}
10-year latent fatal cancers	2.9×10^{-3}
Maximally exposed individual	
Annual dose (mrem)	0.062
Percent of natural background[a]	0.019
10-year latent fatal cancer risk	3.1×10^{-7}
Average exposed individual within 80 km[b]	
Annual dose (mrem)	1.9×10^{-3}
10-year latent fatal cancer risk	9.5×10^{-9}

[a] The annual natural background radiation level at Pantex is 332 mrem for the average individual; the population within 80 km (50 mi) in 2010 would receive 99,300 person-rem.

[b] Obtained by dividing the population dose by the number of people projected to live within 80 km (50 mi) of Pantex in 2010 (299,000).

Source: Model results.

Table J–35. Potential Radiological Impacts on Involved Workers of Operation of New Pit Conversion Facility at Pantex

Number of badged workers	383
Total dose (person-rem/yr)	192
10-year latent fatal cancers	0.77
Average worker dose (mrem/yr)	500
10-year latent fatal cancer risk	2.0×10^{-3}

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995). However, the maximum dose to a worker involved in operations would be kept below the DOE administrative control level of 2,000 mrem/yr (DOE 1994). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: UC 1998e.

J.3.2.2 MOX Facility

J.3.2.2.1 Construction of MOX Facility

No radiological risk would be incurred by members of the public from construction of a new MOX facility at Pantex. According to a recent radiation survey (DOE 1997) conducted in Zone 4, a construction worker would not be expected to receive any additional radiation exposure above natural background levels in the area. Nonetheless, construction workers may be monitored (badged) as a precautionary measure.

J.3.2.2.2 Operation of MOX Facility

Tables J–36 and J–37 present the incident-free radiological impacts of the operation of a new MOX facility at Pantex.

Table J–36. Potential Radiological Impacts on the Public of Operation of New MOX Facility at Pantex[a]

Population within 80 km for year 2010	
Dose (person-rem)	0.027
Percent of natural background[b]	2.7×10^{-5}
10-year latent fatal cancers	1.3×10^{-4}
Maximally exposed individual	
Annual dose (mrem)	0.015
Percent of natural background[b]	$4.5x10^{-3}$
10-year latent fatal cancer risk	7.5×10^{-8}
Average exposed individual within 80 km[c]	
Annual dose (mrem)	8.8×10^{-5}
10-year latent fatal cancer risk	4.5×10^{-10}

[a] As described in Section 4.26.3.2.2, Water Resources, no component was attributed to liquid pathways because it is not expected that significant contamination could reach these pathways given the site's groundwater and surface-water characteristics.

[b] The annual natural background radiation level at Pantex is 332 mrem for the average individual; the population within 80 km (50 mi) in 2010 would receive 99,300 person-rem.

[c] Obtained by dividing the population dose by the number of people projected to live within 80 km (50 mi) of Pantex in 2010 (299,000).

Source: Model results.

Table J–37. Potential Radiological Impacts on Involved Workers of Operation of New MOX Facility at Pantex

Number of badged workers	331
Total dose (person-rem/yr)	22
10-year latent fatal cancers	0.088
Average worker dose (mrem/yr)	65
10-year latent fatal cancer risk	2.6×10^{-4}

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995). However, the maximum dose to a worker involved in operations would be kept below the DOE administrative control level of 2,000 mrem/yr (DOE 1994). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1999; UC 1998f.

J.3.2.3 Pit Conversion and MOX Facilities

J.3.2.3.1 Construction of Pit Conversion and MOX Facilities

No radiological risk would be incurred by members of the public from the construction of new pit conversion and MOX facilities at Pantex. According to a recent radiation survey (DOE 1997) conducted in Zone 4, a construction worker would not be expected to receive any additional radiation exposure above natural background levels in the area. Nonetheless, construction workers may be monitored (badged) as a precautionary measure.

J.3.2.3.2 Operation of Pit Conversion and MOX Facilities

Tables J–38 and J–39 present the incident-free radiological impacts of operation of the new pit conversion and MOX facilities at Pantex.

Table J–38. Potential Radiological Impacts on the Public of Operation of New Pit Conversion and MOX Facilities at Pantex

Impact	Pit Conversion	MOX[a]	Total[b]
Population within 80 km for year 2010			
Dose (person-rem)	0.58	0.027	0.61
Percent of natural background[c]	5.8×10^{-4}	2.7×10^{-5}	6.1×10^{-4}
10-year latent fatal cancers	2.9×10^{-3}	1.3×10^{-4}	3.0×10^{-3}
Maximally exposed individual			
Annual dose (mrem)	0.062	0.015	0.077
Percent of natural background[c]	0.019	4.5×10^{-3}	0.024
10-year latent fatal cancer risk	3.1×10^{-7}	7.5×10^{-8}	3.9×10^{-7}
Average exposed individual within 80 km[d]			
Annual dose (mrem)	1.9×10^{-3}	8.8×10^{-5}	2.0×10^{-3}
10-year latent fatal cancer risk	9.5×10^{-9}	4.4×10^{-10}	9.9×10^{-9}

[a] As described in Section 4.26.3.2.2, Water Resources, no component was attributed to liquid pathways because it is not expected that significant contamination could reach these pathways given the site's groundwater and surface-water characteristics.

[b] Totals are additive in all cases because the same groups or individuals would receive doses from both facilities.

[c] The annual natural background radiation level at Pantex is 332 mrem for the average individual; the population within 80 km (50 mi) in 2010 would receive 99,300 person-rem.

[d] Obtained by dividing the population dose by the number of people projected to live within 80 km (50 mi) of Pantex in 2010 (299,000).

Source: Model results.

Table J–39. Potential Radiological Impacts on Involved Workers of Operation of New Pit Conversion and MOX Facilities at Pantex

Impact	Pit Conversion	MOX	Total
Number of badged workers	383	331	714
Total dose (person-rem/yr)	192	22	214
10-year latent fatal cancers	0.77	0.088	0.86
Average worker dose (mrem/yr)	500	65	300[a]
10-year latent fatal cancer risk	2.0×10^{-3}	2.6×10^{-4}	$1.2\text{x}10^{-3}$

[a] Represents an average of the doses for both facilities.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995). However, the maximum dose to a worker involved in operations would be kept below the DOE administrative control level of 2,000 mrem/yr (DOE 1994). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1999; UC 1998e, 1998f.

J.4 SRS

J.4.1 Assessment Data

To perform the dose assessments for the SPD EIS, different types of data were collected and generated. In addition, calculational assumptions were made. Appendix F.10 provides a summary of the methods and tools (e.g., the GENII computer code) that were used for the assessments.

J.4.1.1 Meteorological Data

The meteorological data used for the SRS dose assessments was in the form of a JFD file. A JFD file is a table listing the percentages of time the wind blows in a certain direction, at a certain speed, and within a certain stability class. The JFD data file was based on measurements taken over a period of several years at a specific location (F-Area) and height. Average annual meteorological conditions, averaged over the measurement period, were used for normal operations. Table J–40 presents the JFD data used in the dose assessments for SRS.

J.4.1.2 Population Data

The SRS population distribution was based on the *1990 Census of Population and Housing Data* (DOC 1992). Projections were determined for the year 2010 (about midlife of operations) for areas within 80 km (50 mi) of the locations for the proposed surplus plutonium disposition facilities. The site population in 2010 was assumed to be representative of the population over the operational period evaluated. The population was spatially distributed on a circular grid with 16 directions and 10 radial distances out to an 80-km (50-mi) distance. The grids were centered at the Actinide Packaging and Storage Facility in F-Area, the locations from which radionuclides are assumed to be released during incident-free operations. Tables J–41 and J–42 present the population data used for the dose assessments at SRS.

J.4.1.3 Agricultural Data

The 1987 Census of Agriculture was the source used to generate site-specific data for food production. Food production was spatially distributed on a circular grid similar to that used for the population distributions described previously. This food grid (or wheel) was generated by combining the fraction of a county in each segment (e.g., south, southwest, north-northeast) and the county production of the eight food categories analyzed by GENII (leafy vegetables, root vegetables, fruits, grains, beef, poultry, milk, and eggs). Each county's food production was assumed to be distributed uniformly over the given county's land area. These categorized food wheels are then used in the assessment of doses to the SRS population from the ingestion pathway. The consumption rates used in the dose assessments were those for the MEI and average exposed individual. People living within the 80-km (50-mi) assessment area were assumed to consume only food grown in that area. SRS food production and consumption data used for the dose assessments in the SPD EIS were obtained from the *Health Risk Data for Storage and Disposition Final PEIS* (HNUS 1996).

Table J–40. SRS 1987–1991 Joint Frequency Distributions at 61-m Height

Wind Speed (m/s)	Stability Class	Wind Blows Toward															
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE
2.0	A	0.27	0.35	0.39	0.42	0.34	0.31	0.28	0.31	0.31	0.3	0.32	0.34	0.5	0.32	0.29	0.26
	B	0.04	0.05	0.06	0.08	0.05	0.05	0.04	0.05	0.05	0.04	0.06	0.07	0.06	0.06	0.06	0.04
	C	0.02	0.03	0.1	0.07	0.02	0.04	0.03	0.06	0.05	0.05	0.07	0.07	0.09	0.06	0.03	0.02
	D	0.01	0.03	0.07	0.02	0.02	0.03	0.05	0.05	0.04	0.04	0.05	0.05	0.03	0.02	0.04	0.03
	E	0	0	0.02	0	0	0.01	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.02
	F	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0
4.0	A	0.64	0.63	0.7	0.77	0.76	0.63	0.54	0.66	0.58	0.64	0.73	1.15	1	0.69	0.52	0.44
	B	0.22	0.3	0.33	0.4	0.33	0.26	0.21	0.22	0.28	0.26	0.51	0.67	0.59	0.3	0.16	0.2
	C	0.08	0.52	0.57	0.77	0.51	0.37	0.33	0.39	0.44	0.45	0.7	0.77	0.69	0.33	0.28	0.15
	D	0.06	0.52	1.49	1.12	0.5	0.51	0.62	0.78	0.77	0.62	0.7	0.75	0.77	0.47	0.31	0.15
	E	0.04	0.2	0.8	0.35	0.18	0.28	0.42	0.55	0.57	0.43	0.51	0.42	0.49	0.33	0.25	0.15
	F	0.02	0.02	0.1	0.05	0.03	0.03	0.07	0.09	0.06	0.07	0.09	0.06	0.06	0.07	0.06	0.04
6.0	A	0.49	0.15	0.1	0.09	0.1	0.09	0.08	0.14	0.11	0.14	0.17	0.17	0.19	0.18	0.1	0.21
	B	0.12	0.22	0.17	0.22	0.19	0.09	0.08	0.15	0.17	0.2	0.3	0.42	0.37	0.28	0.11	0.08
	C	0.08	0.4	0.42	0.63	0.35	0.18	0.19	0.34	0.38	0.43	0.6	0.77	0.64	0.39	0.17	0.11
	D	0.06	0.8	2.28	1.39	0.62	0.44	0.67	1.31	1.21	0.75	0.94	0.87	1.01	0.66	0.29	0.18
	E	0.06	0.51	1.36	1.07	0.56	0.48	0.64	1.25	1.29	0.97	1.08	1.14	1.22	0.77	0.38	0.21
	F	0.02	0.04	0.18	0.28	0.23	0.21	0.2	0.23	0.23	0.26	0.25	0.26	0.21	0.19	0.1	0.08
8.0	A	0.11	0.03	0.01	0.01	0.01	0.01	0	0.02	0.01	0.04	0.02	0.02	0.03	0.03	0.02	0.03
	B	0	0.06	0.02	0.01	0	0	0	0.01	0.03	0.04	0.08	0.06	0.04	0.08	0.03	0.01
	C	0.01	0.11	0.11	0.13	0.06	0.04	0.05	0.07	0.13	0.17	0.27	0.28	0.33	0.29	0.06	0.01
	D	0.04	0.3	0.6	0.41	0.08	0.03	0.1	0.25	0.21	0.15	0.2	0.24	0.63	0.35	0.05	0.02
	E	0.02	0.29	0.25	0.16	0.06	0.02	0.02	0.06	0.08	0.05	0.16	0.12	0.15	0.06	0.02	0.02
	F	0	0.01	0.04	0.06	0.04	0.01	0.02	0.02	0.04	0.05	0.02	0.01	0.01	0	0	0
12.0	A	0.01	0	0	0	0	0	0	0	0	0	0.01	0.01	0	0.01	0	0.01
	B	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.02	0	0
	C	0	0.01	0	0	0	0	0	0.02	0.03	0.03	0.04	0.06	0.2	0.18	0.01	0
	D	0.01	0.06	0.08	0.08	0.01	0.01	0.01	0.03	0.05	0.03	0.06	0.03	0.39	0.2	0.01	0
	E	0	0.01	0.02	0.01	0	0	0	0	0	0	0	0	0	0	0	0
	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14.1	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0.01	0	0
	D	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0
	E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: Simpkins 1997.

Table J–41. Projected SRS Population Surrounding APSF (Pit Conversion and MOX Facilities) for Year 2010

Direction	Distance (mi)										Total
	0–1	1–2	2–3	3–4	4–5	5–10	10–20	20–30	30–40	40–50	
S	0	0	0	0	0	0	600	2,109	3,312	3,447	**9,468**
SSW	0	0	0	0	0	36	935	1,853	4,732	2,501	**10,057**
SW	0	0	0	0	0	73	1,239	8,333	2,023	4,318	**15,986**
WSW	0	0	0	0	0	228	3,762	4,014	3,742	7,194	**18,940**
W	0	0	0	0	0	355	7,786	47,484	21,880	18,192	**95,697**
WNW	0	0	0	0	0	2,439	11,335	205,958	53,232	6,694	**279,658**
NW	0	0	0	0	0	1,455	18,694	38,351	2,884	3,123	**64,507**
NNW	0	0	0	0	0	3,279	40,843	20,468	9,466	5,766	**79,822**
N	0	0	0	0	0	1,012	7,787	6,010	5,928	20,994	**41,731**
NNE	0	0	0	0	0	145	1,934	2,959	6,794	20,775	**32,607**
NE	0	0	0	0	0	0	3,168	3,786	5,985	11,236	**24,175**
ENE	0	0	0	0	0	0	3,077	5,828	7,625	33,477	**50,007**
E	0	0	0	0	0	0	6,188	5,442	7,342	3,952	**22,924**
ESE	0	0	0	0	0	0	996	3,497	4,455	7,253	**16,201**
SE	0	0	0	0	0	0	572	2,555	4,695	7,667	**15,489**
SSE	0	0	0	0	0	0	390	648	4,122	2,975	**8,135**
Total	**0**	**0**	**0**	**0**	**0**	**9,022**	**109,306**	**359,295**	**148,217**	**159,564**	**785,404**

Key: APSF, Actinide Packaging and Storage Facility.
Source: DOC 1992.

Table J–42. Projected SRS Population Surrounding APSF (Immobilization Facility) for Year 2010

Direction	Distance (mi)										Total
	0–1	1–2	2–3	3–4	4–5	5–10	10–20	20–30	30–40	40–50	
S	0	0	0	0	0	0	576	2,124	3,368	3,437	**9,505**
SSW	0	0	0	0	0	33	914	1,849	4,750	2,508	**10,054**
SW	0	0	0	0	0	59	1,204	8,412	2,043	4,640	**16,358**
WSW	0	0	0	0	0	241	3,930	4,188	3,771	6,887	**19,017**
W	0	0	0	0	0	543	7,632	51,313	22,422	18,246	**100,156**
WNW	0	0	0	0	0	2,344	11,777	204,567	51,659	6,581	**276,928**
NW	0	0	0	0	0	1,479	19,053	36,367	2,990	3,123	**63,012**
NNW	0	0	0	0	0	3,394	43,236	17,846	9,567	5,783	**79,826**
N	0	0	0	0	0	961	7,818	5,691	6,005	21,037	**41,512**
NNE	0	0	0	0	0	171	1,936	3,000	6,811	21,327	**33,245**
NE	0	0	0	0	0	0	3,137	3,756	6,043	11,279	**24,215**
ENE	0	0	0	0	0	0	3,202	5,735	7,434	34,686	**51,057**
E	0	0	0	0	0	0	6,264	5,509	7,575	3,991	**23,339**
ESE	0	0	0	0	0	0	1,023	2,892	4,016	7,077	**15,008**
SE	0	0	0	0	0	0	569	3,116	5,213	7,848	**16,746**
SSE	0	0	0	0	0	0	380	636	3,953	3,002	**7,971**
Total	**0**	**0**	**0**	**0**	**0**	**9,225**	**112,651**	**357,001**	**147,620**	**161,452**	**787,949**

Key: APSF, Actinide Packaging and Storage Facility.
Source: DOC 1992.

J.4.1.4 Source Term Data

Estimated incident-free radiological releases associated with the new pit conversion, immobilization, and MOX facilities are presented in Tables J–43 through J–45. Stack heights and release locations are provided in the facility data reports (DOE 1999; UC 1998g, 1998h, 1999c, 1999d).

Table J–43. Estimated Incident-Free Annual Radiological Releases From the Pit Conversion Facility at SRS

Isotope	(μCi/yr)
Plutonium 236	9.3×10^{-11}
Plutonium 238	0.065
Plutonium 239	0.69
Plutonium 240	0.18
Plutonium 241	0.69
Plutonium 242	4.8×10^{-5}
Americium 241	0.37
Hydrogen 3	1.1×10^{9}

Source: UC 1998g.

Table J–44. Estimated Incident-Free Annual Radiological Releases From the New Immobilization Facility at SRS

Isotope	Ceramic (17 t) (μCi/yr)	Ceramic (50 t) (μCi/yr)	Glass (17 t) (μCi/yr)	Glass (50 t) (μCi/yr)
Plutonium 236	–	–	–	–
Plutonium 238	–	0.57	–	0.52
Plutonium 239	3.7	9.5	3.4	8.6
Plutonium 240	1.7	3.1	1.6	2.8
Plutonium 241	110	100	98	93
Plutonium 242	1.3×10^{-3}	1.6×10^{-3}	1.2×10^{-3}	1.5×10^{-3}
Americium 241	2.3	5.4	2.2	5.0
Uranium 234	–	–	–	–
Uranium 235	1.1×10^{-5}	4.5×10^{-5}	2.3×10^{-6}	2.3×10^{-6}
Uranium 238	8.8×10^{-5}	3.5×10^{-4}	1.9×10^{-5}	1.9×10^{-5}

Source: UC 1999c, 1999d.

Table J–45. Estimated Incident-Free Annual Radiological Releases From the New MOX Facility at SRS

Isotope	Airborne (μCi/yr)	Liquid (μCi/yr)
Plutonium 236	$1.3.\times10^{-8}$	9.3×10^{-8}
Plutonium 238	8.5	64
Plutonium 239	91	670
Plutonium 240	23	170
Plutonium 241	101	750
Plutonium 242	6.1×10^{-3}	0.046
Americium 241	48	350
Uranium 234	5.1×10^{-3}	0.037
Uranium 235	2.1×10^{-4}	1.6×10^{-3}
Uranium 238	0.012	0.089

Source: UC 1998h.

J.4.1.5 Other Calculational Assumptions

To estimate radiological impacts of incident-free operation of the facilities at SRS, the following additional assumptions and factors were considered, in accordance with the guidelines established in NRC Regulatory Guide 1.109 (NRC 1977).

Ground surfaces were assumed to have no previous deposition of radionuclides for the purposes of modeling the incremental radiological impacts associated with surplus plutonium disposition activities. However, doses associated with true instances of prior deposition are accounted for in the Affected Environment and Cumulative Impacts sections.

The annual external exposure time to the plume and to soil contamination was 0.7 year for the MEI (NRC 1977).

The annual external exposure time to the plume and to soil contamination was 0.5 year for the population (NRC 1977).

The annual inhalation exposure time to the plume was 1 year for the MEI and general population (NRC 1977).

The exposed individual or population was assumed to have the characteristics and habits (e.g., inhalation and ingestion rates) of the adult human.

A semi-infinite/finite plume model was used for air immersion doses. Other pathways evaluated were ground exposure, inhalation, ingestion of food crops, and ingestion of contaminated animal products. Drinking water, aquatic food ingestion, and any other pathway that may involve liquid exposure were also examined for the MOX facility because it is the only facility with expected liquid releases at SRS.

Reported stack heights were used for atmospheric releases. The resultant doses were conservative as use of the actual stack height instead of the effective stack height negates plume rise.

The calculated doses are 50-year committed doses from 1 year of intake.

J.4.2 Facilities

The following sections present all viable radiological impact scenarios that could be associated with different combinations of incident-free facility operations at SRS.

J.4.2.1 Pit Conversion Facility

J.4.2.1.1 Construction of Pit Conversion Facility

No radiological risk would be incurred by members of the public from the construction of a new pit conversion facility at SRS. Construction worker exposures to radiation that derives from other activities at the site, past and present, would also be kept as low as is reasonably achievable. Construction workers would be monitored (badged) as appropriate. Summaries of radiological impacts of these activities are presented in Table J–46 for workers at risk.

Table J–46. Potential Radiological Impacts on Construction Workers of New Pit Conversion Facility at SRS

Annual average number of workers	341
Total dose (person-rem/yr)	1.4
Annual latent fatal cancers[a]	5.6×10^{-4}
Average worker dose (mrem/yr)	4
Annual latent fatal cancer risk	1.6×10^{-6}

[a] Values are based on a risk factor of 400 latent fatal cancers per million person-rem set by the National Research Council's Committee on the Biological Effects of Ionizing Radiations.

Note: The radiological limit for a construction worker is 100 mrem/yr because they are categorized as members of the public (DOE 1993). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: ICRP 1991; NAS 1990; UC 1998g.

J.4.2.1.2 Operation of Pit Conversion Facility

Tables J–47 and J–48 present the incident-free radiological impacts of the operation of a new pit conversion facility at SRS.

Table J–47. Potential Radiological Impacts on the Public of Operation of New Pit Conversion Facility at SRS

Population within 80 km for year 2010	
Dose (person-rem)	1.6
Percent of natural background[a]	6.9×10^{-4}
10-year latent fatal cancers	8.0×10^{-3}
Maximally exposed individual	
Annual dose (mrem)	3.7×10^{-3}
Percent of natural background[a]	1.3×10^{-3}
10-year latent fatal cancer risk	1.9×10^{-8}
Average exposed individual within 80 km[b]	
Annual dose (mrem)	2.0×10^{-3}
10-year latent fatal cancer risk	1.0×10^{-8}

[a] The annual natural background radiation level at SRS is 295 mrem for the average individual; the population within 80 km (50 mi) in 2010 would receive about 232,000 person-rem.

[b] Obtained by dividing the population dose by the number of people projected to live within 80 km (50 mi) of SRS in 2010 (about 790,000).

Source: Model results.

Table J–48. Potential Radiological Impacts on Involved Workers of Operation of New Pit Conversion Facility at SRS

Number of badged workers	383
Total dose (person-rem/yr)	192
10-year latent fatal cancers	0.77
Average worker dose (mrem/yr)	500
10-year latent fatal cancer risk	2.0×10^{-3}

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995). However, the maximum dose to a worker involved in operations would be kept below the DOE administrative control level of 2,000 mrem/yr (DOE 1994). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: UC 1998g.

J.4.2.2 Immobilization Facility

J.4.2.2.1 Construction of Immobilization Facility

No radiological risk would be incurred by members of the public from the construction of a new immobilization facility at SRS. Construction worker exposures to radiation that derives from other activities at the site, past or present, would also be kept as low as is reasonably achievable. Construction workers would be monitored (badged) as appropriate. Summaries of radiological impacts of these activities are presented in Table J–49 for workers at risk.

Table J–49. Potential Radiological Impacts on Construction Workers of New Immobilization Facility at SRS[a]

Annual average number of workers	374
Total dose (person-rem/yr)	1.5
Annual latent fatal cancers[b]	6.0×10^{-4}
Average worker dose (mrem/yr)	4
Annual latent fatal cancer risk	1.6×10^{-6}

[a] The values would be the same for immobilization in either ceramic or glass.

[b] Values are based on a risk factor of 400 latent fatal cancers per million person-rem set by the National Research Council's Committee on the Biological Effects of Ionizing Radiations.

Note: The radiological limit for a construction worker is 100 mrem/yr because they are categorized as members of the public (DOE 1993). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: ICRP 1991; NAS 1990; UC 1999c, 1999d.

J.4.2.2.2 Operation of Immobilization Facility

Tables J–50 and J–51 present all possible incident-free radiological impact scenarios of the operation of a new immobilization facility at SRS.

Table J–50. Potential Radiological Impacts on the Public of Operation of New Immobilization Facility at SRS

	17 t		50 t	
Impact	**Ceramic**	**Glass**	**Ceramic**	**Glass**
Population within 80 km for year 2010				
Dose (person-rem)	2.8×10^{-3}	2.6×10^{-3}	5.8×10^{-3}	5.3×10^{-3}
Percent of natural background[a]	1.2×10^{-6}	1.1×10^{-6}	2.5×10^{-6}	2.3×10^{-6}
10-year latent fatal cancers	1.4×10^{-5}	1.3×10^{-5}	2.9×10^{-5}	2.7×10^{-5}
Maximally exposed individual				
Annual dose (mrem)	2.8×10^{-5}	2.6×10^{-5}	5.8×10^{-5}	5.3×10^{-5}
Percent of natural background[a]	9.5×10^{-6}	8.8×10^{-6}	2.0×10^{-5}	1.8×10^{-5}
10-year latent fatal cancer risk	1.4×10^{-10}	1.3×10^{-10}	2.9×10^{-10}	2.7×10^{-10}
Average exposed individual within 80 km[b]				
Annual dose (mrem)	3.6×10^{-6}	3.3×10^{-6}	7.4×10^{-6}	6.7×10^{-6}
10-year latent fatal cancer risk	1.8×10^{-11}	1.6×10^{-11}	3.7×10^{-11}	3.4×10^{-11}

[Text deleted.]

[a] The annual natural background radiation level at SRS is 295 mrem for the average individual; the population within 80 km (50 mi) in 2010 would receive about 232,000 person-rem.

[b] Obtained by dividing the population dose by the number of people projected to live within 80 km (50 mi) of the SRS facilities in 2010 (about 790,000).

Source: Model results.

Table J–51. Potential Radiological Impacts on Involved Workers of Operation of New Immobilization Facility at SRS[a]

Impact	17 t	50 t
Number of badged workers	323	339
Total dose (person-rem/yr)	242	254
10-year latent fatal cancers	0.97	1.0
Average worker dose (mrem/yr)	750	750
10-year latent fatal cancer risk	3.0×10^{-3}	3.0×10^{-3}

[a] The values would be the same for immobilization in either ceramic or glass.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995). However, the maximum dose to a worker involved in operations would be kept below the DOE administrative control level of 2,000 mrem/yr (DOE 1994). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: UC 1999c, 1999d.

J.4.2.3 MOX Facility

J.4.2.3.1 Construction of MOX Facility

No radiological risk would be incurred by members of the public from the construction of a new MOX facility at SRS. Construction worker exposures to radiation that derives from other activities at the site, past or present, would also be kept as low as is reasonably achievable. Construction workers would be monitored (badged) as appropriate. Summaries of radiological impacts of these activities are presented in Table J–52 for workers at risk.

Table J–52. Potential Radiological Impacts on Construction Workers of New MOX Facility at SRS

Annual average number of workers	292
Total dose (person-rem/yr)	1.2
Annual latent fatal cancers[a]	4.8×10^{-4}
Average worker dose (mrem/yr)	4
Annual latent fatal cancer risk	1.6×10^{-6}

[a] Values are based on a risk factor of 400 latent fatal cancers per million person-rem set by the National Research Council's Committee on the Biological Effects of Ionizing Radiations.

Note: The radiological limit for a construction worker is 100 mrem/yr because they are categorized as members of the public (DOE 1993). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: ICRP 1991; NAS 1990; UC 1998h.

J.4.2.3.2 Operation of MOX Facility

Tables J–53 and J–54 present the incident-free radiological impacts of the operation of a new MOX facility at SRS.

Table J–53. Potential Radiological Impacts on the Public of Operation of New MOX Facility at SRS[a]

Population within 80 km for year 2010	
Dose (person-rem)	0.18
Percent of natural background[b]	7.8×10^{-5}
10-year latent fatal cancers	9.1×10^{-4}
Maximally exposed individual	
Annual dose (mrem)	3.7×10^{-3}
Percent of natural background[b]	1.3×10^{-3}
10-year latent fatal cancer risk	1.9×10^{-8}
Average exposed individual within 80 km[c]	
Annual dose (mrem)	2.3×10^{-4}
10-year latent fatal cancer risk	1.2×10^{-9}

[a] Includes a dose component from liquid pathways because it is possible that liquid releases could reach these pathways at SRS.

[b] The annual natural background radiation level at SRS is 295 mrem for the average individual; the population within 80 km (50 mi) in 2010 would receive about 232,000 person-rem.

[c] Obtained by dividing the population dose by the number of people projected to live within 80 km (50 mi) of SRS in 2010 (about 790,000).

Source: Model results.

Table J–54. Potential Radiological Impacts on Involved Workers of Operation of New MOX Facility at SRS

Number of badged workers	331
Total dose (person-rem/yr)	22
10-year latent fatal cancers	0.088
Average worker dose (mrem/yr)	65
10-year latent fatal cancer risk	2.6×10^{-4}

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995). However, the maximum dose to a worker involved in operations would be kept below the DOE administrative control level of 2,000 mrem/yr (DOE 1994). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1999; UC 1998h.

J.4.2.4 Pit Conversion and Immobilization Facilities

J.4.2.4.1 Construction of Pit Conversion and Immobilization Facilities

No radiological risk would be incurred by members of the public from construction of new pit conversion and immobilization facilities at SRS. Construction worker exposures to radiation that derives from other activities at the site, past or present, would also be kept as low as is reasonably achievable. Construction workers would be monitored (badged) as appropriate. Summaries of radiological impacts of these activities are presented in Table J–55 for workers at risk.

Table J–55. Potential Radiological Impacts on Construction Workers of New Pit Conversion and Immobilization Facilities at SRS

Impact	Pit Conversion	Immobilization[a]	Total
Annual average number of workers	316	374	690
Total dose (person-rem/yr)	1.3	1.5	2.8
Annual latent fatal cancers[b]	5.2×10^{-4}	6.0×10^{-4}	1.1×10^{-3}
Average worker dose (mrem/yr)	4	4	4[c]
Annual latent fatal cancer risk	1.6×10^{-6}	1.6×10^{-6}	1.6×10^{-6}

[a] The values would be the same for immobilization in either ceramic or glass.

[b] Values are based on a risk factor of 400 latent fatal cancers per million person-rem set by the National Research Council's Committee on the Biological Effects of Ionizing Radiations.

[c] Represents an average of the doses for both facilities.

Note: The radiological limit for a construction worker is 100 mrem/yr because they are categorized as members of the public (DOE 1993). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: ICRP 1991; NAS 1990; UC 1998g, 1999c, 1999d.

J.4.2.4.2 Operation of Pit Conversion and Immobilization Facilities

Tables J–56 and J–57 present all possible incident-free radiological impact scenarios of operation of the new pit conversion and immobilization facilities at SRS.

Table J–56. Potential Radiological Impacts on the Public of Operation of New Pit Conversion and Immobilization Facilities at SRS

Impact	Pit Conversion	Immobilization (50 t) Ceramic	Immobilization (50 t) Glass	Total[a]
Population within 80 km for year 2010				
Dose (person-rem)	1.6	5.8×10^{-3}	5.3×10^{-3}	1.6
Percent of natural background[b]	6.9×10^{-4}	2.5×10^{-6}	2.3×10^{-6}	6.9×10^{-4}
10-year latent fatal cancers	8.0×10^{-3}	2.9×10^{-5}	2.7×10^{-5}	8.0×10^{-3}
Maximally exposed individual				
Annual dose (mrem)	3.7×10^{-3}	5.8×10^{-5}	5.3×10^{-5}	3.8×10^{-3}
Percent of natural background[b]	1.3×10^{-3}	2.0×10^{-5}	1.8×10^{-5}	1.3×10^{-3}
10-year latent fatal cancer risk	1.9×10^{-8}	2.9×10^{-10}	2.7×10^{-10}	1.9×10^{-8}
Average exposed individual within 80 km[c]				
Annual dose (mrem)	2.0×10^{-3}	7.4×10^{-6}	6.7×10^{-6}	2.0×10^{-3}
10-year latent fatal cancer risk	1.0×10^{-8}	3.7×10^{-11}	3.4×10^{-11}	1.0×10^{-8}

[Text deleted.]

[a] Totals represent the largest possible sums for each public category. Totals are additive in all cases because the same groups or individuals would receive doses from both facilities.

[b] The annual natural background radiation level at SRS is 295 mrem for the average individual; the population within 80 km (50 mi) in 2010 would receive about 232,000 person-rem.

[c] Obtained by dividing the population dose by the number of people projected to live within 80 km (50 mi) of the SRS facilities in 2010 (about 790,000).

Source: Model results.

Table J–57. Radiological Impacts on Involved Workers of Operation of New Pit Conversion and Immobilization Facilities at SRS

Impact	Pit Conversion	Immobilization (50 t)[a]	Total
Number of badged workers	383	339	772
Total dose (person-rem/yr)	192	254	446
10-year latent fatal cancers	0.77	1.0	1.8
Average worker dose (mrem/yr)	500	750	618[b]
10-year latent fatal cancer risk	2.0×10^{-3}	3.0×10^{-3}	2.5×10^{-3}

[a] The values would be the same for immobilization in either ceramic or glass.
[b] Represents an average of the doses for both facilities.
Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995). However, the maximum dose to a worker involved with operations would be kept below the DOE administrative control level of 2,000 mrem/yr (DOE 1994). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.
Source: UC 1998g, 1999c, 1999d.

J.4.2.5 Pit Conversion and MOX Facilities

J.4.2.5.1 Construction of Pit Conversion and MOX Facilities

No radiological risk would be incurred by members of the public from the construction of new pit conversion and MOX facilities at SRS. Construction worker exposures to radiation that derives from other activities at the site, past or present, would also be kept as low as is reasonably achievable. Construction workers would be monitored (badged) as appropriate. Summaries of radiological impacts of these activities are presented in Table J–58 for workers at risk.

Table J–58. Potential Radiological Impacts on Construction Workers of New Pit Conversion and MOX Facilities at SRS

Impact	Pit Conversion	MOX	Total
Annual average number of workers	341	292	633
Total dose (person-rem/yr)	1.4	1.2	2.6
Annual latent fatal cancers[a]	5.6×10^{-4}	4.8×10^{-4}	1.0×10^{-3}
Average worker dose (mrem/yr)	4	4	4[b]
Annual latent fatal cancer risk	1.6×10^{-6}	1.6×10^{-6}	1.6×10^{-6}

[a] Values are based on a risk factor of 400 latent fatal cancers per million person-rem set by the National Research Council's Committee on the Biological Effects of Ionizing Radiations.
[b] Represents an average of the doses for both facilities.
Note: The radiological limit for a construction worker is 100 mrem/yr because they are categorized as members of the public (DOE 1993). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.
Source: ICRP 1991; NAS 1990; UC 1998g, 1998h.

J.4.2.5.2 Operation of Pit Conversion and MOX Facilities

Tables J–59 and J–60 present the incident-free radiological impacts of operation of the new pit conversion and MOX facilities at SRS.

Table J–59. Potential Radiological Impacts on the Public of Operation of New Pit Conversion and MOX Facilities at SRS

Impact	Pit Conversion	MOX[a]	Total[b]
Population within 80 km for year 2010			
Dose (person-rem)	1.6	0.18	1.8
Percent of natural background[c]	6.9×10^{-4}	7.8×10^{-5}	7.7×10^{-4}
10-year latent fatal cancers	8.0×10^{-3}	9.1×10^{-4}	8.9×10^{-3}
Maximally exposed individual			
Annual dose (mrem)	3.7×10^{-3}	3.7×10^{-3}	7.4×10^{-3}
Percent of natural background[c]	1.3×10^{-3}	1.3×10^{-3}	2.5×10^{-3}
10-year latent fatal cancer risk	1.9×10^{-8}	1.9×10^{-8}	3.7×10^{-8}
Average exposed individual within 80 km[d]			
Annual dose (mrem)	2.0×10^{-3}	2.3×10^{-4}	2.2×10^{-3}
10-year latent fatal cancer risk	1.0×10^{-8}	1.2×10^{-9}	1.1×10^{-8}

[a] Includes a dose component from liquid pathways because it is possible that liquid releases could reach these pathways at SRS.

[b] Totals are additive in all cases because the same groups or individuals would receive doses from both facilities.

[c] The annual natural background radiation level at SRS is 295 mrem for the average individual; the population within 80 km (50 mi) in 2010 would receive about 232,000 person-rem.

[d] Obtained by dividing the population dose by the number of people projected to live within 80 km (50 mi) of SRS in 2010 (about 790,000).

Source: Model results.

Table J–60. Potential Radiological Impacts on Involved Workers of Operation of New Pit Conversion and MOX Facilities at SRS

Impact	Pit Conversion	MOX	Total
Number of badged workers	383	331	714
Total dose (person-rem/yr)	192	22	214
10-year latent fatal cancers	0.77	0.088	0.86
Average worker dose (mrem/yr)	500	65	300[a]
10-year latent fatal cancer risk	2.0×10^{-3}	2.6×10^{-4}	1.2×10^{-3}

[a] Represents an average of the doses for both facilities.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995). However, the maximum dose to a worker involved in operations would be kept below the DOE administrative control level of 2,000 mrem/yr (DOE 1994). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1999; UC 1998g, 1998h.

J.4.2.6 Immobilization and MOX Facilities

J.4.2.6.1 Construction of Immobilization and MOX Facilities

No radiological risk would be incurred by members of the public from the construction of new immobilization and MOX facilities at SRS. Construction worker exposures to radiation deriving from other activities, past or present, at the site would also be kept as low as is reasonably achievable. Construction workers would be monitored (badged) as appropriate. Summaries of radiological impacts of these activities are presented in Table J–61 for workers at risk.

Table J–61. Potential Radiological Impacts on Construction Workers of New Immobilization and MOX Facilities at SRS

Impact	Immobilization[a]	MOX	Total
Annual average number of workers	374	292	666
Total dose (person-rem/yr)	1.5	1.2	2.7
Annual latent fatal cancers[b]	6.0×10^{-4}	4.8×10^{-4}	1.1×10^{-3}
Average worker dose (mrem/yr)	4	4	4[c]
Annual latent fatal cancer risk	1.6×10^{-6}	1.6×10^{-6}	1.6×10^{-6}

[a] The values would be the same for immobilization in either ceramic or glass.

[b] Values are based on a risk factor of 400 latent fatal cancers per million person-rem set by the National Research Council's Committee on the Biological Effects of Ionizing Radiations.

[c] Represents an average of the doses for both facilities.

Note: The radiological limit for a construction worker is 100 mrem/yr because they are categorized as members of the public (DOE 1993). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: ICRP 1991; NAS 1990; UC 1998h, 1999c, 1999d.

J.4.2.6.2 Operation of Immobilization and MOX Facilities

Tables J–62 and J–63 present the incident-free radiological impacts of operation of the new immobilization and MOX facilities at SRS.

Table J–62. Potential Radiological Impacts on the Public of Operation of New Immobilization and MOX Facilities at SRS

Impact	Immobilization (17 t)		MOX[a]	Total[b]
	Ceramic	Glass		
Population within 80 km for year 2010				
Dose (person-rem)	2.8×10^{-3}	2.6×10^{-3}	0.18	0.18
Percent of natural background[c]	1.2×10^{-6}	1.1×10^{-6}	7.8×10^{-5}	7.9×10^{-5}
10-year latent fatal cancers	1.4×10^{-5}	1.3×10^{-5}	9.1×10^{-4}	9.2×10^{-4}
Maximally exposed individual				
Annual dose (mrem)	2.8×10^{-5}	2.6×10^{-5}	3.7×10^{-3}	3.7×10^{-3}
Percent of natural background[c]	9.5×10^{-6}	8.8×10^{-6}	1.3×10^{-3}	1.3×10^{-3}
10-year latent fatal cancer risk	1.4×10^{-10}	1.3×10^{-10}	1.9×10^{-8}	1.9×10^{-8}
Average exposed individual within 80 km[d]				
Annual dose (mrem)	3.6×10^{-6}	3.3×10^{-6}	2.3×10^{-4}	2.3×10^{-4}
10-year latent fatal cancer risk	1.8×10^{-11}	1.6×10^{-11}	1.2×10^{-9}	1.2×10^{-9}

[Text deleted.]

[a] Includes a dose component from liquid pathways because it is possible that liquid releases could reach these pathways at SRS.

[b] Totals represent the largest possible sums for each public category. Totals are additive in all cases because the same groups or individuals would receive doses from both facilities.

[c] The annual natural background radiation level at SRS is 295 mrem for the average individual; the population within 80 km (50 mi) in 2010 would receive about 232,000 person-rem.

[d] Obtained by dividing the population dose by the number of people projected to live within 80 km (50 mi) of the SRS facilities in 2010 (about 790,000).

Source: Model results.

Table J–63. Potential Radiological Impacts on Involved Workers of Operation of New Immobilization and MOX Facilities at SRS

Impact	Immobilization (17 t)[a]	MOX	Total
Number of badged workers	323	331	654
Total dose (person-rem/yr)	242	22	264
10-year latent fatal cancers	0.97	0.088	1.1
Average worker dose (mrem/yr)	750	65	404[b]
10-year latent fatal cancer risk	3.0×10^{-3}	2.6×10^{-4}	1.6×10^{-3}

[a] The values would be the same for immobilization in either ceramic or glass.

[b] Represents an average of the doses for both facilities.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995). However, the maximum dose to a worker involved in operations would be kept below the DOE administrative control level of 2,000 mrem/yr (DOE 1994). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1999; UC 1998h, 1999c, 1999d.

J.4.2.7 Pit Conversion, Immobilization, and MOX Facilities

J.4.2.7.1 Construction of Pit Conversion, Immobilization, and MOX Facilities

No radiological risk would be incurred by members of the public from the construction of new pit conversion, immobilization, and MOX facilities at SRS. Construction worker exposures to radiation that derives from other activities at the site, past or present, would also be kept as low as is reasonably achievable. Construction workers would be monitored (badged) as appropriate. Summaries of radiological impacts of these activities are presented in Table J–64 for workers at risk.

Table J–64. Potential Radiological Impacts on Construction Workers of New Pit Conversion, Immobilization, and MOX Facilities at SRS

Impact	Pit Conversion	Immobilization[a]	MOX	Total
Annual average number of workers	341	374	292	1,007
Total dose (person-rem/yr)	1.4	1.5	1.2	4.1
Annual latent fatal cancers[b]	5.6×10^{-4}	6.0×10^{-4}	4.8×10^{-4}	1.6×10^{-3}
Average worker dose (mrem/yr)	4	4	4	4[c]
Annual latent fatal cancer risk	1.6×10^{-6}	1.6×10^{-6}	1.6×10^{-6}	1.6×10^{-6}

[a] The values would be the same for immobilization in either ceramic or glass.

[b] Values are based on a risk factor of 400 latent fatal cancers per million person-rem set by the National Research Council's Committee on the Biological Effects of Ionizing Radiations.

[c] Represents an average of the doses for all three facilities.

Note: The radiological limit for construction workers is 100 mrem/yr because they are categorized as members of the public (DOE 1993). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: ICRP 1991; NAS 1990; UC 1998g, 1998h, 1999c, 1999d.

J.4.2.7.2 Operation of Pit Conversion, Immobilization, and MOX Facilities

Tables J–65 and J–66 present all possible incident-free radiological impact scenarios of operation of all three new facilities at SRS.

Table J–65. Potential Radiological Impacts on the Public of Operation of New Pit Conversion, Immobilization, and MOX Facilities at SRS

Impact	Pit Conversion	Immobilization (17 t)		MOX[a]	Total[b]
		Ceramic	Glass		
Population within 80 km for year 2010					
Dose (person-rem)	1.6	2.8×10^{-3}	2.6×10^{-3}	0.18	1.8
Percent of natural background[c]	6.9×10^{-4}	1.2×10^{-6}	1.1×10^{-6}	7.8×10^{-5}	7.8×10^{-4}
10-year latent fatal cancers	8.0×10^{-3}	1.4×10^{-5}	1.3×10^{-5}	9.1×10^{-4}	9.0×10^{-3}
Maximally exposed individual					
Annual dose (mrem)	3.7×10^{-3}	2.8×10^{-5}	2.6×10^{-5}	3.7×10^{-3}	7.4×10^{-3}
Percent of natural background[c]	1.3×10^{-3}	9.5×10^{-6}	8.8×10^{-6}	1.3×10^{-3}	2.5×10^{-3}
10-year latent fatal cancer risk	1.9×10^{-8}	1.4×10^{-10}	1.3×10^{-10}	1.9×10^{-8}	3.7×10^{-8}
Average exposed individual within 80 km[d]					
Annual dose (mrem)	2.0×10^{-3}	3.6×10^{-6}	3.3×10^{-6}	2.3×10^{-4}	2.2×10^{-3}
10-year latent fatal cancer risk	1.0×10^{-8}	1.8×10^{-11}	1.6×10^{-11}	1.2×10^{-9}	1.1×10^{-8}

[Text deleted.]

[a] Includes a dose component from liquid pathways because it is possible that liquid releases could reach these pathways at SRS.

[b] Totals represent the largest possible sums for each public category. Totals are additive in all cases because the same groups or individuals would receive doses from all three facilities.

[c] The annual natural background radiation level at SRS is 295 mrem for the average individual; the population within 80 km (50 mi) in the year 2010 receives about 232,000 person-rem.

[d] Obtained by dividing the population dose by the number of people projected to live within 80 km (50 mi) of the SRS facilities in 2010 (about 790,000).

Source: Model results.

Table J–66. Potential Radiological Impacts on Involved Workers of Operation of New Pit Conversion, Immobilization, and MOX Facilities at SRS

Impact	Pit Conversion	Immobilization (17 t)[a]	MOX	Total
Number of badged workers	383	323	331	1,037
Total dose (person-rem/yr)	192	242	22	456
10-year latent fatal cancers	0.77	0.97	0.088	1.8
Average worker dose (mrem/yr)	500	750	65	440[b]
10-year latent fatal cancer risk	2.0×10^{-3}	3.0×10^{-3}	2.6×10^{-4}	1.8×10^{-3}

[a] The values would be the same for immobilization in either ceramic or glass.

[b] Represents an average of the doses for all three facilities.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995). However, the maximum dose to a worker involved in operations would be kept below the DOE administrative control level of 2,000 mrem/yr (DOE 1994). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1999; UC 1998g, 1998h, 1999c, 1999d.

J.5 LEAD ASSEMBLY FABRICATION

J.5.1 ANL–W

J.5.1.1 Assessment Data

This section presents applicable data and assumptions used in the assessment of lead assembly human health risks at ANL–W at INEEL. Appendix F.10 provides a summary of the methods and tools (e.g., the GENII computer code) used for the assessment.

J.5.1.1.1 Meteorological Data

The meteorological data used for the ANL–W dose assessments was in the form of a JFD file. A JFD file is a table listing the percentages of time the wind blows in a certain direction, at a certain speed, and within a certain stability class. The JFD file was based on measurements taken over a period of several years at a specific location and height. Average annual meteorological conditions, averaged over the measurement period, were used for normal operations. Table J–20 presents the JFD used in the dose assessments for ANL–W.

J.5.1.1.2 Population Data

The INEEL population distribution was based on the *1990 Census of Population and Housing Data* (DOC 1992). Projections were determined for the year 2005 for areas within 80 km (50 mi) of the proposed facility location. The site population in 2005 was assumed to be representative of the population over the operational period evaluated. The population was spatially distributed on a circular grid with 16 directions and 10 radial distances out to an 80-km (50-mi) distance. The grid was centered at ANL–W, the location from which radionuclides are assumed to be released during incident-free operations. Table J–67 presents the population data used for the lead assembly dose assessments at ANL–W.

J.5.1.1.3 Agricultural Data

The 1987 Census of Agriculture was the source used to generate site-specific data for food production. Food production was spatially distributed on a circular grid similar to that used for the population distributions described previously. This food grid (or wheel) was generated by combining the fraction of a county in each segment (e.g., south, southwest, north-northeast) and the county production of the eight food categories analyzed by GENII—leafy vegetables, root vegetables, fruits, grains, beef, poultry, milk, and eggs. Each county's food production was assumed to be distributed uniformly over the given county's land area. These categorized food wheels were then used in the assessment of doses to the population from the ingestion pathway. The consumption rates used in the dose assessments were those for the MEI and average exposed individual. People living within the 80-km (50-mi) assessment area were assumed to consume only food grown in that area. ANL–W food production and consumption data used for the dose assessments in the SPD EIS were obtained from the *Health Risk Data for Storage and Disposition Final PEIS* (HNUS 1996).

J.5.1.1.4 Source Term Data

Estimated incident-free radiological releases associated with the MOX fuel lead assembly facility are presented in Table J–68. Stack height and release location are provided in the Oak Ridge National Laboratory (ORNL) *ANL-W MOX Fuel Lead Assemblies Data Report for the Surplus Plutonium Disposition Environmental Impact Statement* (O'Connor et al. 1998a).

Table J–67. Projected INEEL Population Surrounding ANL–W for Year 2005

Direction	Distance (mi)										Total
	0–1	1–2	2–3	3–4	4–5	5–10	10–20	20–30	30–40	40–50	
S	0	0	0	0	0	0	277	2,086	6,173	30,883	**39,419**
SSW	0	0	0	0	0	0	273	323	906	3,267	**4,769**
SW	0	0	0	0	0	0	246	247	224	334	**1,051**
WSW	0	0	0	0	0	0	0	238	177	181	**596**
W	0	0	0	0	0	0	0	179	224	528	**931**
WNW	0	0	0	0	0	0	35	474	824	467	**1,800**
NW	0	0	0	0	0	0	36	57	280	929	**1,302**
NNW	0	0	0	0	0	0	0	81	76	76	**233**
N	0	0	0	0	0	0	0	254	140	146	**540**
NNE	0	0	0	0	0	0	252	450	266	158	**1,126**
NE	0	0	0	0	0	0	252	443	515	98	**1,308**
ENE	0	0	0	0	0	0	253	706	1,411	5,196	**7,566**
E	0	0	0	0	0	0	367	1,405	18,570	32,506	**52,848**
ESE	0	0	0	0	0	103	509	4,197	90,875	756	**96,440**
SE	0	0	0	0	17	80	589	3,523	11,502	411	**16,122**
SSE	0	0	0	0	17	52	279	4,816	19,230	1,068	**25,462**
Total	**0**	**0**	**0**	**0**	**34**	**235**	**3,368**	**19,479**	**151,393**	**77,004**	**251,513**

Key: ANL–W, Argonne National Laboratory–West.
Source: DOC 1992.

Table J–68. Estimated Incident-Free Annual Radiological Releases From the MOX Lead Assembly Facility at ANL–W

Isotope	(μCi/yr)
Plutonium 236	–
Plutonium 238	0.85
Plutonium 239	23
Plutonium 240	5.3
Plutonium 241	58
Plutonium 242	9.3×10^{-4}
Americium 241	2.0
Uranium 234	1.3×10^{-3}
Uranium 235	5.4×10^{-5}
Uranium 238	3.1×10^{-3}

Source: O'Connor et al. 1998a.

J.5.1.1.5 Other Calculational Assumptions

To estimate radiological impacts of incident-free operation of the lead assembly facility at ANL–W, the following additional assumptions and factors were considered, in accordance with the guidelines established in NRC Regulatory Guide 1.109 (NRC 1977).

> Ground surfaces were assumed to have no previous deposition of radionuclides for the purposes of modeling the incremental radiological impacts associated with surplus plutonium disposition activities.

However, doses associated with true instances of prior deposition are accounted for in the Affected Environment and Cumulative Impacts sections.

The annual external exposure time to the plume and to soil contamination was 0.7 year for the MEI (NRC 1977).

The annual external exposure time to the plume and to soil contamination was 0.5 year for the population (NRC 1977).

The annual inhalation exposure time to the plume was 1 year for the MEI and general population (NRC 1977).

The exposed individual or population was assumed to have the characteristics and habits (e.g., inhalation and ingestion rates) of the adult human.

A semi-infinite/finite plume model was used for air immersion doses. Other pathways evaluated were ground exposure, inhalation, ingestion of food crops, and ingestion of contaminated animal products. Drinking water, aquatic food ingestion, and any other pathway that may involve liquid exposure were not examined because all releases are to the air.

Reported stack heights were used for atmospheric releases and were assumed to be the effective stack height. The resultant doses were conservative because use of the actual stack height negates plume rise.

The calculated doses are 50-year committed doses from 1 year of intake.

J.5.1.2 Human Health Impacts

Potential radiological impacts on the public and workers resulting from normal lead assembly operations are presented in Section 4.27.1.4. Potential impacts on postirradiation examination facility workers are presented in Section 4.27.6.2.

J.5.2 Hanford

J.5.2.1 Assessment Data

This section presents applicable data and assumptions used in the assessment of lead assembly human health risks at Hanford. Appendix F.10 provides a summary of the methods and tools (e.g., the GENII computer code) used for the assessment.

J.5.2.1.1 Meteorological Data

The meteorological data used for the Hanford dose assessments was in the form of a JFD file. A JFD file is a table listing the percentages of time the wind blows in a certain direction, at a certain speed, and within a certain stability class. The JFD file was based on measurements taken over a period of several years at a specific location and height. Average annual meteorological conditions, averaged over the measurement period, were used for normal operations. Table J–1 presents the JFD used in the dose assessments for Hanford.

J.5.2.1.2 Population Data

The Hanford population distribution was based on the *1990 Census of Population and Housing Data* (DOC 1992). Projections were determined for the year 2005 for areas within 80 km (50 mi) of the proposed facility location. The site population in 2005 was assumed to be representative of the population over the operational period evaluated. The population was spatially distributed on a circular grid with 16 directions and 10 radial distances out to an 80-km (50-mi) distance. The grid was centered at FMEF in the 400 Area, the location from which radionuclides are assumed to be released during incident-free operations. Table J–69 presents the population data used for lead assembly dose assessments at Hanford.

Table J–69. Projected Hanford Population Surrounding FMEF for Year 2005

Direction	Distance (mi)										Total
	0–1	1–2	2–3	3–4	4–5	5–10	10–20	20–30	30–40	40–50	
S	0	0	0	0	0	3,886	40,763	1,039	7,050	19,641	**72,379**
SSW	0	0	0	0	2	1,380	2,513	399	2,888	3,828	**11,010**
SW	0	0	0	0	38	1,265	4,361	288	207	1,923	**8,082**
WSW	0	0	0	0	0	50	2,175	15,734	3,338	300	**21,597**
W	0	0	0	0	0	0	698	5,764	26,190	14,858	**47,510**
WNW	0	0	0	0	0	0	5	813	1,147	8,446	**10,411**
NW	0	0	0	0	0	0	0	592	377	163	**1,132**
NNW	0	0	0	0	0	0	0	1,034	1,317	1,362	**3,713**
N	0	0	0	0	0	0	0	1,224	3,458	2,520	**7,202**
NNE	0	0	0	0	0	16	425	5,074	1,388	23,720	**30,623**
NE	0	0	0	0	0	86	751	6,743	2,769	1,153	**11,502**
ENE	0	0	0	0	0	313	1,401	3,391	385	410	**5,900**
E	0	0	0	0	0	386	861	410	319	300	**2,276**
ESE	0	0	0	0	0	393	595	315	245	302	**1,850**
SE	0	0	0	0	0	381	1,191	1,604	366	1,364	**4,906**
SSE	0	0	0	0	0	6,366	79,333	30,715	565	979	**117,958**
Total	**0**	**0**	**0**	**0**	**40**	**14,522**	**135,072**	**75,139**	**52,009**	**81,269**	**358,051**

Key: FMEF, Fuels and Materials Examination Facility.
Source: DOC 1992.

J.5.2.1.3 Agricultural Data

The 1987 Census of Agriculture was the source used to generate site-specific data for food production. Food production was spatially distributed on a circular grid similar to that used for the population distributions described previously. This food grid (or wheel) was generated by combining the fraction of a county in each segment (e.g., south, southwest, north-northeast) and the county production of the eight food categories analyzed by GENII—leafy vegetables, root vegetables, fruits, grains, beef, poultry, milk, and eggs. Each county's food production was assumed to be distributed uniformly over the given county's land area. These categorized food wheels were then used in the assessment of doses to the population from the ingestion pathway. The consumption rates used in the dose assessments were those for the MEI and average exposed individual. People living within the 80-km (50-mi) assessment area were assumed to consume only food grown in that area. Hanford food production and consumption data used for the dose assessments in the SPD EIS were obtained from the *Health Risk Data for Storage and Disposition Final PEIS* (HNUS 1996).

J.5.2.1.4 Source Term Data

Estimated incident-free radiological releases associated with the MOX fuel lead assembly facility are presented in Table J–70. Stack height and release location are reported in the ORNL *Hanford MOX Fuel Lead Assemblies Data Report for the Surplus Plutonium Disposition Environmental Impact Statement* (O'Connor et al. 1998b).

Table J–70. Estimated Incident-Free Annual Radiological Releases From the MOX Lead Assembly Facility at Hanford

Isotope	(μCi/yr)
Plutonium 236	–
Plutonium 238	0.85
Plutonium 239	23
Plutonium 240	5.3
Plutonium 241	58
Plutonium 242	9.3×10^{-4}
Americium 241	2.0
Uranium 234	1.3×10^{-3}
Uranium 235	5.4×10^{-5}
Uranium 238	3.1×10^{-3}

Source: O'Connor et al. 1998b.

J.5.2.1.5 Other Calculational Assumptions

To estimate radiological impacts of incident-free operation of the lead assembly facility at Hanford, the following additional assumptions and factors were considered, in accordance with the guidelines established in NRC Regulatory Guide 1.109 (NRC 1977).

Ground surfaces were assumed to have no previous deposition of radionuclides for the purposes of modeling the incremental radiological impacts associated with surplus plutonium disposition activities. However, doses associated with true instances of prior deposition are accounted for in the Affected Environment and Cumulative Impacts sections.

The annual external exposure time to the plume and to soil contamination was 0.7 year for the MEI (NRC 1977).

The annual external exposure time to the plume and to soil contamination was 0.5 year for the population (NRC 1977).

The annual inhalation exposure time to the plume was 1 year for the MEI and general population (NRC 1977).

The exposed individual or population was assumed to have the characteristics and habits (e.g., inhalation and ingestion rates) of the adult human.

A semi-infinite/finite plume model was used for air immersion doses. Other pathways evaluated were ground exposure, inhalation, ingestion of food crops, and ingestion of contaminated animal products. Drinking water, aquatic food ingestion, and any other pathway that may involve liquid exposure were not examined because all releases are to the air.

Reported stack heights were used for atmospheric releases and were assumed to be the effective stack height. The resultant doses were conservative because use of the actual stack height negates plume rise.

The calculated doses are 50-year committed doses from 1 year of intake.

J.5.2.2 Human Health Impacts

Potential radiological impacts on the public and workers resulting from normal lead assembly operations are presented in Section 4.27.2.4.

J.5.3 LLNL

J.5.3.1 Assessment Data

This section presents applicable data and assumptions used in the assessment of lead assembly human health risks at LLNL. Appendix F.10 provides a summary of the methods and tools (e.g., the GENII computer code) used for the assessment.

J.5.3.1.1 Meteorological Data

The meteorological data used for the LLNL dose assessments was in the form of a JFD file. A JFD file is a table listing the percentages of time the wind blows in a certain direction, at a certain speed, and within a certain stability class. The JFD file was based on measurements taken at a specific location and height. Annual meteorological conditions were used for normal operations. Table J–71 presents the JFD used in the dose assessments for LLNL.

J.5.3.1.2 Population Data

The LLNL population distribution was based on the *1990 Census of Population and Housing Data* (DOC 1992). Projections were determined for the year 2005 for areas within 80 km (50 mi) of the proposed facility location. The site population in 2005 was assumed to be representative of the population over the operational period evaluated. The population was spatially distributed on a circular grid with 16 directions and 10 radial distances out to an 80-km (50-mi) distance. The grid was centered at Building 332, the location from which radionuclides are assumed to be released during incident-free operations. Table J–72 presents the population data that were used for lead assembly dose assessments at LLNL.

J.5.3.1.3 Agricultural Data

The 1992 Census of Agriculture (DOC 1992) was the source used to generate site-specific data for food production. Food production was spatially distributed on a circular grid similar to that used for the population distributions described previously. This food grid (or wheel) was generated by combining the fraction of a county in each segment (e.g., south, southwest, north-northeast) and the county production of the eight food categories analyzed by GENII—leafy vegetables, root vegetables, fruits, grains, beef, poultry, milk, and eggs. Each county's food production was assumed to be distributed uniformly over the given county's land area. These categorized food wheels were then used in the assessment of doses to the population from the ingestion pathway. The consumption rates used in the dose assessments were those for the MEI and average exposed individual. People living within the 80-km (50-mi) assessment area were assumed to consume only food grown in that area. LLNL food production and consumption data used for the dose assessments in the SPD EIS were obtained from the 1992 census data for LLNL (DOC 1992).

Table J–71. LLNL 1993 Joint Frequency Distributions at 10-m Height

Wind Speed (m/s)	Stability Class	Wind Blows Toward															
		S	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**
0.89	A	0.45	0.41	0.4	0.33	0.27	0.17	0.14	0.11	0.13	0.34	0.62	1.14	1.53	0.78	0.57	0.45
	B	0.22	0.11	0.1	0.11	0.1	0.03	0.03	0.01	0.07	0.05	0.27	0.41	0.17	0.17	0.14	0.09
	C	0.13	0.09	0.15	0.03	0.02	0.01	0	0.03	0.08	0.14	0.16	0.22	0.16	0.09	0.08	0.07
	D	0.17	0.33	0.45	0.53	0.65	0.67	0.23	0.34	1.05	1.86	1.21	0.7	0.27	0.13	0.05	0.03
	E	0.18	0.33	0.86	0.99	1.01	1.13	0.39	0.48	1.07	1.7	0.74	0.41	0.25	0.06	0.09	0.03
	F	0.11	0.16	0.61	0.93	0.8	0.63	0.55	0.31	0.35	0.38	0.39	0.14	0.1	0.08	0.11	0.07
	G	0.62	0.74	1.06	1.64	1.97	1.78	1.53	0.97	0.73	0.75	0.49	0.48	0.34	0.27	0.35	0.37
2.86	A	0.3	0.37	0.24	0.18	0.03	0.02	0.02	0.01	0	0.02	0.26	0.81	0.89	0.31	0.21	0.16
	B	0.4	0.39	0.77	0.16	0	0.03	0.02	0.01	0.02	0.08	0.39	1.26	1.15	0.22	0.07	0.21
	C	0.07	0.59	1.21	0	0	0	0	0.01	0.02	0.09	0.7	1.28	1.17	0.23	0.01	0.03
	D	0.03	0.82	1.04	0.03	0	0	0.03	0.09	0.25	1.14	4.88	2.71	1.81	0.21	0.02	0
	E	0.07	0.13	0.27	0.07	0	0	0.05	0.06	0.63	1.91	0.93	0.16	0.03	0	0	0.02
	F	0.03	0.03	0.16	0.1	0.01	0.02	0.01	0.02	0.03	0.02	0.06	0.02	0.01	0.02	0.01	0.01
	G	0.01	0.05	0.07	0.06	0.05	0.02	0.03	0.02	0.05	0.03	0.06	0	0	0	0.01	0.01
4.71	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	C	0.34	0.71	0.23	0.02	0	0.02	0	0.05	0.01	0.03	0.3	1.22	1.62	0.16	0.01	0
	D	0.08	0.72	0.56	0	0	0	0	0.06	0.09	0.61	3.64	1.51	2.04	0.11	0.01	0.02
	E	0	0.02	0	0	0	0	0	0	0	0.15	0.17	0.01	0	0	0	0
	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	G	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.69	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	D	0.15	0.24	0.02	0	0	0	0	0	0.03	0.45	1.25	0.32	0.13	0.03	0	0
	E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	G	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.68	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	D	0.07	0.08	0	0	0	0	0	0	0.02	0.07	0.02	0	0.01	0	0	0
	E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	G	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table J–71. LLNL 1993 Joint Frequency Distributions at 10-m Height (Continued)

Wind Speed (m/s)	Stability Class	Wind Blows Toward															
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE
10.5	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0
	E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	G	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Key: LLNL, Lawrence Livermore National Laboratory.
Source: Gouveia 1997.

Table J–72. Projected LLNL Population Surrounding Building 332 for Year 2005

Direction	Distance (mi)										Total
	0–1	1–2	2–3	3–4	4–5	5–10	10–20	20–30	30–40	40–50	
S	5	14	6	8	10	84	178	157	15,286	56,124	**71,872**
SSW	5	15	13	8	10	47	1,080	301,887	190,271	27,874	**521,210**
SW	31	538	25	18	16	91	42,723	589,979	350,562	52,017	**1,036,000**
WSW	228	1,283	660	982	1,885	644	146,903	239,224	184,580	4,845	**581,234**
W	302	1,316	3,338	6,379	9,931	24,309	112,488	123,480	333,290	64,111	**678,944**
WNW	311	1,316	4,567	6,337	8,349	20,051	92,859	476,610	570,787	545,627	**1,726,814**
NW	272	1,316	1,770	2,274	212	677	78,366	170,569	454,881	135,688	**846,025**
NNW	109	1,423	2,850	2,109	53	404	8,150	275,850	117,234	154,923	**563,105**
N	5	49	1,094	324	39	367	4,555	139,309	1,444	230,332	**377,518**
NNE	5	15	25	35	45	283	13,831	24,535	7,317	5,523	**51,614**
NE	5	15	16	25	21	127	8,403	12,091	128,594	36,124	**185,421**
ENE	5	11	6	8	10	111	2,218	130,249	211,561	11,360	**355,539**
E	5	14	8	8	10	249	54,523	86,577	30,047	47,622	**219,063**
ESE	5	15	17	8	10	103	1,898	7,484	230,939	242,714	**483,193**
SE	5	15	10	8	10	91	512	902	18,290	23,344	**43,187**
SSE	5	12	6	8	10	85	314	83	26	1,063	**1,612**
Total	**1,303**	**7,367**	**14,411**	**18,539**	**20,621**	**47,723**	**569,001**	**2,578,986**	**2,845,109**	**1,639,291**	**7,742,351**

Key: LLNL, Lawrence Livermore National Laboratory.
Source: DOC 1992.

J.5.3.1.4 Source Term Data

Estimated incident-free radiological releases associated with the MOX fuel lead assembly facility are presented in Table J–73. Stack height and release location are provided in the ORNL *LLNL MOX Fuel Lead Assemblies Data Report for the Surplus Plutonium Disposition Environmental Impact Statement* (O'Connor et al. 1998c).

Table J–73. Estimated Incident-Free Annual Radiological Releases From the MOX Lead Assembly Facility at LLNL

Isotope	(μCi/yr)
Plutonium 236	–
Plutonium 238	0.85
Plutonium 239	23
Plutonium 240	5.3
Plutonium 241	58
Plutonium 242	9.3×10^{-4}
Americium 241	2.0
Uranium 234	1.3×10^{-3}
Uranium 235	5.4×10^{-5}
Uranium 238	3.1×10^{-3}

Source: O'Connor et al. 1998c.

J.5.3.1.5 Other Calculational Assumptions

To estimate radiological impacts of incident-free operation of the lead assembly facility at LLNL, the following additional assumptions and factors were considered, in accordance with the guidelines established in NRC Regulatory Guide 1.109 (NRC 1977).

> Ground surfaces were assumed to have no previous deposition of radionuclides for the purposes of modeling the incremental radiological impacts associated with surplus plutonium disposition activities. However, doses associated with true instances of prior deposition are accounted for in the Affected Environment and Cumulative Impacts sections.
>
> The annual external exposure time to the plume and to soil contamination was 0.7 year for the MEI (NRC 1977).
>
> The annual external exposure time to the plume and to soil contamination was 0.5 year for the population (NRC 1977).
>
> The annual inhalation exposure time to the plume was 1 year for the MEI and general population (NRC 1977).
>
> The exposed individual or population was assumed to have the characteristics and habits (e.g., inhalation and ingestion rates) of the adult human.
>
> A semi-infinite/finite plume model was used for air immersion doses. Other pathways evaluated were ground exposure, inhalation, ingestion of food crops, and ingestion of contaminated animal products. Drinking water, aquatic food ingestion, and any other pathway that may involve liquid exposure were not examined because all releases are to the air.
>
> Reported stack heights were used for atmospheric releases and were assumed to be the effective stack height. The resultant doses were conservative because use of the actual stack height negates plume rise.
>
> The calculated doses are 50-year committed doses from 1 year of intake.

J.5.3.2 Human Health Impacts

Potential radiological impacts on the public and workers resulting from normal lead assembly operations are presented in Section 4.27.3.4.

J.5.4 LANL

J.5.4.1 Assessment Data

This section presents applicable data and assumptions used in the assessment of lead assembly human health risks at LANL. Appendix F.10 provides a summary of the methods and tools (e.g., the GENII computer code) used for the assessment.

J.5.4.1.1 Meteorological Data

The meteorological data used for the LANL dose assessments was in the form of a JFD file. A JFD file is a table listing the percentages of time the wind blows in a certain direction, at a certain speed, and within a certain stability class. The JFD file was based on measurements taken at a specific location and height. Annual meteorological conditions were used for normal operations. Table J–74 presents the JFD used in the dose assessments for LANL.

J.5.4.1.2 Population Data

The LANL population distribution was based on the *1990 Census of Population and Housing Data* (DOC 1992). Projections were determined for the year 2005 for areas within 80 km (50 mi) of the proposed facility location. The site population in 2005 was assumed to be representative of the population over the operational period evaluated. The population was spatially distributed on a circular grid with 16 directions and 10 radial distances out to an 80-km (50-mi) distance. The grid was centered at Technical Area 55 (TA–55), the location from which radionuclides are assumed to be released during incident-free operations. Table J–75 presents the population data used for lead assembly dose assessments at LANL.

J.5.4.1.3 Agricultural Data

The 1992 Census of Agriculture was the source used to generate site-specific data for food production. Food production was spatially distributed on a circular grid similar to that used for the population distributions described previously. This food grid (or wheel) was generated by combining the fraction of a county in each segment (e.g., south, southwest, north-northeast) and the county production of the eight food categories analyzed by GENII—leafy vegetables, root vegetables, fruits, grains, beef, poultry, milk, and eggs. Each county's food production was assumed to be distributed uniformly over the given county's land area. These categorized food wheels were then used in the assessment of doses to the population from the ingestion pathway. The consumption rates used in the dose assessments were those for the MEI and average exposed individual. People living within the 80-m (50-mi) assessment area were assumed to consume only food grown in that area. LANL food production and consumption data used for the dose assessments in the SPD EIS were obtained from the *Final Environmental Impact Statement on Management of Certain Plutonium Residues and Scrub Alloy Stored at the Rocky Flats Environmental Technology Site* (DOE 1998).

Table J–74. LANL 1993–1996 Joint Frequency Distributions at 11-m Height

Wind Speed (m/s)	Stability Class	Wind Blows Toward															
		S	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**
0.78	A	0.12	0.26	0.5	0.84	0.74	0.54	0.45	0.32	0.18	0.11	0.08	0.05	0.06	0.06	0.07	0.07
	B	0.03	0.05	0.12	0.19	0.16	0.09	0.08	0.07	0.04	0.01	0.02	0.01	0.02	0.02	0.01	0.02
	C	0.05	0.09	0.14	0.2	0.16	0.09	0.09	0.09	0.07	0.04	0.03	0.03	0.02	0.03	0.02	0.03
	D	0.86	0.69	0.57	0.45	0.47	0.34	0.33	0.33	0.38	0.35	0.33	0.31	0.35	0.4	0.57	0.72
	E	0.59	0.45	0.33	0.23	0.22	0.15	0.13	0.13	0.17	0.24	0.32	0.28	0.29	0.4	0.51	0.62
	F	0.26	0.28	0.27	0.19	0.18	0.17	0.2	0.25	0.3	0.32	0.22	0.17	0.15	0.2	0.24	0.25
2.5	A	0.03	0.07	0.17	0.45	0.56	0.43	0.33	0.22	0.18	0.08	0.06	0.05	0.04	0.03	0.03	0.03
	B	0.02	0.05	0.2	0.39	0.42	0.31	0.27	0.22	0.16	0.1	0.06	0.05	0.05	0.04	0.03	0.02
	C	0.05	0.15	0.46	0.68	0.65	0.45	0.46	0.59	0.59	0.26	0.16	0.12	0.16	0.12	0.07	0.05
	D	0.95	1.09	0.94	0.72	0.56	0.34	0.47	1.3	2.12	1.89	1.93	0.95	1.08	0.81	0.56	0.63
	E	0.87	0.59	0.34	0.19	0.11	0.1	0.13	0.24	0.67	1.82	2.41	1.72	1.84	1.41	0.8	0.8
	F	0.09	0.07	0.05	0.03	0.01	0.01	0.05	0.1	0.25	0.33	0.11	0.36	0.39	0.39	0.12	0.07
4.5	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01	0.02	0.01	0
	C	0.02	0.04	0.07	0.04	0.02	0.01	0.01	0.03	0.15	0.09	0.11	0.19	0.31	0.19	0.09	0.02
	D	0.81	0.8	0.42	0.16	0.07	0.04	0.11	0.99	3.24	3.52	2.59	1.61	1.86	1.05	0.54	0.44
	E	0.21	0.2	0.08	0.01	0	0	0.01	0.07	0.32	1.74	1.08	1.32	1.31	0.32	0.23	0.22
	F	0	0.01	0	0	0	0	0	0	0.02	0.04	0	0.05	0.05	0.01	0.01	0
6.9	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01	0	0
	D	0.19	0.2	0.05	0	0	0	0.01	0.31	0.96	1.42	0.87	0.93	0.62	0.48	0.31	0.15
	E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9.6	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	D	0.01	0.01	0	0	0	0	0	0.05	0.03	0.08	0.09	0.19	0.08	0.05	0.04	0.02
	E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	0	0.01	0	0	0.01	0.01	0	0	0	0
	E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Key: LANL, Los Alamos National Laboratory.
Source: LANL 1997.

Table J–75. Projected LANL Population Surrounding TA–55 for Year 2005

Direction	Distance (mi)										Total
	0–1	1–2	2–3	3–4	4–5	5–10	10–20	20–30	30–40	40–50	
S	0	0	25	26	44	221	701	1,606	1,125	2,962	**6,710**
SSW	0	0	26	20	56	21	1,373	4,464	4,949	43,596	**54,505**
SW	0	0	26	22	80	29	155	1,767	817	30,893	**33,789**
WSW	0	0	26	21	56	302	159	1,187	2,500	61	**4,312**
W	0	0	27	20	26	457	190	1,084	135	350	**2,289**
WNW	0	12	39	135	90	532	73	138	1,755	1,306	**4,080**
NW	0	152	1,287	2,379	1,500	720	102	195	248	274	**6,857**
NNW	0	427	844	224	126	421	169	211	174	220	**2,816**
N	500	585	264	107	137	560	609	688	659	289	**4,398**
NNE	0	480	61	57	56	463	958	919	658	143	**3,795**
NE	0	101	12	17	22	378	12,856	2,950	1,954	3,236	**21,526**
ENE	0	10	12	17	22	618	13,270	3,439	2,869	1,938	**22,195**
E	0	10	12	17	22	684	3,598	590	719	1,161	**6,813**
ESE	0	10	12	17	33	220	1,602	3,608	316	834	**6,652**
SE	0	0	0	0	4,488	952	6,143	76,455	4,503	742	**93,283**
SSE	0	0	0	117	85	224	5,021	10,633	2,091	483	**18,654**
Total	**500**	**1,787**	**2,673**	**3,196**	**6,843**	**6,802**	**46,979**	**109,934**	**25,472**	**88,488**	**292,674**

Key: LANL, Los Alamos National Laboratory; TA–55, Technical Area 55.
Source: DOC 1992.

J.5.4.1.4 Source Term Data

Estimated incident-free radiological releases associated with the MOX fuel lead assembly facility are presented in Table J–76. Stack height and release location are provided in the ORNL *LANL MOX Fuel Lead Assemblies Data Report for the Surplus Plutonium Disposition Environmental Impact Statement* (O'Connor et al. 1998d).

Table J–76. Estimated Incident-Free Annual Radiological Releases From the MOX Lead Assembly Facility at LANL

Isotope	(μCi/yr)
Plutonium 236	–
Plutonium 238	0.85
Plutonium 239	23
Plutonium 240	5.3
Plutonium 241	58
Plutonium 242	9.3×10^{-4}
Americium 241	2.0
Uranium 234	1.3×10^{-3}
Uranium 235	5.4×10^{-5}
Uranium 238	3.1×10^{-3}

Source: O'Connor et al. 1998d.

J.5.4.1.5 Other Calculational Assumptions

To estimate radiological impacts of incident-free operation of the lead assembly facility at LANL, the following additional assumptions and factors were considered, in accordance with the guidelines established in NRC Regulatory Guide 1.109 (NRC 1977).

Ground surfaces were assumed to have no previous deposition of radionuclides for the purposes of modeling the incremental radiological impacts associated with surplus plutonium disposition activities. However, doses associated with true instances of prior deposition are accounted for in the Affected Environment and Cumulative Impacts sections.

The annual external exposure time to the plume and to soil contamination was 0.7 year for the MEI (NRC 1977).

The annual external exposure time to the plume and to soil contamination was 0.5 year for the population (NRC 1977).

The annual inhalation exposure time to the plume was 1 year for the MEI and general population (NRC 1977).

The exposed individual or population was assumed to have the characteristics and habits (e.g., inhalation and ingestion rates) of the adult human.

A semi-infinite/finite plume model was used for air immersion doses. Other pathways evaluated were ground exposure, inhalation, ingestion of food crops, and ingestion of contaminated animal products. Drinking water, aquatic food ingestion, and any other pathway that may involve liquid exposure were not examined because all releases are to the air.

Reported stack heights were used for atmospheric releases and were assumed to be the effective stack height. The resultant doses were conservative, because use of the actual stack height negates plume rise.

The calculated doses are 50-year committed doses from 1 year of intake.

J.5.4.2 Human Health Impacts

Potential radiological impacts on the public and workers resulting from normal lead assembly operations are presented in Section 4.27.4.4.

J.5.5 SRS

J.5.5.1 Assessment Data

This section presents applicable data and assumptions used in the assessment of lead assembly human health risks at SRS. Appendix F.10 provides a summary of the methods and tools (e.g., the GENII computer code) used for the assessment.

J.5.5.1.1 Meteorological Data

The meteorological data used for the SRS dose assessments was in the form of a JFD file. A JFD file is a table listing the percentages of time the wind blows in a certain direction, at a certain speed, and within a certain stability class. The JFD file was based on measurements taken over a period of several years at a specific location (H-Area) and height. Average annual meteorological conditions, averaged over the measurement period, were used for normal operations. Table J–77 presents the JFD used in the dose assessments for SRS.

J.5.5.1.2 Population Data

The SRS population distribution was based on the *1990 Census of Population and Housing Data* (DOC 1992). Projections were determined for the year 2005 for areas within 80 km (50 mi) of the proposed facility location. The site population in 2005 was assumed to be representative of the population over the operational period evaluated. The population was spatially distributed on a circular grid with 16 directions and 10 radial distances out to an 80-km (50-mi) distance. The grid was centered within H-Area, the location from which radionuclides are assumed to be released during incident-free operations. Table J–78 presents the population data used for the lead assembly dose assessments at SRS.

J.5.5.1.3 Agricultural Data

The 1987 Census of Agriculture was the source used to generate site-specific data for food production. Food production was spatially distributed on a circular grid similar to that used for the population distributions described previously. This food grid (or wheel) was generated by combining the fraction of a county in each segment (e.g., south, southwest, north-northeast) and the county production of the eight food categories analyzed by GENII—leafy vegetables, root vegetables, fruits, grains, beef, poultry, milk, and eggs. Each county's food production was assumed to be distributed uniformly over the given county's land area. These categorized food wheels were then used in the assessment of doses to the population from the ingestion pathway. The consumption rates used in the dose assessments were those for the MEI and average exposed individual. People living within the 80-km (50-mi) assessment area were assumed to consume only food grown in that area. SRS food production and consumption data used for the dose assessments in the SPD EIS were obtained from the *Health Risk Data for Storage and Disposition of Final PEIS* (HNUS 1996).

Table J–77. SRS 1987–1991 Joint Frequency Distributions at 61-m Height

Wind Speed (m/s)	Stability Class	Wind Blows Toward															
		S	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**
2.0	A	0.37	0.41	0.37	0.42	0.4	0.37	0.4	0.36	0.36	0.35	0.45	0.39	0.45	0.43	0.37	0.41
	B	0.08	0.08	0.09	0.1	0.05	0.06	0.06	0.05	0.08	0.07	0.05	0.05	0.05	0.08	0.05	0.07
	C	0.03	0.06	0.09	0.07	0.06	0.05	0.06	0.05	0.07	0.05	0.06	0.05	0.08	0.05	0.05	0.05
	D	0.02	0.05	0.06	0.04	0.06	0.03	0.06	0.07	0.06	0.03	0.07	0.05	0.04	0.03	0.05	0.04
	E	0.01	0.02	0.04	0.01	0.01	0.03	0.03	0.03	0.02	0.02	0.01	0.01	0.02	0.01	0.02	0.02
	F	0	0.01	0.01	0.01	0.01	0.01	0	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01
4.0	A	0.87	0.74	0.88	1	0.94	0.94	0.65	0.62	0.74	0.72	1	1.28	1.29	0.94	0.53	0.6
	B	0.27	0.41	0.58	0.62	0.43	0.34	0.24	0.22	0.32	0.33	0.48	0.67	0.56	0.37	0.25	0.21
	C	0.17	0.57	1.13	1.03	0.6	0.41	0.41	0.37	0.48	0.52	0.59	0.79	0.53	0.45	0.3	0.24
	D	0.1	0.44	1.07	0.89	0.55	0.5	0.71	0.69	0.92	0.91	0.8	0.81	0.72	0.57	0.43	0.27
	E	0.06	0.27	0.69	0.48	0.3	0.33	0.46	0.7	0.67	0.57	0.54	0.47	0.43	0.43	0.33	0.3
	F	0.02	0.05	0.09	0.04	0.02	0.08	0.09	0.09	0.11	0.08	0.12	0.09	0.03	0.05	0.05	0.07
6.0	A	0.57	0.26	0.16	0.19	0.15	0.07	0.07	0.09	0.14	0.14	0.21	0.24	0.27	0.24	0.14	0.24
	B	0.14	0.39	0.38	0.31	0.16	0.11	0.07	0.08	0.19	0.21	0.32	0.51	0.51	0.36	0.13	0.09
	C	0.12	0.54	1.3	0.74	0.35	0.19	0.22	0.25	0.47	0.46	0.56	0.69	0.64	0.56	0.21	0.12
	D	0.12	0.43	0.85	0.58	0.4	0.44	0.65	1.16	1.45	0.78	0.9	0.77	0.78	0.65	0.32	0.09
	E	0.07	0.53	0.69	0.71	0.6	0.45	0.65	1.01	1.18	0.94	0.91	0.89	0.48	0.4	0.19	0.14
	F	0.01	0.26	0.21	0.14	0.14	0.19	0.13	0.16	0.22	0.21	0.24	0.23	0.07	0.04	0.02	0.04
8.0	A	0.09	0.05	0.01	0.01	0.01	0	0.01	0.01	0.02	0.02	0.02	0.04	0.03	0.02	0.01	0.06
	B	0.01	0.08	0.03	0.01	0.01	0.01	0	0.01	0.05	0.04	0.05	0.1	0.17	0.21	0.06	0.01
	C	0.01	0.1	0.2	0.08	0.02	0.03	0.03	0.06	0.16	0.16	0.21	0.26	0.45	0.43	0.1	0.02
	D	0.01	0.05	0.1	0.02	0.01	0.01	0.05	0.18	0.22	0.15	0.1	0.09	0.03	0.05	0.03	0
	E	0	0.05	0.03	0.04	0.01	0.01	0	0.03	0.04	0.02	0.04	0.01	0.01	0	0	0
	F	0	0.03	0.02	0.02	0	0.01	0	0.01	0.02	0.01	0.02	0.01	0	0	0	0
12.0	A	0.01	0	0	0	0	0	0	0	0	0.01	0.01	0.01	0	0.01	0	0.01
	B	0	0.01	0	0	0	0	0	0	0	0	0.01	0.01	0.06	0.06	0.01	0
	C	0	0.01	0	0	0	0.01	0	0.03	0.04	0.04	0.05	0.06	0.16	0.17	0.02	0.01
	D	0	0.02	0.02	0	0	0	0	0.01	0.02	0.04	0	0	0.01	0	0	0
	E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14.1	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: Simpkins 1997.

Table J–78. Projected SRS Population Surrounding H-Area for Year 2005

Direction	Distance (mi)										Total
	0–1	1–2	2–3	3–4	4–5	5–10	10–20	20–30	30–40	40–50	
S	0	0	0	0	0	0	485	1,807	5,207	3,545	**11,044**
SSW	0	0	0	0	0	0	629	1,906	5,070	2,361	**9,966**
SW	0	0	0	0	0	25	895	7,586	1,939	2,953	**13,398**
WSW	0	0	0	0	0	71	2,428	4,529	3,330	8,327	**18,685**
W	0	0	0	0	0	683	4,586	54,394	22,338	13,086	**95,087**
WNW	0	0	0	0	0	1,384	7,849	172,996	76,767	6,917	**265,913**
NW	0	0	0	0	0	1,026	14,508	34,759	4,044	3,629	**57,966**
NNW	0	0	0	0	0	2,691	30,598	23,544	8,243	6,184	**71,260**
N	0	0	0	0	0	363	4,049	3,790	4,887	20,832	**33,921**
NNE	0	0	0	0	0	89	1,790	3,016	6,535	21,457	**32,887**
NE	0	0	0	0	0	15	3,754	3,684	6,147	9,896	**23,496**
ENE	0	0	0	0	0	9	3,723	6,246	6,956	43,139	**60,073**
E	0	0	0	0	0	113	7,647	3,844	6,830	4,084	**22,518**
ESE	0	0	0	0	0	3	1,329	2,551	3,551	5,933	**13,367**
SE	0	0	0	0	0	0	552	4,950	4,962	8,342	**18,806**
SSE	0	0	0	0	0	0	374	597	1,940	2,703	**5,614**
Total	**0**	**0**	**0**	**0**	**0**	**6,472**	**85,196**	**330,199**	**168,746**	**163,388**	**754,001**

Source: DOC 1992.

J.5.5.1.4 Source Term Data

Estimated incident-free radiological releases associated with the MOX fuel lead assembly facility are presented in Table J–79. Stack height and release location are provided in the ORNL *SRS MOX Fuel Lead Assemblies Data Report for the Surplus Plutonium Disposition Environmental Impact Statement* (O'Connor et al. 1998e).

Table J–79. Estimated Incident-Free Annual Radiological Releases From the MOX Lead Assembly Facility at SRS

Isotope	(μCi/yr)
Plutonium 236	–
Plutonium 238	0.85
Plutonium 239	23
Plutonium 240	5.3
Plutonium 241	58
Plutonium 242	9.3×10^{-4}
Americium 241	2.0
Uranium 234	1.3×10^{-3}
Uranium 235	5.4×10^{-5}
Uranium 238	3.1×10^{-3}

Source: O'Connor et al. 1998e.

J.5.5.1.5 Other Calculational Assumptions

To estimate radiological impacts of incident-free operation of the facilities at SRS, the following additional assumptions and factors were considered, in accordance with the guidelines established in NRC Regulatory Guide 1.109 (NRC 1977).

> Ground surfaces were assumed to have no previous deposition of radionuclides for the purposes of modeling the incremental radiological impacts associated with surplus plutonium disposition activities. However, doses associated with true instances of prior deposition are accounted for in the Affected Environment and Cumulative Impacts sections.
>
> The annual external exposure time to the plume and to soil contamination was 0.7 year for the MEI (NRC 1977).
>
> The annual external exposure time to the plume and to soil contamination was 0.5 year for the population (NRC 1977).
>
> The annual inhalation exposure time to the plume was 1 year for the MEI and general population (NRC 1977).
>
> The exposed individual or population was assumed to have the characteristics and habits (e.g., inhalation and ingestion rates) of the adult human.
>
> A semi-infinite/finite plume model was used for air immersion doses. Other pathways evaluated were ground exposure, inhalation, ingestion of food crops, and ingestion of contaminated animal products. Drinking water, aquatic food ingestion, and any other pathway that may involve liquid exposure were not examined because all releases are to the air.
>
> Reported stack heights were used for atmospheric releases and were assumed to be the effective stack height. The resultant doses were conservative because use of the actual stack height negates plume rise.
>
> The calculated doses are 50-year committed doses from 1 year of intake.

J.5.5.2 Human Health Impacts

Potential radiological impacts on the public and workers resulting from normal lead assembly operations are presented in Section 4.27.5.4.

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Appendix K
Facility Accidents

K.1 IMPACT ASSESSMENT METHODS FOR FACILITY ACCIDENTS

K.1.1 Introduction

The potential for facility accidents and the magnitude of their consequences are important factors for making reasonable choices among the various surplus plutonium disposition alternatives analyzed in the *Surplus Plutonium Disposition Environmental Impact Statement* (SPD EIS). Guidance on the implementation of 40 CFR 1502.22, as amended (EPA 1992), requires the evaluation of impacts that have a low frequency of occurrence but high consequences. Further, public comments received during the scoping process have clearly indicated the public's concern with facility safety and health risks and the need to address these concerns in the decisionmaking process.

For the No Action Alternative, potential accidents are defined in existing facility documentation, such as safety analysis reports (SARs), hazards assessment documents, National Environmental Policy Act (NEPA) documents, and probabilistic risk assessments (PRAs). The accidents include radiological and chemical accidents that have a low frequency of occurrence but high consequences, and a spectrum of other accidents that have a higher frequency of occurrence and lesser consequences. The data in these documents include accident scenarios, materials at risk, source terms (quantities of hazardous materials released to the environment), and consequences.

For each facility, a hazards analysis document identifying and estimating the effects of all major hazards that could affect the environment, workers, and the public would be issued in conjunction with the conceptual design package. Additional accident analyses for identified major hazards would be provided in a preliminary SAR issued during the period of definitive design (Title II) review. A final SAR would be prepared during the construction period and issued before testing began as final documented evidence that the new facility could be operated in a manner that did not pose any undue risk to the health and safety of workers and the public.

In determining the potential for facility accidents and the magnitude of their consequences, the SPD EIS considers two important concepts in the presentation of results: (1) risk and (2) uncertainties and conservatism.

K.1.1.1 Risk

One type of metric that can be obtained from the accident analysis results presented in the SPD EIS is accident risk. Risk is usually defined as the product of the consequences and estimated frequency of a given accident. Accident consequences may be presented in terms of dose (e.g., person-rem) or health effects (e.g., latent cancer fatalities [LCFs]). The accident frequency is the number of times the accident is expected to occur over a given period of time (e.g., per year). In general, the frequency of design basis and beyond-design-basis accidents is much lower than 1 per year, and therefore is approximately equal to the probability of the accident during 1 year. If an accident is expected to occur once every 1,000 years (i.e., a frequency of 1.0×10^{-3} per year) and the consequences of the accident is five LCFs, then the risk is $1.0\times10^{-3}\times5 = 5.0\times10^{-3}$ LCF per year.

A number of specific types of risk can be directly calculated from the Melcor Accident Consequence Code System (MACCS2) results reported in the SPD EIS (SNL 1997). One type of risk, average individual risk, is the product of the total consequences experienced by the population and the accident frequency, divided by the population.[1] For example, if an accident has a frequency of 1.0×10^{-3} per year, the consequence thereof is 5 LCFs, and the

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[1] Population data for each facility considered in the SPD EIS can be found in Appendix J.

population in which the fatalities are experienced is 100,000, then the average individual risk is $1.0\times10^{-3} \times 5/100{,}000 = 5.0\times10^{-8}$ LCF per year. This metric is meaningful only when the mean value for consequence is used because risk itself is not a random parameter, even though it involves underlying randomness. It is noteworthy that the value of the average individual risk depends on the size of the area for which the population is defined. In general, the larger the area considered, the smaller the average individual risk for a given accident. The choice of an 80-km (50-mi) radius is common practice.

The average individual risk is a measure of the risk that an average individual (in this case within 80 km [50 mi] of the accident) experiences from specified accidents at the facility. This risk can be compared with other average individual risks, such as the risk of dying from a motor vehicle accident (about 1 in 80), the risk of death from fires (about 1 in 500), or the risk of accidental poisoning (about 1 in 1,000). These comparisons are not meant to imply that risks of an LCF caused by U.S. Department of Energy (DOE) operations are trivial, but only to show how they compare with other, more common risks. Radiological risks to the general public from DOE operations are considered to be involuntary risks as opposed to voluntary risks, such as operating a motor vehicle.

It is also possible to calculate population risk, which is the product of the total consequences experienced by the population and accident frequency. For example, if an accident has a frequency of 1.0×10^{-3} per year and the consequences of the accident is 5 LCFs, then the population risk is $1.0\times10^{-3}\times5 = 5.0\times10^{-3}$ LCF per year. Population risk is a measure of the expected number of consequences experienced by the population as a whole over the course of a year.

It would be inappropriate, however, to simply take the LCFs given the dose at 1,000 m (3,281 ft) or the LCFs given the dose at the site boundary and multiply them by the corresponding accident frequencies in an attempt to obtain the maximum individual risk to the noninvolved worker or the maximally exposed individual (MEI) member of the public. The reasons for this are discussed in the following paragraphs.

The distribution of centerline consequences from which the reported doses are obtained is constructed by modeling the accidental release many times using different weather conditions (i.e., windspeed, wind direction, stability class, and rainfall) each time. For each weather condition, the centerline consequences at 1,000 m (3,281 ft) and at the site boundary are calculated, and those values contribute to their respective distributions. Thus, given the accidental release, there is a 95 percent chance that the centerline consequences at 1,000 m (3,281 ft) and at the site boundary will fall below the reported 95th percentile consequences, and the expected consequences would be equal to the reported mean consequences. It is noteworthy, however, that the actual locations of the centerline consequences vary with wind direction, so the reported consequences are not associated with a specific point at 1,000 m (3,281 ft) or the site boundary. It is known only that the centerline consequences, wherever they might be, are characterized by the reported values.

A problem arises when these consequences are used to characterize individual risk. Although there is always some location that is exposed to the centerline consequences, no location is associated with the risk obtained by multiplying the centerline consequences by the accident frequency, because the direction of the plume centerline changes for each set of weather conditions. As a result, the risk to an individual at the location of maximum risk is likely to be much lower than the risk calculated by multiplying the centerline consequences by the accident frequency. In fact, because there are 16 sectors, and because doses decrease with lateral movement away from the centerline even within a sector, risk values generated in this way would tend to overstate the risk by a factor of as much as 100, and possibly more. The values are bounding, but have a potentially misleading degree of conservatism. Ultimately, MACCS2 is capable of calculating individual consequences at the point of maximum consequence (as reported in the SPD EIS), but it is not configured to calculate individual risk at the point of maximum risk.

K.1.1.2 Uncertainties and Conservatism

The analyses of accidents are based on calculations relevant to hypothetical sequences of events and models of their effects. The models provide estimates of the frequencies, source terms, pathways for dispersion, exposures, and the effects on human health and the environment that are as realistic as possible within the scope of the analysis. In many cases, a paucity of experience with the accidents postulated leads to uncertainty in the calculation of their consequences and frequencies. This fact has prompted the use of models or input values that yield conservative estimates of consequence and frequency. All alternatives have been evaluated using uniform methods and data, allowing for a fair comparison of all alternatives.

Although average individual and population risks can be calculated from the information in the SPD EIS, the equations for such calculations involve accident frequency, a parameter whose calculation is subject to considerable uncertainty. The uncertainty in estimates of the frequency of highly unlikely events can be several orders of magnitude. This is the reason accident frequencies are reported in the SPD EIS qualitatively, in terms of broad frequency bins, as opposed to numerically. Similarly, any metric that includes frequency as a factor will have at least as much, and generally more, uncertainty associated with it. Therefore, the consequence metrics have been preserved as the primary accident analysis results, and accident frequencies identified qualitatively, to provide a perspective on risk that does not imply an unjustified level of precision.

K.1.2 Safety Design Process

The proposed surplus plutonium disposition facilities would be designed to comply with current Federal, State, and local laws, DOE orders, and industrial codes and standards. This would result in a plant that is highly resistant to the effects of natural phenomena, including earthquake, flood, tornado, and high wind, as well as credible events as appropriate to the site, such as fire, explosions, and man-made threats.

The design process for the proposed facilities would comply with the requirements for safety analysis and evaluation in DOE Orders 430.1 and 5480.23. These orders require that the safety assessment be an integral part of the design process to ensure compliance with all DOE construction and operation safety criteria by the time the facilities are constructed and in operation.

The safety analysis process begins early in conceptual design with the identification of hazards that could produce unintended adverse safety consequences to workers or the public. As the design develops, failure modes and effects analyses (FMEAs) are performed to identify events capable of releasing hazardous material. The kinds of events considered include equipment failures, spills, human errors, fires, explosions, criticality, earthquakes, electrical storms, tornadoes, floods, and aircraft crashes. These postulated events become focal points for design changes or improvements to prevent unacceptable accidents. The analyses continue as the design progresses, the object being to assess the need for safety equipment and the performance of such equipment. Eventually, the safety analyses are formally documented in a SAR and, if appropriate, a PRA. The PRA documents the estimated frequency and consequences of a complete spectrum of accidents and helps to identify where design improvements could make meaningful safety improvements.

The first SAR, completed at the conclusion of conceptual design, includes identification of hazards and some limited assessment of a few enveloping design basis accidents. It includes deterministic safety analysis and FMEA of major systems. A comprehensive preliminary SAR, completed by the end of the preliminary design, provides a broad assessment of the range of design basis accident scenarios and the performance of equipment provided in the facility specifically for accident consequence mitigation. A limited PRA may be included in that analysis.

The SAR continues to be developed during detailed design. The safety review of the report and any supporting PRA are completed and safety issues resolved before the initiation of facility construction. Also, a final SAR is produced that includes documentation of safety-related design changes made during construction and the impact of those changes on the safety assessment. It also includes the results of any safety-related research and development that was performed to support the safety assessment of the facility. Approval of the final SAR is required before the facility is allowed to commence operation.

K.1.3 DOE Facility Accident Identification and Quantification

K.1.3.1 Background

Identification of accident scenarios for the proposed facilities is fairly straightforward. The proposed facilities are simple, and their processes have been used in other facilities for other purposes. From an accident identification and quantification perspective, therefore, these processes are well known and understood. Very few of the proposed activities would differ from activities at other facilities.

New facilities would likely be designed, constructed, and operated to provide an even lower accident risk than other facilities that have used these types of processes. The new facilities would benefit from lessons learned in the operation of similar processes. They would be designed to surpass existing plutonium facilities in the ability to reduce the frequency of accidents and to mitigate the consequences thereof.

A large experience base exists for the design of the proposed facilities and processes. Because the principal hazard to workers and the public from plutonium is the inhalation of very small particles, the safety management approach that has evolved is centered on control of those particles. The control approach is to perform all operations that could release airborne plutonium particles in a glovebox. The glovebox protects workers from inhalation of the particles and provides a convenient means for the collection of any particle that becomes airborne on filters. Air from the gloveboxes, operating areas, and buildings is exhausted through multiple stages of high-efficiency particulate air (HEPA) filters and monitored for radioactivity prior to release from the building. These exhaust systems are designed for effective performance even under the severe conditions of design basis accidents, such as major fires involving an entire process line.

While the new processes and facilities would be designed to reduce the risks of a wide range of possible accidents to a level deemed acceptable, some such risks would remain. As with all engineered structures—e.g., houses, bridges, dams—there is some level of earthquake or high wind the structure could not survive. While new plutonium facilities must be designed to very high standards—for instance, they must survive, with little plutonium release, a 1-in-10,000-year earthquake—an accident more severe than the design basis can always be postulated. Current DOE standards require that new facilities be designed to prevent to the extent possible, and then withstand, control, and mitigate, all credible process-related accidents. For safety analysis purposes, credible accidents are generally defined as accidents with frequencies greater than 1 in 1 million per year, including such natural-phenomena-induced accidents as earthquakes, high winds, and flooding. The accidents considered in the design, construction, and operation of these facilities are generally called design basis accidents.

In addition to the accident risks from the design basis accidents, the new facilities would face risks from beyond-design-basis accidents. For most plutonium facilities, the design basis includes all types of process-related accidents that have occurred in past operations: major spills, leaks, transfer errors, process-related fires, explosions, and nuclear criticalities. Certain natural-phenomena-initiated accidents also meet the DOE design basis criteria. While extremely unlikely, all new plutonium facilities, as essentially all manmade structures, could collapse under the influence of an earthquake. For most new plutonium facilities, the worst possible accident is a beyond-design-basis earthquake that results in partial or total collapse of the structure, spills, possibly fires, and loss of confinement of the plutonium powder. Also conceivable are such external events as the crash of a large aircraft onto the structure with an ensuing fuel-fed fire. At most locations away from major airports, however, the likelihood is less than 1 in 10 million per year. For some locations, such as Pantex, the frequency is higher, so aircraft crash–initiated accidents are a basic consideration.

The accident analysis reported in the SPD EIS is less detailed than a formal PRA or facility safety analysis because it addresses bounding accidents (accidents with low frequency of occurrence and high consequence) and a representative spectrum of possible operational accidents (accidents with high frequency of occurrence and low consequence). The technical approach for the selection of accidents is consistent with the DOE Office of NEPA Oversight's *Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements* (DOE 1993), which recommends consideration of two major categories of accidents: design basis accidents and beyond-design-basis accidents.[2]

K.1.3.2 Identification of Accident Scenarios and Frequencies

A range of design basis and beyond-design-basis accident scenarios have been identified for each of the surplus plutonium disposition technologies (UC 1998a–h, 1999a–d). For each technology, the wide range of process-related accidents possible during construction and operation of the facility have been evaluated to ensure that their consequences are low or the frequency of occurrence, extremely low.

All of the analyzed accidents would involve a release of small, respirable plutonium particles or direct gamma and neutron radiation, and to a lesser extent, fission products from a nuclear criticality. Analyses of each proposed operation for accidents involving hazardous chemicals are reflected in the data reports supporting the SPD EIS. However, as the quantities of hazardous chemicals to be handled are small relative to those of many industrial facilities, no major chemical accidents were identified. The general categories of process-related accidents considered include:

- Drops or spills of materials within and outside the gloveboxes
- Fires involving process equipment or materials, and room or building fires
- Explosions initiated by the process equipment or materials or by conditions or events external to the process
- Nuclear criticalities

The analyses considered synergistic effects and determined that the only significant source of such effects would be a seismic event (i.e., a design basis seismic event or a seismically induced total collapse). The synergy would be due to the common-cause initiator (i.e., seismic ground motion). This was accounted for by summing population doses and LCFs for alternatives in which facilities would be located at the same site. MEI doses were not summed because an individual would only receive a summed dose if he or she were located along the line connecting the release points from two facilities and the wind were blowing along the same line at the time of the accident.

For each of these accident categories, a conservative preliminary assessment of consequence was made, and where consequences were significant, one or more bounding accident scenarios were postulated. The building confinement and fire suppression systems would be adequate to reduce the risks of most spills and minor fires. The systems would be designed to prevent, to the extent practicable, larger fires and explosions. Great efforts have always been made to prevent nuclear criticalities, which have the potential to kill workers in their immediate

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[2] Some of the data reports supporting the SPD EIS use the terms "evaluation basis" and "beyond-evaluation-basis" to denote the two major categories of accidents. For clarity, the SPD EIS uses the terms "design basis" and "beyond-design-basis" throughout.

vicinity. In all cases, standard practice is expected to keep the frequency of accidental nuclear criticalities as low as possible.

The proposed surplus plutonium disposition facilities would be expected to meet or exceed the requirements of DOE Order 420.1, *Facility Safety,* and *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities* (DOE-STD-1020-94) (DOE 1994a), or the requirements of 10 CFR 70, *Domestic Licensing of Special Nuclear Material,* if the proposed facility were to be licensed by the U.S. Nuclear Regulatory Commission (NRC). Because the DOE and, if applicable, NRC design criteria require that new plutonium-processing buildings be of very robust, reinforced-concrete construction, very few events outside the building would have sufficient energy to threaten the building confinement. The principal concern would be the crash of a large commercial or military aircraft into the facility. Such an event, however, is highly unlikely. Only those crashes with a frequency greater than 10^{-7} per year are addressed in the SPD EIS.

Design basis and beyond-design-basis natural-phenomena-initiated accidents are also considered. Because of the robust nature of construction of new plutonium facilities, the only design basis natural-phenomena-initiated accidents with the potential to impact the facility interior are seismic events. Similarly, seismic events also bound the consequences and risks posed by beyond-design-basis natural phenomena.

The suite of generic accidents in the *Storage and Disposition PEIS* (DOE 1996a) was considered in the analysis of accidents for the SPD EIS. However, the more detailed design information in the surplus plutonium disposition data reports was the primary basis for the identification of accidents because it most accurately represents the expected facility configuration. The fire on the loading dock and the oxyacetylene explosion in a process cell were unsupported by this information, so were not included in the SPD EIS.

Accident frequencies are generally grouped into the bins of “anticipated,” “unlikely,” and “extremely unlikely,” with estimated frequencies of greater than 10^{-2}, 10^{-2} to 10^{-4}, and 10^{-4} to 10^{-6} per year, respectively. The accidents evaluated represent a spectrum of accident frequencies and consequences ranging from low-frequency/high-consequence to high-frequency/low-consequence events. However, given the preliminary nature of the designs under consideration, it was not possible to assess quantitatively the frequency of occurrence of all the events addressed. The evaluation does not indicate the total risk of operating the facility, but does provide information on high-risk events that could be used to develop an accident risk ranking of the various alternatives.

K.1.3.3 Identification of Material at Risk

For each accident scenario, the material at risk—generally plutonium—was identified. Plutonium to be disposed of has a wide range of chemical and isotopic forms. The sources of plutonium vary among the various candidate facilities, and for specific facilities among various alternatives. Table K–1 presents the isotopic compositions that were used in the development of accident consequences in the SPD EIS. The vulnerability of material generally depends on the form of that material, the degree and robustness of containment, and the energetics of the potential accident scenario (UC 1998a:table 6-6; 1998c:tables 9-2 and A-7; 1998d:table B-1). For example, plutonium stored in strong, tight storage containers is not generally vulnerable to simple drops or spills, but may be vulnerable in a total collapse earthquake scenario.

Table K–1. Isotopic Composition of Plutonium Used in Accident Analysis (wt %)

Isotope	Pit Disassembly and MOX	Immobilization: Plutonium Conversion	Immobilization: First Stage, Hybrid Case	Immobilization: First Stage, 50-t Case
Plutonium 238	3.00×10^{-2}	0.0	0.0	2.0×10^{-2}
Plutonium 239	92.2	86.9	86.9	91.0
Plutonium 240	6.46	11.1	11.1	8.2
Plutonium 241	5.00×10^{-2}	1.5	1.5	5.80×10^{-1}
Plutonium 242	1.00×10^{-1}	5.0×10^{-1}	5.0×10^{-1}	2.50×10^{-1}
Americium 241	9.00×10^{-1}	1.0	1.0	9.4×10^{-1}

On an industrial scale, the quantities of hazardous chemicals are generally small. The occupational risks are generally limited to material handling and are managed under the required industrial hygiene program. No substantial hazardous chemical releases are expected.

K.1.3.4 Identification of Material Potentially Released to the Environment

The amount and particle size distribution of material aerosolized in an accident generally depends on the form of that material, the degree and robustness of containment, and the energetics of the potential accident scenario. Once the material is aerosolized, it must still travel through building confinement and filtration systems or bypass the systems before being released to the environment.

A standard DOE formula was used to estimate the source term for each accident at each of the proposed surplus plutonium facilities:

$$\text{Source Term} = \text{MAR} \times \text{DR} \times \text{ARF} \times \text{RF} \times \text{LPF}$$

where:

MAR = material at risk (curies or grams)
DR = damage ratio
ARF = airborne release fraction
RF = respirable fraction[3]
LPF = leak path factor

The value of each of these factors depends on the details of the specific accident scenario postulated. ARF and RF were estimated according to reference material in *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities* (DOE-HDBK-3010-94) (DOE 1994b). Conservative HEPA filter efficiencies of 0.999 and 0.99 were assumed, based on two stages of filtration, for a total LPF of 1.0×10^{-5}; however, actual efficiencies would likely be 0.999 and 0.998 or better. [Text deleted.]

No accident scenarios were identified that would result in a substantial release of plutonium or other radionuclides via liquid pathways.

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[3] Respirable fractions are not applied in the assessment of doses based on noninhalation pathways, such as criticality.

K.1.4 Evaluation of Consequences of Accidents

K.1.4.1 Potential Receptors

For each potential accident, information is provided on accident consequences and frequencies to three types of receptors: (1) a noninvolved worker, (2) the maximally exposed member of the public, and (3) the offsite population. The first receptor, a noninvolved worker, is a hypothetical individual working on the site but not involved in the proposed activity. The worker is assumed to be downwind at a point 1,000 m (3,281 ft) from the accident. Although other distances closer to the accident could have been assumed, the calculations break down at distances of about 200 m (656 ft) or less due to limitations in modeling the effects of building wake and local terrain on dispersion of the released radioactive substances. A worker closer than 1,000 m (3,281 ft) to the accident would generally receive a higher dose; a worker farther away, a lower dose. At some sites where the distance from the accident to the nearest site boundary is less than 1,000 m (3,281 ft), the worker is assumed to be at the site boundary. The second receptor, a maximally exposed member of the public, is a hypothetical individual assumed to be downwind at the site boundary. Exposures received by this individual are intended to represent the highest doses to a member of the public. The third receptor, the offsite population, is all members of the public within 80 km (50 mi) of the accident location.

Consequences to workers directly involved in the processes under consideration are addressed generically, without attempt at a scenario-specific quantification of consequences. This approach to in-facility consequences was selected for two reasons. First, the uncertainties involved in quantifying accident consequences become overwhelming for most radiological accidents due to the high sensitivity of dose values to assumptions about the details of the release and the location and behavior of the impacted worker. Also, the dominant accident risks to the worker of facility operations are from standard industrial accidents, as opposed to bounding radiological accidents. The accident fatality risk for DOE has been reported as 2.7×10^{-5} per person per year (DOE 1999a). According to historical data on standard industrial accidents, the national average fatality risk from manufacturing operations is 3.5×10^{-5} per person per year (DOL 1997).

Consequences for potential receptors as a result of plume passage were determined without regard for emergency response measures, and thus are more conservative than would be expected if evacuation and sheltering were explicitly modeled. Instead, it is assumed that potential receptors are fully exposed in fixed positions for the duration of plume passage, thereby maximizing their exposure to the plume. As discussed in Appendix K.1.4.2, a conservative estimate of total risk was obtained by assuming that all released radionuclides contributed to the inhalation dose rather than being removed from the plume by surface deposition, which is a less significant contributor to overall risk and is controllable through interdiction.

K.1.4.2 Modeling of Dispersion of Releases to the Environment

The MACCS2 computer code (version 1.12) was used to estimate the consequences of accidents for the proposed facilities. A detailed description of the MACCS2 model is available in NUREG/CR-4691 (NRC 1990). Originally developed to model the radiological consequences of nuclear reactor accidents, this code has been used for the analysis of accidents for many EISs and other safety documentation, and is considered applicable to the analysis of accidents associated with the disposition of plutonium.

MACCS2 models the offsite consequences of an accident that releases a plume of radioactive materials into the atmosphere, specifically, the degree of dispersion versus distance as a function of historical wind direction, speed, and atmospheric conditions. Were such an accidental release to occur, the radioactive gases and aerosols in the plume would be transported by the prevailing wind and dispersed in the atmosphere, and the population would be exposed to radiation. MACCS2 generates the distribution of downwind doses at specified distances, as well as the distribution of population doses out to 80 km (50 mi).

As implemented, the MACCS2 model evaluates doses due to inhalation of aerosols, such as respirable plutonium, as well as exposure to the passing plume. This represents the major portion of the dose that a noninvolved worker or member of the public would receive as a result of a plutonium disposition facility accident. The longer-term effects of plutonium deposited on the ground and surface waters after the accident, including the resuspension and inhalation of plutonium and the ingestion of contaminated crops, were not modeled for the SPD EIS. These pathways have been studied and been found not to contribute as significantly to dosage as inhalation, and they are controllable through interdiction. Instead, the deposition velocity of the radioactive material was set to zero, so that material that might otherwise be deposited on surfaces remained airborne and available for inhalation. This adds a conservatism to inhalation doses that can become considerable at large distances (as much as two orders of magnitude at the 80-km [50-mi] limit). Thus, the method used in the SPD EIS is conservative compared with dose results that would be obtained if deposition and resuspension were taken into account.

Longer-term effects of fission products released in a nuclear criticality accident have been extensively studied. The principal concern is ingestion of iodine 131 via milk that becomes contaminated due to the ingestion of contaminated grains by milk cows. This pathway can be controlled if necessary. In terms of the effects of an accidental criticality, doses from this pathway are small.

The potential for tritium contamination of the Ogallala aquifer as a consequence of an accident at Pantex involving tritium was identified as a specific concern during the development of the SPD EIS. The assessment of consequences of accidental tritium releases in the SPD EIS is consistent with the method used in the *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling* (DOE 1995a). Unlike plutonium, oxidized tritium (i.e., water vapor) is not significantly deposited on the ground for subsequent percolation into the local groundwater except under conditions of rain or dew. Pantex has a rather arid climate, so the chance of these weather conditions at the time of an accident is slight. Moreover, even if it were to happen as indicated in Section 4.6.1.2 of the *Final Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components* (DOE 1996b), actual movement of contaminated groundwater off the site would require about 10 to 20 years. In fact, current test data show that it could take as long as 50 or more years for a contaminant plume to move off the site. The half-life of tritium is 12 years; therefore, any hypothetical contamination deposited on the ground surface and carried into the groundwater regime would be reduced by a factor of roughly 2 to 16 by the time it moved off the site. Because of these considerations, health consequences of contamination of the Ogallala aquifer were not considered to be a significant contributor to health risks from a tritium release accident.

The region around the facility is divided by a polar-coordinate grid centered on the facility itself. The user specifies the number of radial divisions and their endpoint distances. The angular divisions used to define the spatial grid correspond to the 16 directions of the compass.

MACCS2 was applied in a probabilistic manner using a weather bin–sampling technique. Centerline doses, as a function of distance, were calculated for each of 1,460 meteorological sequence samples, resulting in a distribution of doses reflecting variations in weather conditions at the time of the postulated accidental release. The code outputs the conditional probability of exceeding a dose as a function of distance. The mean and 95th percentile consequences are reported in the SPD EIS. Doses higher than the 95th percentile values would be expected only 5 percent of the time.

MACCS2 cannot be used to calculate directly the distribution of maximum doses (resulting from meteorological variations) around irregular contours, such as a site boundary. As a result, analyses that use MACCS2 to calculate site boundary doses usually default to calculating doses at the distance corresponding to the shortest distance to the site boundary. In effect, the site boundary is treated as if it were circular, with a radius equal to the shortest distance from the facility to the actual site boundary. While this approximation is conservative with respect to dose (with the possible exception of doses from elevated plumes), it eliminates the use of some site-specific information, namely the site boundary location (other than the nearest point), wind direction, and any correlation between wind direction and other meteorological parameters. Because the primary purpose of the SPD EIS is to aid in decisions about facility locations, and because differences in dose values among the various options are largely a function of site-specific variations, a different approach was taken to more accurately characterize the potential for maximum doses at the site boundary.

For the SPD EIS, MACCS2 was used to generate intermediate results that could be further processed to obtain the distribution of doses around the site boundary, accounting for variations in site boundary distance as a function of direction. The specific instrument was the Type B result option of MACCS2, which renders the distribution of doses at a specified radial distance within a specified compass sector, given a release. Type B results were requested for the site boundary distance for each of the 16 compass sectors over which the meteorological data is defined. This resulted in 16 separate dose distributions; one for each specific location around the site boundary. The distribution of maximum doses around the site boundary was constructed by first summing the values of the Type B distributions for each dose value. The resulting distribution was then truncated for low dose values to the point where the remainder of the distribution was normalized. This produced the distribution of maximum doses around the site boundary, which is the distribution from which the mean and 95th percentile doses are reported.

Radiological consequences may vary somewhat as a result of variations in the duration of release. For longer releases, there is a greater chance of plume meander (i.e., variations in wind direction over the duration of release). MACCS2 models plume meander by increasing the lateral dispersion coefficient of the plume for longer release durations, thus lowering the dose. For perspective, doses from an homogenous, 1-hr release would be 30 percent lower than those of a 10-min release as a result of plume meander; doses from a 2-hr release, 46 percent lower. The other effect of longer release durations is involvement of a greater variety of meteorological conditions in a given release, which reduces the variance of the resulting dose distributions. This would tend to lower high-percentile doses, raise low-percentile doses, and have no effect on the mean dose.

For the SPD EIS accident analysis, a duration of 10 min was assumed for all releases. This is consistent with the accident phenomenology expected for all scenarios, with the possible exception of fire. Depending on the circumstances, the time between fire ignition and extinction may be considerably longer, particularly for the larger, beyond-design-basis fires. However, even in a fire of long duration, it is possible to release substantial fractions of the total radiological source term in fairly short periods, as the fire consumes areas of high MAR concentrations. The assumption of a 10-min release duration for fire is intended to generically account for this circumstance.

K.1.4.3 Modeling of Consequences of Releases to the Environment

The mean and 95th percentile consequences of accidental radiological releases, given variations in meteorological conditions at the time of the accident, are calculated as radiological doses in terms of rem. The mean consequences, or the expected consequences of the accident, are an appropriate statistic for use in risk estimates. The 95th percentile consequences represent bounding consequences of the accident; that is, if the accident were to occur and release the stated source term, there would be a 95 percent probability of lower than the stated consequences. This statistic is thus useful for characterizing the bounding consequence potential of the proposed activity under the stated accident condition. The consequences are also expressed as the additional potential or likelihood of death from cancer for the noninvolved worker and the maximally exposed member of the public, and the expected number of incremental LCFs among the exposed population.

The probability coefficients for determining the likelihood of fatal cancer, given a dose, are taken from the *1990 Recommendations of the International Commission on Radiological Protection* (ICRP 1991). For low doses or low dose rates, respective probability coefficients of 4.0×10^{-4} and 5.0×10^{-4} fatal cancers per rem are applied for workers and the general public.[4] For high doses received at a high rate, respective probability coefficients of 8.0×10^{-4} and 1.0×10^{-3} fatal cancers per rem are applied for noninvolved workers and the public. These higher probability coefficients apply where doses are above 20 rem and dose rates above 10 rem/hr.

K.1.5 Accident Scenarios for Surplus Plutonium Disposition Facilities

Bounding design basis and beyond-design-basis accident scenarios have been developed from accident scenarios presented in each of the surplus plutonium disposition data reports (UC 1998a–h, 1999a–d). These scenarios are discussed in detail, along with specific assumptions for each facility and site, in these documents.

K.1.5.1 Accident Scenario Consistency

In preparing the accident analysis for the SPD EIS, the primary objective was to ensure consistency between the data reports so that results of the analyses for the proposed surplus plutonium disposition alternatives could be compared on as equal a footing as possible. In spite of efforts by all parties, some inconsistencies exist between the data reports. This does not imply technical inaccuracy in any analysis; it merely reflects the uncertainties and reliance on convention that are inherent in accident analyses in general. In order to provide a consistent analytical basis, information in the data reports has been modified or augmented as described below.

Aircraft Crash. It was decided early in the process of developing accident scenarios that aircraft crash scenarios would not be provided in the data reports, but would be developed, as appropriate, directly for the SPD EIS.

Frequencies of an aircraft crash into each facility for each alternative were developed in accordance with DOE-STD-3014 (DOE 1996c). The frequency of crashes involving aircraft capable of penetrating the subject facility (assumed to be all aircraft except those in general aviation) would be below 1.0×10^{-7} per year for all facilities except those at Pantex. For facilities at Pantex, the frequency of impact would be 1.7×10^{-6} per year.

Of the variety of impact conditions accounted for in the above frequency values (e.g., impact angle, direction, lateral distance from building center, speed) only a fraction would have the potential to produce consequences comparable to those reported in the SPD EIS, while other impacts (grazing impacts, impacts into office areas, etc.) would not result in significant radiological impacts. [Text deleted.] Aircraft crashes at Pantex with the potential for significant consequences could occur more frequently than 1.0×10^{-7} per year, so these scenarios were analyzed further.

For the facilities at Pantex, the potential for an aircraft crash into vaults containing large quantities of plutonium powder was examined in relation to the potential for a crash into the facility as a whole. For the pit conversion and mixed oxide (MOX) facilities, the footprint of the vault would be considerably less than one-tenth that of the facility as a whole, indicating that vault impact frequencies would be on the order of, and perhaps less than, one-tenth the facility impact frequencies. Moreover, fewer types of aircraft would have the potential to penetrate the vault due to the robustness of the reinforced-concrete vault structures and their location in the basements of the facilities. Inside the vault, the storage containers would provide additional protection against the release of material. The protection provided by the vault structure and the storage containers can be regarded as conducive to a further reduction in the frequency of aircraft crashes into vault areas.

In response to public concern over the risk of an aircraft crash at Pantex, and consistent with a Memorandum of Understanding between the DOE Amarillo Area Office and the Federal Aviation Administration (FAA), an

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[4] Probability coefficients for the likelihood of nonfatal cancer are 8.0×10^{-5} for adult workers and 1.0×10^{-4} for the public. The probability coefficients for severe hereditary effects are 8.0×10^{-5} for adult workers and 1.3×10^{-4} for the public.

Overflight Working Group was established. This working group provided a number of recommendations for reducing the risk of an aircraft crash into any facility at Pantex. DOE supplemented the Memorandum of Understanding with an Interagency Agreement with the FAA. These actions resulted in the following recommendations:

- Modifying the vectoring of approaching aircraft to preclude extended flying over plant boundaries and reducing the number of aircraft turning on final approach over the plant
- Modifying holding patterns so that they are away from the plant
- Developing a new global positioning satellite (GPS), nonprecision approach to runway 22
- Replacing the backcourse localizer approach to runway 22 with an offset localizer approach
- Upgrading the lighting system for the approach to runway 4
- Establishing a hotline between the FAA and DOE
- Establishing new very high frequency omnidirection radio tactical (VORTAC) air navigation device locations
- Installing a GPS ground differential station, and commissioning a new GPS precision approach to runway 22

As of this date, all the recommendations except the last two have been implemented. The recommendation to install a precision approach is on hold until the FAA develops the standards for the augmentation system. While these changes cannot be quantitatively reflected in the frequency of aircraft crash as calculated by DOE-STD-3014, the improvements have been acknowledged as representing a reduction in the exposure of Pantex to aircraft, which translates to a reduction in the aircraft crash frequency at that site.

As a result of these considerations, it was qualitatively estimated that the overall scenario frequency of an aircraft crash into a plutonium powder vault associated with either the pit conversion or MOX facility was below the threshold frequency of 1.0×10^{-7} per year. Additionally, it was qualitatively estimated that in light of these considerations, the overall frequency of aircraft impact into the pit conversion or MOX facility at Pantex was below 1×10^{-6} per year, or "beyond extremely unlikely." The development of consequences of an aircraft crash was therefore refocused on the MAR that could be in process areas at the time of the crash. To develop representative consequences, it was assumed that the aircraft impact would involve the process area containing the largest amount of material in the most dispersable form. For the MOX facility, the impact was assumed to involve the unloading vessel and hopper storage, powder-blending process, and MOX powder storage areas. These processes would contain the bulk of process plutonium in powder form. The total quantity of plutonium in powder form would be 1.8×10^{5} g (6.3×10^{3} oz) (UC 1998d:table B-13), assuming that one-third of the plutonium in MOX powder storage was in powder form, one-third in green pellet form, and one-third in the form of sintered pellets. However, given the potentially high-energy densities associated with an aircraft crash, it was assumed that the green pellets would be equally vulnerable to release as powder, for a total effective powder quantity of 3.5×10^{5} g (1.2×10^{4} oz). For the pit conversion facility, the impact was assumed to involve the bisector, blending, canning, nondestructive analysis, and temporary storage areas, for a total of 6.0×10^{4} g (2.1×10^{3} oz) (UC 1998a:table 7-3) of plutonium in powder form.

The initial effect of the impact would be to disperse the material in a manner consistent with DOE-HDBK-3010-94 values for debris impact in powder. For this phenomenon, DOE-HDBK-3010-94 recommends bounding ARF and RF values of 1.0×10^{-2} and 0.2 (DOE 1994a:4-10), respectively, resulting in an initial source term of 117 g (4.1 oz) for the pit conversion facility and 690 g (24 oz) for the MOX facility. An aircraft crash could also induce a fire capable of entraining additional material in a lofted plume. The ARF and RF values for thermal stress, 6.0×10^{-3} and 1.0×10^{-2} (DOE 1994a:4-7), respectively, would result in a 3 percent increase in the source term. This additional source term should not contribute significantly to the noninvolved worker dose or the MEI dose, given the trajectory of the plume. However, it would contribute to the population dose. For simplicity, the source term was included in the ground-level release, yielding a total plutonium release of 124 g (4.4 oz) for the pit conversion facility and 710 g (25 oz) for the MOX facility.

The same source terms would result from postulated aircraft crashes into the pit conversion and MOX facilities regardless of their location. As discussed above, inclusion of the consequence analysis for Pantex, but not for other sites such as SRS, was solely due to differences in accident frequency.

Criticality. All of the data reports provide technically defensible information on criticality, but the analytical assumptions vary among the reports. To assess the significance of the variations, MACCS2 runs were performed for each criticality source term. The resulting doses varied by a factor of about 15 for all criticalities except the natural phenomena hazard (NPH) vault criticality in the immobilization data report. Doses from this criticality were roughly 100 times larger than any other doses and were dominated by aerosolized plutonium from the vault.

For the SPD EIS, it was decided to discard the NPH vault criticality on the grounds that it is, at most, an improbable event that is conditional on the occurrence of a beyond-design-basis earthquake and does not represent the potential consequences of an isolated criticality. Beyond-design-basis earthquakes have been addressed via a total collapse scenario in all data reports, and the additional assumption of a criticality occurring in addition to the total collapse does not significantly increase doses beyond those resulting from the collapse itself.

Of the remaining criticalities, the criticality in the rotary splitter tumbler in the glass immobilization data report produced the highest doses, dominated by fission products as opposed to plutonium. The source term for this criticality is based on a fission yield from 1.0×10^{19} fissions in an oxide powder.

For the SPD EIS, it was decided to use this source term for criticality for all facilities, because all facilities would handle oxide powder in quantities sufficient for criticality. For the aqueous plutonium-polishing process at the MOX facility, a solution criticality of 10^{19} fissions was also postulated, which bounds the powder criticality due to the greater release potential of fission products from solution. The estimated frequency of extremely unlikely (i.e., 10^{-6} to 10^{-4} per year) reported in the immobilization data report was also used because it is the bounding estimate.

The criticality source term provided in the immobilization data report neglects some very short-lived isotopes that would be expected in a criticality, namely bromine 85, iodine 136, krypton 89 and 90, and xenon 137. Since the half-lives of these isotopes are all less than 4 min, they do not have a significant direct impact on radiological consequences. However, the daughters of some of the isotopes are themselves radioactive; in particular, krypton 89 decays to rubidium 89, which has a half-life of 15 min. The significance of the daughters for overall consequences has been assessed for Pantex, which is considered bounding because Pantex has the highest windspeeds and tends to carry the daughters the farthest for a given level of decay. As expected, the increase in dose is greatest for the noninvolved worker; approximately 25 percent higher for both the mean and 95th percentile. The dose increase decreases to 3 and 13 percent, respectively, for the mean and 95th percentile doses to the population within 80 km (50 mi). Dose increases at other sites are expected to be lower than corresponding increases at Pantex. Because these increases are small considering the great uncertainty inherent in the estimate of the total number of fissions, the source term in the immobilization data report remains a conservative estimate of the potential release from a criticality accident, and no modification of the source term has been made.

Design Basis Earthquake. Each data report presents an analysis of the design basis earthquake. The immobilization and MOX data reports provide source terms for that earthquake, while the pit conversion data reports indicate no release as a result of a design basis earthquake because the facility would be designed to withstand the event.

For the SPD EIS, a nonzero source term for pit conversion was generated by applying a building ventilation LPF of 1.0×10^{-5}, accounting for a HEPA filtered release, to the beyond-design-basis earthquake source term. It is recognized that this is a conservative procedure, in that the beyond-design-basis earthquake would release more material into the air within the building than a design basis earthquake. The combined ARF×RF for powder under beyond-design-basis earthquake conditions has been assessed as three times that for design basis earthquake conditions, and the total amount of vulnerable material may be somewhat greater. (For perspective, it resulted in a ratio of design basis earthquake to beyond-design-basis earthquake source term values that is somewhat higher than the corresponding ratio for MOX fuel fabrication, but lower than for plutonium conversion and immobilization.)

Beyond-Design-Basis Earthquake. All of the proposed operations would be in either existing or new facilities that would be expected to meet or exceed the requirements of DOE O 420.1 (DOE 1995b) and DOE-STD-1020-94 for reducing the risks associated with natural phenomena hazards. The proposed facilities would be characterized as Performance Category 3 facilities. Such facilities would have to be designed or evaluated for a design basis earthquake with a mean annual exceedance probability of 5×10^{-4}, corresponding to a return period of 2,000 years. For sites such as Lawrence Livermore National Laboratory (LLNL), which are near tectonic plate boundaries, the requirements would include a mean annual seismic hazard exceedance probability of 1.0×10^{-3}, or a return period of 1,000 years.

The numerical seismic design requirements detailed in DOE-STD-1020-94 are structured such that there is assurance that specific performance goals are met. For plutonium facilities (Performance Category 3), the performance goal is that occupant safety, continued operation, and hazard confinement would be ensured for earthquakes with an annual probability exceeding approximately 1×10^{-4}. There is sufficient conservatism in the design of buildings and the structures, systems, and components important to safety that these goals should be met given that they are designed against earthquakes with an estimated mean annual probability of 5×10^{-4}.

[Text deleted.]

By contrast, nonnuclear structures at these sites and the surrounding community would be constructed to the standards of the Uniform Building Code for that region. These peak acceleration values are 50 to 82 percent of the peak acceleration design requirements for plutonium facilities in the same area and correspond approximately to DOE Performance Category 1 facilities with 500-year return intervals. During major earthquakes, structures built to these Uniform Building Code requirements would be expected to suffer significantly more damage than reinforced-concrete structures designed for plutonium operations.

At sites far from tectonic plate boundaries, deterministic techniques such as those used by NRC in evaluating safe-shutdown earthquakes for the siting of nuclear reactors have also been used to determine the maximum seismic ground motion requirements for facility designs. These techniques involve estimating the ground acceleration at the proposed facility either by assuming the largest historical earthquake within the tectonic province or by assessing the maximum earthquake potential of the appropriate tectonic structure or capable fault closest to the facility. For NRC-licensed reactors, this technique resulted in safe-shutdown earthquakes with estimated return periods in the 1,000- to 100,000-year range (DOE 1994a:C-17).

All the existing facilities under consideration in the SPD EIS have had seismic evaluations demonstrating that they meet the seismic evaluation requirements for the design basis earthquake. Some facilities, such as

Building 332 at LLNL under consideration for preparation of the lead test assemblies, have had extensive evaluations of the ability of the structures, systems, and components important to safety to survive a range of seismic loadings. Evaluations reported in the *Final Environmental Impact Statement and Environmental Impact Report for Continued Operation of Lawrence Livermore National Laboratory and Sandia National Laboratories, Livermore* (DOE 1992) indicate that Building 332 would survive a postulated 0.8g earthquake and retain those features essential for the safe containment of radioactive materials. The estimated return interval for this level of ground accelerations is about 10,000 years. The facility was also examined for damage due to a 0.9g earthquake and found to be survivable (DOE 1992:app. D.5.2.1), albeit with some potential for loss of confinement due to equipment damage in safety systems (DOE 1992:table I-14).

The magnitude of potential earthquakes with return periods greater than 10,000 years is highly uncertain. For purposes of the SPD EIS, it was assumed that at all the candidate sites, earthquakes with return periods in the 100,000- to 10-million-year range might result in sufficient ground motion to cause major damage to even a modern, well-engineered and well-constructed plutonium facility. Therefore, in the absence of convincing evidence otherwise, a total collapse of the plutonium facilities was assumed to be scientifically credible and within the rule of reason for return intervals in this range.

Each data report presents an analysis of total collapse. The immobilization and MOX data reports are fairly consistent in their use of damage estimates and release fractions. They assume that material in storage containers in vault storage would be adequately protected from the scenario energetics, for a damage ratio of zero in the vault. They also assume powder ARF and RF values of 1.0×10^{-3} and 0.3 (UC 1998c:tables 8-14 and 8-15; 1998d:169), respectively. The pit conversion data reports assume a damage ratio of 50 percent for material held in storage containers, applies cumulative ARF and RF values of 2.7×10^{-3} to powder subject to seismic vibration, free-fall spill, and turbulent air currents; and also presents a resuspension source term (UC 1998a:79–81).

For the SPD EIS, the pit conversion source term was modified by adjusting the damage ratio in the vault from 0.5 to 0 based on the corresponding analyses in the immobilization and MOX data reports, and adjusting the ARF and RF values for powder to 1.0×10^{-3} and 0.3, respectively. The assumption of vault survival in the beyond-design-basis earthquake was based on the fact that the vaults would be designed with significantly more robustness than the balance of the proposed facilities. The requirements for the additional robustness of the vault derive from the desire for increased protection of vault contents against external events such as aircraft crash or proliferation concerns, as well as increased earthquake survivability. It is expected that the vaults would survive the most likely seismic events of sufficient magnitude to collapse the processing areas of the proposed facilities. While there may be even more intense seismic events capable of compromising the protection afforded by the vaults, such events are expected to be beyond extremely unlikely.

The value of 2.7×10^{-3}, used in the pit conversion data report, is based on seismic-induced collapse of large structures into loose bulk powder; this assumption is considered unnecessarily conservative given the expectation of containered storage for the majority of the powder inventory at any given time. The resuspension source term was kept (and was not applied to either immobilization or MOX). Although worth noting, this difference between the data reports is not considered particularly significant, for the resuspension source term constitutes only 30 percent of the total.

The frequency for all beyond-design-basis earthquakes for all facilities is reported in the SPD EIS as extremely unlikely to beyond extremely unlikely (the pit conversion facility data report estimated a frequency of less than 1×10^{-6} per year.) They are reported as such because the uncertainties inherent in associating damage levels with earthquake frequencies become overwhelming below frequencies of about 1.0×10^{-5} per year.

Filtration Efficiency. The immobilization and MOX data reports use a building filtration efficiency of 1.0×10^{-5} for particulate releases (UC 1998c:8-3; 1998d:tables B-18–B-20). The pit conversion data report uses a building filtration efficiency of 2.0×10^{-6} (UC 1998a:73). For consistency, the pit conversion source terms have been adjusted to reflect an LPF of 1.0×10^{-5}. This is reasonable because it is expected that the ventilation efficiencies of all HEPA-filtered buildings would be essentially the same.

Beyond-Design-Basis Fire. The MOX data report presents an analysis of a beyond-design-basis fire whose basis in terms of scenario definition was from the *Data Report for Plutonium Conversion Facility* (Smith, Wilkey, and Siebe 1996), which was produced for the *Storage and Disposition PEIS* (DOE 1996a). Neither the pit conversion nor the immobilization data reports contain analyses of a beyond-design-basis fire.

For the SPD EIS, beyond-design-basis fires were developed for pit conversion and immobilization by replacing the building filtration LPF with an LPF of 1.4 percent, in accordance with the beyond-design-basis scenario definition presented in the *Data Report for Plutonium Conversion Facility* (Smith, Wilkey, and Siebe 1996) and adapted for the MOX fuel fabrication analysis. (For perspective, it resulted in a ratio of design basis fire to beyond-design-basis fire source term values that are within a factor of 2 of the corresponding ratio for MOX fuel fabrication.)

It is understood that the LPF of 1.4 percent is based on a facility-specific analysis of the Plutonium Finishing Building (PF–4) in Technical Area 55 at LANL, and that an analysis of other facilities using the same phenomenological assumptions might yield somewhat different results. However, for the purpose of this analysis, and considering the degree of similarity expected between facilities as a result of required plutonium-handling practices, this value was used generically in the assessment of beyond-design-basis fire.

K.1.5.2 Facility Accident Scenarios

K.1.5.2.1 Pit Conversion Facility

A wide range of potential accident scenarios were considered for the pit conversion facility. These scenarios are considered in detail in the pit conversion facility data reports (UC 1998a, 1998c, 1998e, 1998f). The analysis assumes that the pit conversion facility is located in a new or upgraded existing building designed to withstand design basis natural phenomena hazards such as earthquakes, winds, tornadoes, and floods such that no unfiltered releases would be expected. Also, no site-specific accidents conducive to releases are identified. Therefore, the potential accident scenarios apply to all four candidate sites.

Analysis of the proposed process operations for the pit conversion facility identified the following broad categories of accidents: aircraft crash, criticality, design basis earthquake, beyond-design-basis earthquake, explosion, fire, leaks or spills, and tritium release. Basic characteristics of each of these postulated accidents are described below. Additional discussion of scenario development based on consistency concerns can be found in Appendix K.1.5.1.

Aircraft Crash. A crash of a large, heavy commercial or military aircraft directly into a reinforced-concrete facility could damage the structure sufficient to breach confinement and disperse material into the environment. A subsequent fuel-fed fire could provide energy to further damage structures and equipment, aerosolize material, and drive materials into the environment. Source terms are highly speculative but would be expected to exceed those from the beyond-design-basis earthquake. At all sites except Pantex, the frequency of such a crash is below 10^{-7} per year.

Criticality. Engineered and administrative controls should be available to ensure that the double-contingency principles are in place for all portions of the process. It is assumed that human error results in multiple failures leading to an inadvertent nuclear criticality. The estimated frequency of this accident is in the range of 10^{-4} to 10^{-6} per year. A bounding source term resulting from 10^{19} fissions is assumed.

Design Basis Earthquake. The principal design basis natural phenomena event that could release material to the environment is the design basis earthquake. While the major safety systems, including building confinement and the building HEPA filtration system should continue to function, the vibratory motion would be expected to resuspend loose plutonium powder within gloveboxes and cause some minor spills. These would be picked up by the ventilation system and filtered by the HEPA filters before release from the building. Although highly uncertain, the source term should be much lower than that postulated for the beyond-design-basis earthquake. Based on an LPF of 1.0×10^{-5} for two HEPA filters, a stack release of 3.9×10^{-4} g (1.4×10^{-5} oz) is postulated. The estimated frequency of this accident is in the range of 10^{-4} to 10^{-2} per year.

Beyond-Design-Basis Earthquake. The postulated beyond-design-basis earthquake is assumed to be of sufficient magnitude to cause total collapse of the process equipment, building walls, roof, and floors, and loss of the containment function of the building. The material in the building is assumed to be driven airborne by the seismic vibrations, free-fall during the collapse, and impact. Molten metal in furnaces is also assumed to burn in the aftermath of the collapse. An instantaneous plus-resuspension ground-level release of 39 g (1.4 oz) of respirable plutonium is estimated for the process area. While the release of an additional 2,529 g (89 oz) from the vault would be possible, it would be unlikely given the expected packaging of materials in the vault. The estimated frequency of this accident is in the range of 10^{-5} to 10^{-7} per year.

Explosion. The bounding explosion is a deflagration of a hydrogen gas mixture inside the hydride oxidation (HYDOX) furnace. The deflagration is assumed to result from multiple equipment failures and operator errors that lead to a buildup of hydrogen and a flow of oxygen into the inert-atmosphere glovebox used in the HYDOX process. Also assumed is an MAR of 4.5 kg (9.9 lb) of plutonium powder, and given the venting of pressurized gas through the powder, bounding ARF and RF of 0.1 and 0.7, respectively. The explosive energy would be sufficient to damage glovebox windows but insufficient to threaten the building HEPA filter system. Based on an LPF of 1.0×10^{-5} for two HEPA filters, a stack release of 3.2×10^{-3} g (1.1×10^{-4} oz) is postulated. The estimated frequency of this accident is in the range of 10^{-2} to 10^{-4} per year.

Fire. According to the several safety analyses of the plutonium facility at LANL, the bounding fire within the pit conversion facility is a fire involving all of the gloves in a glovebox used for blending plutonium powder. A flammable cleaning liquid is assumed to be brought into the glovebox, in violation of procedure, then to spill and ignite. The gloves are assumed to be stowed outside the glovebox but to be ignited by the fire and completely consumed. An MAR of 2 g (0.07 oz) of plutonium dust is assumed for each of 12 gloves, with all of the 24 g (0.85 oz) assumed to be aerosolized. The sprinkler system is assumed to function and protect the room and remainder of the building. Also assumed are an ARF of 0.05 and an RF of 1.0, resulting in a 1.2-g (0.04-oz) release to the building ventilation system. Based on an LPF of 1.0×10^{-5} for two HEPA filters, a stack release of 1.2×10^{-5} g (4.2×10^{-7} oz) is postulated. The estimated frequency of this accident is in the range of 10^{-2} to 10^{-4} per year.

Leaks or Spills of Nuclear Material. The most catastrophic leak or spill postulated would result from a forklift or other large vehicle running over a package of nuclear material and breaching the storage container. If a 4-kg (8.8-lb) package of plutonium oxide were breached, a total airborne release of 0.44 g (0.016 oz) to the room would occur, and after HEPA filtration of the facility exhaust, a total release of 4.4×10^{-6}. This accident has an estimated frequency in the range of 10^{-4} to 10^{-6} per year.

Tritium Release. A major glovebox fire is assumed to heat multiple parts contaminated with up to 20 g (0.71 oz) of tritium and convert all of it into tritiated water vapor. Very conservatively, the ARF, RF, and LPF are all assumed to be 1.0, resulting in a release of 20 g (0.71 oz) (1.9×10^{-5} Ci) through the stack to the atmosphere. The estimated frequency of this accident is in the range of 10^{-4} to 10^{-6} per year.

K.1.5.2.2 Immobilization Facility

A wide range of potential accident scenarios are reflected in the immobilization facility data reports (UC 1999a–d). The analysis assumes that the immobilization facility is located in a new or upgraded existing building designed to withstand design basis natural phenomena hazards such as earthquakes, winds, tornadoes, and floods such that no unfiltered releases would be expected. Also, no site-specific accidents conducive to releases are identified. Therefore, the potential accident scenarios apply to all four candidate sites. Additional discussion of scenario development based on consistency concerns can be found in Appendix K.1.5.1.

Analysis of the proposed process operations identified specific scenarios for the conversion process, each of the immobilization options (ceramic and glass), and the canister-handling portion of the process. Design basis and beyond-design-basis earthquakes were identified for the overall facility. Identified as accidents specific to the plutonium conversion processes were a criticality, an explosion in HYDOX furnace, a calcining furnace–glovebox fire, and a hydrogen explosion in the plutonium conversion room. For the ceramic immobilization option, moreover, a sintering furnace–glovebox fire was identified; for the glass immobilization option, a melter eruption and a melter spill. All of the scenarios identified with the canister-handling phase were negligible compared with the conversion and immobilization scenarios.

PLUTONIUM CONVERSION OPERATIONS

Criticality. Review of the possibility of accidents attributable to plutonium conversion operations indicated that the principal processes of concern include the halide wash operations, the HYDOX furnace, and the sorting/unpacking glovebox. Engineered and administrative controls should be available to ensure that the double-contingency principles are in place for all portions of the process. It is assumed that human error could result in multiple failures leading to an inadvertent nuclear criticality. The estimated frequency of this accident is in the range of 10^{-4} to 10^{-6} per year. A bounding source term resulting from 10^{19} fissions is assumed.

Explosion in HYDOX Furnace. The bounding explosion is a deflagration of a hydrogen gas mixture inside the HYDOX furnace. The deflagration is assumed to result from multiple equipment failures and operator errors that lead to a buildup of hydrogen and a flow of oxygen into the inert-atmosphere glovebox used in the HYDOX process. Also assumed is an MAR of 4.8 kg (11 lb) of plutonium powder, and given the venting pressurized gas through the powder, bounding ARF and RF of 0.1 and 0.7, respectively. The explosive energy would be sufficient to damage glovebox windows but insufficient to threaten the building HEPA filter system. Based on an LPF of 1.0×10^{-5} for two HEPA filters, a stack release of 3.4×10^{-3} g (1.2×10^{-4} oz) is postulated. The estimated frequency of this accident is approximately 10^{-3} per year or in the unlikely range.

Hydrogen Explosion in Plutonium Conversion Room. A supply pipe leak in the plutonium conversion room could result in a hydrogen explosion. Conversion of plutonium metal is accomplished using the HYDOX process, which entails the introduction of hydrogen gas. Were the hydrogen supply piping to leak into the operating/maintenance room, the gas could be ignited by an electrical short or operating mechanical equipment, causing an explosion. Depending on the volume of the leak, the structural integrity of the glovebox glove ports could fail and disperse the plutonium oxide. It is assumed that the building ventilation does not fail, and that the two HEPA filters provide filtration prior to discharge of the powder to the stack. An entire day's inventory of 25 kg (55 lb) of plutonium oxide powder is assumed present in the plutonium conversion gloveboxes. Based on an ARF of 5×10^{-3}, an RF of 0.3, and an LPF of 1.0×10^{-5} for two HEPA filters, a stack release of 3.8×10^{-4} g (1.3×10^{-5} oz) of plutonium is postulated. The estimated frequency of this accident is approximately 10^{-3} per year or in the unlikely range.

Furnace-Initiated Glovebox Fire (Calcining Furnace). It is assumed that a fault in the calcining furnace results in the ignition of any combustibles (e.g., bags) left inside the glovebox. The fire would be self-limiting, but would cause suspension of the radioactive material. It is also assumed that the glovebox (including the window) maintains its structural integrity, but that the internal glovebox HEPA filter fails. All of the loose surface contamination within the glovebox, assumed to be 10 percent of the daily inventory (4.5 kg [9.9 lb] of plutonium) of the calcining furnace, is assumed to be involved. Based on an ARF of 6×10^{-3}, an RF of 0.01, and an LPF of 1.0×10^{-5} for two HEPA filters, a stack release of 2.7×10^{-7} g (9.5×10^{-9} oz) of plutonium is postulated. The estimated frequency of this accident is in the range of 10^{-4} to 10^{-6} per year.

CERAMIC IMMOBILIZATION OPTION

Criticality. Review of the possibility of accidents attributable to the ceramic immobilization operations indicated that the principal operation of concern is the rotary splitter tumbler. Engineered and administrative controls should be available to ensure that the double-contingency principles are in place for all portions of the process. It is assumed that human error results in multiple failures leading to an inadvertent nuclear criticality. The estimated frequency of this accident is in the range of 10^{-4} to 10^{-6} per year. A bounding source term resulting from 10^{19} fissions is assumed.

Design Basis Earthquake. The principal design basis natural phenomena event that could release material to the environment is the design basis earthquake. While the major safety systems, including building confinement and the building HEPA filtration system should continue to function, the vibratory motion would be expected to suspend loose plutonium powder within gloveboxes and cause some minor spills. These would be picked up by the ventilation system and filtered by the HEPA filters before release from the building. Most material storage containers are assumed to be engineered to withstand design basis earthquakes without failing. For plutonium conversion, it is assumed that at the time of the event the entire day's inventory (25 kg [55 lb] of plutonium) is present in the form of oxide powder. For the ceramic immobilization portion, this includes the oxide inventories from the rotary splitter, oxide grinding, blend and granulate feed storage, drying and storage, pressing, inspection, and load trays and weigh areas. Although the source term is highly uncertain, an assessment of the MAR, ARF, and RF for each of the process areas indicated a potential for the release of 38 g (1.3 oz) of plutonium to the still-functioning building ventilation system and 3.8×10^{-4} g (1.3×10^{-5} oz) from the stack. The nominal frequency estimate for a design basis earthquake affecting new DOE plutonium facilities is 5×10^{-4} per year, or in the unlikely range.

Beyond-Design-Basis Earthquake. The postulated beyond-design-basis earthquake is assumed to be of sufficient magnitude to cause total collapse of the process equipment, building walls, roof, and floors, and loss of the containment function of the building. The material in the building is assumed to be driven airborne by the seismic vibrations, free-fall during the collapse, and impact. Material in storage containers in vaults would be adequately protected from the scenario energetics. Although the source term is highly uncertain, an assessment of the MAR, ARF, and RF for each of the process areas indicated a potential for the release of 19 g (0.67 oz) of plutonium at ground level. The estimated frequency of this accident is in the range of 10^{-5} to 10^{-7} per year.

Furnace-Initiated Glovebox Fire (Sintering Furnace). It is assumed that the sintering gas supplied to the furnace gloveboxes is a safe gas mixture—hydrogen and argon. Human errors are at issue—either a vendor/supplier that causes a supply of air or noninerting gas to be supplied to the furnace glovebox, or a piping error at the facility itself, in which oxygen is inadvertently substituted for the inert gas. Any combustibles (e.g., bags) left inside the glovebox could ignite, causing a glovebox fire. It is assumed that the fire is self-limiting, but causes suspension of the radioactive material. It is also assumed that the glovebox (including the window) maintains its structural integrity, but that the internal glovebox HEPA filter fails. All of the loose surface contamination within the glovebox, assumed to be 10 percent of the daily inventory (25 kg [55 lb] of plutonium) of the calcining furnace, is assumed to be involved. Based on an ARF of 6×10^{-3}, an RF of 0.01, and an LPF of 1.0×10^{-5} for two HEPA filters, a stack release of 1.5×10^{-6} g (5.3×10^{-8} oz) of plutonium is postulated. The estimated frequency of this accident is in the range of 10^{-4} to 10^{-6} per year.

GLASS IMMOBILIZATION OPTION

Design Basis Earthquake. The principal design basis natural phenomena event that could release material to the environment is the design basis earthquake. While the major safety systems, including building confinement and the building HEPA filtration system should continue to function, the vibratory motion would be expected to suspend loose plutonium powder within gloveboxes and cause some minor spills. These would be picked up by the ventilation system and filtered by the HEPA filters before release from the building. Most material storage containers are assumed to be engineered to withstand design basis earthquakes without failing. For plutonium conversion, it is assumed that at the time of the event the entire day's inventory (25 kg [55 lb] of plutonium) is present in the form of oxide powder. For the glass immobilization portion, this includes oxide inventories from the rotary splitter, oxide grinding, blend melter, and feed storage. Although the source term is highly uncertain, an assessment of the MAR, ARF, and RF for each of the process areas indicated a potential for the release of 33 g (1.2 oz) of plutonium to the still-functioning building ventilation system and 3.3×10^{-4} g (1.2×10^{-5} oz) from the stack. The nominal frequency estimate for a design basis earthquake affecting new DOE plutonium facilities is 5×10^{-4} per year, or in the unlikely range.

Beyond-Design-Basis Earthquake. The postulated beyond-design-basis earthquake is assumed to be of sufficient magnitude to cause total collapse of the process equipment, building walls, roof, and floors, and loss of the containment function of the building. The material in the building is assumed to be driven airborne by the seismic vibrations, free-fall during the collapse, and impact. Material in storage containers in vaults storage would be adequately protected from the scenario energetics. Although the source term is highly uncertain, an assessment of the MAR, ARF, and RF for each of the process areas indicated a potential for the release of 17 g (0.60 oz) of plutonium released at ground level. The estimated frequency of this accident is in the range of 10^{-5} to 10^{-7} per year.

Melter Eruption. A melter eruption could result from the buildup of impurities in, or addition of impurities to, the glass frit or melt. Impurities range from water, which could cause a steam eruption, to chemical contaminants, which could react at elevated temperatures and produce a highly exothermic reaction (eruption or deflagration). The resulting sudden pressure increase could eject the fissile material bearing melt liquid into the processing glovebox structure. However the energy release would likely be insufficient to challenge the glovebox structure. It is assumed that the entire contents of the melter, about 1.4 kg (3.1 lb) of plutonium, are ejected into the glovebox. Based on an ARF of 4×10^{-4}, an RF of 1, and an LPF of 1.0×10^{-5} for two HEPAs, a stack release of 1.4×10^{-6} g (4.9×10^{-8} oz) of plutonium is postulated. The estimated frequency of this accident is approximately 2.5×10^{-3} per year, or in the unlikely range.

Melter Spill. A melter spill into the glovebox could occur due to improper alignment of the product glass cans during pouring operations. The melter glovebox enclosure and the off-gas exhaust ventilation system would confine radioactive material released in the spill. The glovebox structure and its associated filtered exhaust ventilation system would not be impacted by this event. It is assumed that the entire contents of the melter, about 1.4 kg (3.1 lb) of plutonium, are spilled into the glovebox. On the basis of an ARF of 2.4×10^{-5}, a RF of 1, and an LPF of 1.0×10^{-5} for two HEPAs, a stack release of 3.3×10^{-7} g (1.2×10^{-8} oz) of plutonium is postulated. The estimated frequency of this accident is approximately 3×10^{-4} per year, or in the unlikely range.

CAN-IN-CANISTER OPERATIONS

Can-Handling Accident (Before Shipment to Vitrification Facility). A can-handling accident would involve a can containing either ceramic pellets or a vitrified glass log of plutonium material. Studies supporting the Defense Waste Processing Facility (DWPF) SAR (UC 1999a–d) indicate that the source term resulting from dropping or tipping a log of vitrified waste, even without credit for the steel canister, would be negligible. Both surplus plutonium immobilization technologies (ceramic and glass) result in a form with a durability that is comparable to that of the DWPF vitrified waste form. Consequently, no postulated can-handling event would result in a radioactive release to the environment.

Melter Spill (Melt Pour at Vitrification Facility). Analysis of a spill of melt material was included in studies performed in support of the DWPF SAR. According to that analysis, the source term resulting from the dropping or tipping a log of vitrified waste, even without credit for the steel canister, would be negligible. Both surplus plutonium immobilization technologies (ceramic and glass) result in a form with a durability that is comparable to the DWPF vitrified waste form. Consequently, it is postulated that no melter spill event results in a radioactive release to the environment.

Canister-Handling Accident (After Melt Pour at DWPF). Analysis of events involving the handling and storage of vitrified waste canisters was included in studies performed in support of the DWPF SAR. Results of that analysis indicate that the source term resulting from the dropping or tipping of a log of vitrified waste, even without credit for the steel canister, would be negligible. Both surplus plutonium immobilization technologies (ceramic and glass) result in a form with a durability that is comparable to the DWPF vitrified waste form. Consequently, it is postulated that no canister-handling event results in a radioactive release to the environment.

K.1.5.2.3 MOX Facility Accident Scenarios

A wide range of potential accident scenarios were considered in the analysis reflected in the MOX facility data reports (UC 1998b, 1998d, 1998g, 1998h). The analysis assumes that the MOX facility is located in a new or upgraded existing building designed to withstand design basis natural phenomena hazards such as earthquakes, winds, tornadoes, and floods such that no unfiltered releases would be expected. The MOX facility includes an aqueous plutonium-polishing process by which impurities, in particular gallium, are removed from the plutonium feed for MOX fuel fabrication. Bounding accidents for this process were developed separately from the accidents reflected in the MOX facility data reports and are documented in a stand-alone, process-specific data report (ORNL 1998).

Analysis of the proposed process operations for the MOX facility identified the following broad categories of accidents: aircraft crash (Pantex only), criticality, design basis earthquake, beyond-design-basis earthquake, explosion in sintering furnace, fire, and beyond-design-basis fire. Basic characteristics of each of these postulated accidents are described below. Additional discussion of scenario development based on consistency concerns can be found in Appendix K.1.5.1.

Aircraft Crash. A crash of a large, heavy commercial or military aircraft directly into a reinforced-concrete facility could damage the structure sufficiently to breach confinement and disperse material into the environment. A subsequent fuel-fed fire could provide energy to further damage structures and equipment, aerosolize material, and drive materials into the environment. Source terms are highly speculative but would be expected to exceed those from the beyond-design-basis earthquake. At all sites except Pantex, the frequency of such a crash is below 10^{-7} per year.

Criticality. Review of the possibility of accidents for the MOX facility indicated no undue criticality risk associated with the proposed operations. Engineered and administrative controls should be available to ensure that the double-contingency principles are in place for all portions of the process. It is assumed that human error could result in multiple failures leading to an inadvertent nuclear criticality. The estimated frequency of this accident is in the range of 10^{-4} to 10^{-6} per year. A bounding source term resulting from 10^{19} fissions in solution is assumed.

Design Basis Earthquake. The principal design basis natural phenomena event that could release material to the environment is the design basis earthquake. While the major safety systems, including building confinement and the building HEPA filtration system should continue to function, the vibratory motion would be expected to resuspend loose plutonium powder within gloveboxes and cause some minor spills. These would be picked up by the ventilation system and filtered by the HEPA filters before to release from the building. Material storage containers including cans, hoppers, and bulk storage vessels are assumed to be engineered to withstand design basis earthquakes without failing. Although the source term is highly uncertain, an assessment of the MAR, ARF, and RF for each of the process areas indicated a potential for the release of 4 g (0.14 oz) of plutonium (in the form of MOX powder) to the still-functioning building ventilation system and 4.0×10^{-5} g (3.5×10^{-7} oz) from the stack. The nominal frequency estimate for a design basis earthquake for new DOE plutonium facilities is 5×10^{-4} per year, or in the unlikely range.

Beyond-Design-Basis Earthquake. The postulated beyond-design-basis earthquake is assumed to be of sufficient magnitude to cause total collapse of the process equipment, building walls, roof, and floors, and loss of the containment function of the building. The material in the building is assumed to be driven airborne by the seismic vibrations, free-fall during the collapse, and impact. Although the source term is highly uncertain, an assessment of the MAR, ARF, and RF for each of the process areas indicated a potential for the release of 124 g (4.4 oz) of plutonium (in the form of MOX powder) at ground level. The estimated frequency of this accident is in the range of 10^{-5} to 10^{-7} per year.

Explosion in Sintering Furnace. The several furnaces proposed for the MOX fuel fabrication process all use nonexplosive mixtures of 6 percent hydrogen and 94 percent argon. Given the physical controls on the piping for nonexplosive and explosive gas mixtures, operating procedures, and other engineered safety controls, accidental use of an explosive gas is extremely unlikely, though not impossible. A bounding explosion or deflagration is postulated to occur in one of the three sintering furnaces in the MOX facility building. Multiple equipment failures and operator errors would be required to lead to a buildup of hydrogen and an inflow of oxygen into the inert furnace atmosphere. As much as 5.6 kg (12.3 lb) of plutonium in the form of MOX powder would be at risk, and a bounding ARF of 0.01 and RF of 1.0 is assumed. Based on an LPF of 1.0×10^{-5} for two HEPA filters, a stack release of 5.6×10^{-4} g (2.0×10^{-5} oz) of plutonium (in the form of MOX powder) is postulated. It is estimated that the frequency of this accident is in the range of 10^{-4} to 10^{-6} per year.

Ion Exchange Column Exotherm. A thermal excursion within an ion exchange column is postulated to result from offnormal operations, degraded resin, or a glovebox fire. It is also assumed that the column venting/pressure relief valve fails to vent the overpressure, causing the column to rupture violently. The overpressure releases plutonium nitrate solution as an aerosol within the affected glovebox, which in turn is processed through the ventilation system. If the overpressure also breaches the glovebox, a fraction of the aerosol is released within the room as well. The combined ARF and RF values for this scenario are 9.0×10^{-3} for burning resin and 6.0×10^{-3} for liquid behaving as a flashing spray on depressurization. Additionally, 10 percent of the resin is assumed to burn, yielding a combined ARF and RF value of 9.0×10^{-3} for loaded plutonium. The LPF for the ventilation system is 1.0×10^{-5}.

With regard to probability, process controls are used to ensure that nitrated anion exchange resins are maintained in a wet condition, that the maximum nitric acid concentration and the operating temperature are limited to safe values, and that the time for absorption of plutonium in the resin is minimized. With these controls in place, the frequency of this accident is estimated to be in the unlikely range.

Fire. It is assumed that the liquid organic solvent containing the maximum plutonium concentration leaks as a spray into the glovebox, builds to a flammable concentration, and is contacted by an ignition source. The combined ARF and RF value for this scenario is 1.0×10^{-2} for quiescent burning to self-extinguishment. The LPF for the ventilation system is 1.0×10^{-5}. Scenario frequency is assessed as unlikely.

Spill. Leakage of liquids from process equipment must be considered as an anticipated event. However, with multiple containment barriers, a release from the process room would be extremely unlikely. A bounding scenario involved a liquid spill of concentrated aqueous plutonium solution, with 50 l (13.2 gal) accumulating before the leak is stopped. The ARF and RF values used for this scenario are 2.0×10^{-4} and 0.5, respectively. The LPF for the building ventilation system is 1.0×10^{-5}.

Beyond-Design-Basis Fire. The MOX facility would be built and operated such that there would be insufficient combustible materials to support a large fire. To bound the possible consequences of a major fire, a large quantity of combustible materials are assumed to be introduced into the process area near the blending area, which contains a fairly large amount of plutonium. A major fire is assumed to occur that causes the building ventilation and filtration systems to fail, possibly due to clogged HEPA filters. A total of 11 kg (24 lb) of plutonium in the form of MOX powder is assumed at risk. Based on an ARF of 6×10^{-3}, a RF of 0.01, and an LPF of 1.4×10^{-2} for two damaged, clogged HEPA filters, a stack release of 9.4×10^{-3} g (3.3×10^{-4} oz) of plutonium (in the form of MOX powder) is postulated. It is estimated that the frequency of this accident is less than 10^{-6} per year.

K.1.5.2.4 Lead Assembly Accident Scenarios

Design basis and beyond-design-basis accident scenarios have been developed for the fabrication of MOX fuel lead assemblies. These scenarios are discussed in detail, with specific assumptions for each facility and site, in the site data reports (O'Connor et al. 1998a–e). In spite of efforts by all parties, however, some inconsistencies exist between the data reports. This does not imply technical inaccuracy in any analysis; it merely reflects the uncertainties and reliance on convention inherent in accident analyses in general. In preparing the accident analysis for the SPD EIS, therefore, information in the data reports was modified or augmented to ensure the consistency, as appropriate, that is necessary for a reliable comparison of lead assembly fabrication accidents and the other accidents analyzed herein. Modifications were made to ensure that, to the extent practical, differences in analytical results were based on actual differences in facility conditions, as opposed to arbitrary differences in analytical methods or assumptions. One change, reflected in Table K–2, involved the assumption for all accidents of an isotopic composition of plutonium identical to that assumed in the analyses of pit disassembly and conversion and MOX fuel fabrication.

Table K–2. Isotopic Composition of Plutonium Used in Lead Assembly Accident Analysis

Isotope	Weight Percent
Plutonium 238	3.0×10^{-2}
Plutonium 239	92.2
Plutonium 240	6.46
Plutonium 241	5.0×10^{-2}
Plutonium 242	1.0×10^{-1}
Americium 241	9.0×10^{-1}

Criticality. Criticalities could be postulated in several areas (e.g., powder storage, the gloveboxes involved in mixing, the furnace, the fuel rod storage area). The estimated frequencies associated with these events would vary depending on the controls in place, the number of operator movements, and the amount of fissile material present. A generic approach was taken with respect to the selection of the specifics of this event, rather than selection of a criticality scenario associated with a specific operation in the lead assembly fabrication.

The criticality source term stipulated in the data reports was modified to make it identical to the corresponding source term used in the assessment of criticality in the pit conversion, immobilization, and MOX facilities. That source term is based on a fission yield from 1.0×10^{19} fissions in an oxide powder. The discussion provided in Appendix K.1.5 on criticality is also applicable here.

Design Basis Earthquake. An earthquake appropriate with the facility's design basis was selected. For this event, major portions of the process line gloveboxes are assumed to be breached, making the contents available for release. The storage vault and receiving area are assumed to have suitable storage containers for plutonium oxide that would survive the earthquake (storage containers with double containment). In-process material in gloveboxes is, however, more vulnerable, as are powder storage areas that may exist. Of particular concerns are the dispersable powders at the powder-blending stations. Finished pellets and fuel rods are thought to be generally nondispersable, even though they could escape the gloveboxes. In this earthquake, some non-seismically qualified process equipment could fail, and some process material spill. It is also conservatively assumed that glovebox filtration would fail.

The lead assembly data reports use ARF and RF values of 1.0×10^{-2} and 0.2, respectively, for plutonium oxide in cans involved in a design basis earthquake. These values are based on DOE-HDBK-3010-94 recommendations for the suspension of bulk powder by debris impact and air turbulence from falling objects. For consistency with the design basis accident analyses for the other facilities, these values were changed to 1.0×10^{-3} and 0.1, values based on DOE-HDBK-3010-94 recommendations for the suspension of bulk powder due to vibration of substrate from shock-impact to powder confinement (e.g., gloveboxes, cans) due to external energy (e.g., seismic vibrations). Such values are appropriate for earthquakes in which structural integrity is largely maintained and there is not a significant amount of debris or falling objects.

Beyond-Design-Basis Earthquake. For this analysis an event much more severe in consequences than would be expected from the design basis earthquake was examined. For some existing DOE facilities, the estimated seismic frequencies of beyond-design-basis events can be greater than 1.0×10^{-6} per year. The design basis for every building in the complex varies considerably depending on site specifics, including the type of construction used in the building. A damage assessment of the facility is further complicated by the fact that seismic considerations could also be incorporated in the glovebox design of the facility. In reality, such a catastrophic event may or may not demolish the building and the gloveboxes. However, for the purposes of illustrating a high-consequence accident, total demolition of the building is assumed. In this event, no credit is taken for the building, filters, or gloveboxes.

In the data report, an estimated frequency of 1.0×10^{-6} per year is cited as appropriate. To acknowledge the high degree of uncertainty in assessing a frequency of this scenario, a range of extremely unlikely to beyond extremely unlikely has been assigned to this event.

The source term for the beyond-design-basis earthquake includes a contribution from the plutonium storage vault, the assumed DR being 5 percent. The values used for the ARF, RF and vault DR—1.0×10^{-3}, 0.3, and 0, respectively—derive from adjustments consistent with the analysis of the corresponding scenario in the MOX facility data report. This results in a reduction of the source term for this accident by a factor of 2, to 11 g (0.39 oz) plutonium.

Extensive analyses have been performed on the seismic hazard at LLNL and the response of the plutonium facility, Building 332, to that hazard. According to the geology and seismology studies characterizing the nature and magnitude of the seismic threat, there is no physiographic basis for postulating earthquake magnitudes and ground accelerations higher than Richter magnitude 6.9 and 1.1g, respectively. Building 332, Increment III, has been evaluated for resistance to earthquakes and ground accelerations of these magnitudes and found to be adequate. Events of significantly higher magnitude and ground acceleration would be required to collapse Increment III. The frequency of these larger events would most likely be extremely low (1.0×10^{-6} per year or less), as the physiography of the dominant fault systems is such that they are thought incapable of producing the required magnitudes of ground accelerations (Coats 1998). Results of a number of reviews of Increment III indicate that the actual ground motion needed to cause collapse of the structure is above 1.5g. Based on the current LLNL hazard curve and various estimates of the fragility curves for collapse of Increment III, the frequency of collapse is estimated at 1.0×10^{-7} per year or less (Murray 1998). The frequency of a total collapse of Building 332 at LLNL is thus considered sufficiently low that additional examination is unnecessary.

Explosion. An explosion event was postulated in the sintering furnace in the lead assembly fabrication facility. A nonexplosive mixture of 6 percent hydrogen and 94 percent argon is used in the furnace. Multiple equipment and operator errors would have to occur to enable the buildup of an explosive mixture of hydrogen and air in the box. It is assumed that green pellets are subjected to the direct force of the shock waves resulting from such an explosion. It is further assumed that the gloveboxes involved in powder blending are damaged indirectly by the explosion. It is not expected that the shock wave impacting this area would be severe enough to significantly damage all of the storage inventory because interim storage containers would provide some mitigation.

Fire. A moderate-size room fire is assumed. Combustible material such as hydraulic fluid, alcohol, or contaminated combustibles is assumed to be present in the room. Adjoining facilities such as offices conceivably add to the risk of fires in the building. The gloveboxes are assumed to fail in the fire. The MOX powder in interim storage is assumed to be at risk and subjected to the thermal stress of the fire, given failure of the gloveboxes. Because of the limited combustible material and mitigation features such as fire protection systems and a firefighting unit, the event is assumed to be terminated. This fire is not severe enough to jeopardize the overall confinement characteristics of the building.

The source term for the design basis fire analyzed in the lead assembly data reports is dominated by the explosive release of high pressure from two plutonium oxide cans as they are heated to the point of failure. The ARF and RF values for this phenomenon are 0.1 and 0.7, respectively, and reflect burst pressures on the order of 25 to 500 psig. The potential for this kind of release is highly uncertain, and a valid design basis fire may be defined without including it, as is the case with the data reports for the other facilities. Therefore, for greater consistency between the design basis fire for the lead assembly and those for the other facilities, it is assumed that the two plutonium oxide cans are already open and vulnerable to the same phenomena as the rest of the analyzed powder. This results in a reduction of the data report source term by a factor of 38.

It is noteworthy that the lead assembly data report assumes a room fire, and the other data reports, a process fire. This is not considered inconsistent: the lead assembly processes are expected to be closer to one another other than the MOX processes, so the potential for propagation of fire may be somewhat greater.

Beyond-Design-Basis Fire. Fuel-manufacturing operations do not involve the use of significant amounts of combustible material. For the purpose of analysis, the lead assembly data reports define a beyond-design-basis fire that results in building collapse, the breach of material in the plutonium storage vault, and a lofted plume. These assumptions, however, are inconsistent with the beyond-design-basis fires analyzed for the other facilities. The beyond-design-basis fire has therefore been modified to reflect a room fire or building fire that clogs the building HEPA filters, resulting in a ground-level, unfiltered release. The assumed LPF is 1.4×10^{-2} (Smith, Wilkey, and Siebe 1996), consistent with the other analyses. Additionally, it is assumed that the fire does not involve the vault or that the storage canisters in the vault provide adequate protection for the duration of the fire.

K.2 FACILITY ACCIDENT IMPACTS AT HANFORD

The potential source terms and consequences of postulated bounding facility accidents for each facility option at Hanford are presented in Tables K–3 through K–9. Accident scenarios and source terms were developed from data reports prepared for each technology. Consequences were estimated using the MACCS2 computer code and local population and meteorology data. The consequences are presented for mean and 95th percentile meteorological conditions.

Meteorological data are based on 10-m (33-ft) weather readings at Hanford for the 1996 calendar year.[5] In accordance with the MACCS2 format requirements, the data set consists of 8,760 consecutive hourly readings of windspeed, wind direction, Pasquill-Gifford stability class, and accumulated rainfall.

Population estimates for Hanford are for the year 2010, are based on the *Census of Population and Housing, 1990* (DOC 1992), and are identical to the estimates used for the analysis of normal operations in the SPD EIS. Population values are formatted into 16 sectors centered around the 16 standard compass directions, which are further subdivided into 10 radial distance intervals out to 80 km (50 mi).

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[5] The choice of calendar year was based primarily on data quality. For some combinations of site and calendar year, the data set contains significant gaps, making that data undesirable for use in dispersion modeling. As a result, not all sites were analyzed using meteorological data for the same calendar year.

Table K–3. Accident Impacts of Pit Conversion Facility in FMEF at Hanford

				Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	**Source Term (g)**	**Frequency (per year)**	**Meteorology**	**Dose (rem)**	**Probability of Cancer Fatality**[a]	**Dose (rem)**	**Probability of Cancer Fatality**[a]	**Dose (person-rem)**	**Latent Cancer Fatalities**[b]
Fire	1.2×10^{-5}	Unlikely	Mean	2.8×10^{-6}	1.1×10^{-9}	5.2×10^{-7}	2.6×10^{-10}	8.7×10^{-4}	4.3×10^{-7}
			95th percentile	1.1×10^{-5}	4.3×10^{-9}	1.6×10^{-6}	8.1×10^{-10}	5.3×10^{-3}	2.6×10^{-6}
Explosion	3.2×10^{-3}	Unlikely	Mean	7.3×10^{-4}	2.9×10^{-7}	1.4×10^{-4}	6.8×10^{-8}	2.3×10^{-1}	1.1×10^{-4}
			95th percentile	2.8×10^{-3}	1.1×10^{-6}	4.2×10^{-4}	2.1×10^{-7}	1.4	6.8×10^{-4}
Leaks/spills of nuclear material	4.4×10^{-6}	Extremely unlikely	Mean	1.0×10^{-6}	4.1×10^{-10}	1.9×10^{-7}	9.6×10^{-11}	3.2×10^{-4}	1.6×10^{-7}
			95th percentile	3.9×10^{-6}	1.6×10^{-9}	5.9×10^{-7}	3.0×10^{-10}	1.9×10^{-3}	9.5×10^{-7}
Tritium release	2.0×10^{1}	Extremely unlikely	Mean	1.2×10^{-1}	4.7×10^{-5}	2.2×10^{-2}	1.1×10^{-5}	3.7×10^{1}	1.8×10^{-2}
			95th percentile	4.5×10^{-1}	1.8×10^{-4}	6.8×10^{-2}	3.4×10^{-5}	2.2×10^{2}	1.1×10^{-1}
Criticality	1.0×10^{19} Fissions	Extremely unlikely	Mean	1.1×10^{-2}	4.4×10^{-6}	1.2×10^{-3}	6.0×10^{-7}	8.5×10^{-1}	4.3×10^{-4}
			95th percentile	3.3×10^{-2}	1.3×10^{-5}	3.4×10^{-3}	1.7×10^{-6}	5.4	2.7×10^{-3}
Design basis earthquake	3.9×10^{-4}	Unlikely	Mean	9.0×10^{-5}	3.6×10^{-8}	1.7×10^{-5}	8.4×10^{-9}	2.8×10^{-2}	1.4×10^{-5}
			95th percentile	3.5×10^{-4}	1.4×10^{-7}	5.2×10^{-5}	2.6×10^{-8}	1.7×10^{-1}	8.4×10^{-5}
Beyond-design-basis fire	1.7×10^{-2}	Beyond extremely unlikely	Mean	2.9×10^{-2}	1.1×10^{-5}	1.1×10^{-3}	5.6×10^{-7}	1.5	7.7×10^{-4}
			95th percentile	1.1×10^{-1}	4.3×10^{-5}	4.1×10^{-3}	2.0×10^{-6}	9.9	4.9×10^{-3}
Beyond-design-basis earthquake	3.9×10^{1}	Extremely unlikely to beyond extremely unlikely	Mean	6.6×10^{1}	2.6×10^{-2}	2.6	1.3×10^{-3}	3.6×10^{3}	1.8
			95th percentile	2.5×10^{2}	9.9×10^{-2}	9.4	4.7×10^{-3}	2.3×10^{4}	11

[a] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single noninvolved worker at a distance of 1,000 m [3,281 ft] or at the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[b] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) if exposed to the indicated dose. The value assumes that the accident has occurred.

Key: FMEF, Fuels and Materials Examination Facility.

Note: Calculated using the source terms in the pit conversion data report, as modified in Appendix K.1.5.1, site meteorology, projected regional population, and the MACCS2 computer code.

Source: UC 1998a.

Table K–4. Accident Impacts of Ceramic Immobilization Facility in FMEF and HLWVF at Hanford (Hybrid Case)

				Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts of Population Within 80 km	
Accident	**Source Term (g)**	**Frequency (per year)**	**Meteorology**	**Dose (rem)**	**Probability of Cancer Fatality**[a]	**Dose (rem)**	**Probability of Cancer Fatality**[a]	**Dose (person-rem)**	**Latent Cancer Fatalities**[b]
Criticality	1.0×10^{19} fissions	Extremely unlikely	Mean	1.1×10^{-2}	4.4×10^{-6}	1.2×10^{-3}	6.0×10^{-7}	8.5×10^{-1}	4.3×10^{-4}
			95th percentile	3.3×10^{-2}	1.3×10^{-5}	3.4×10^{-3}	1.7×10^{-6}	5.4	2.7×10^{-3}
Explosion in HYDOX furnace	3.4×10^{-3}	Unlikely	Mean	1.0×10^{-3}	4.0×10^{-7}	1.9×10^{-4}	9.4×10^{-8}	3.1×10^{-1}	1.6×10^{-4}
			95th percentile	3.8×10^{-3}	1.5×10^{-6}	5.8×10^{-4}	2.9×10^{-7}	1.9	9.4×10^{-4}
Glovebox fire (calcining furnace)	2.7×10^{-7}	Extremely unlikely	Mean	8.0×10^{-8}	3.2×10^{-11}	1.5×10^{-8}	7.4×10^{-12}	2.5×10^{-5}	1.2×10^{-8}
			95th percentile	3.0×10^{-7}	1.2×10^{-10}	4.6×10^{-8}	2.3×10^{-11}	1.5×10^{-4}	7.4×10^{-8}
Hydrogen explosion	3.8×10^{-4}	Unlikely	Mean	1.1×10^{-4}	4.4×10^{-8}	2.1×10^{-5}	1.0×10^{-8}	3.4×10^{-2}	1.7×10^{-5}
			95th percentile	4.2×10^{-4}	1.7×10^{-7}	6.4×10^{-5}	3.2×10^{-8}	2.1×10^{-1}	1.0×10^{-4}
Glovebox fire (sintering furnace)	1.5×10^{-6}	Extremely unlikely	Mean	4.4×10^{-7}	1.8×10^{-10}	8.3×10^{-8}	4.1×10^{-11}	1.4×10^{-4}	6.9×10^{-8}
			95th percentile	1.7×10^{-6}	6.8×10^{-10}	2.6×10^{-7}	1.3×10^{-10}	8.3×10^{-4}	4.1×10^{-7}
Design basis earthquake	3.8×10^{-4}	Unlikely	Mean	1.1×10^{-4}	4.5×10^{-8}	2.1×10^{-5}	1.0×10^{-8}	3.5×10^{-2}	1.7×10^{-5}
			95th percentile	4.3×10^{-4}	1.7×10^{-7}	6.4×10^{-5}	3.2×10^{-8}	2.1×10^{-1}	1.0×10^{-4}
Beyond-design-basis fire	2.1×10^{-3}	Beyond extremely unlikely	Mean	4.5×10^{-3}	1.8×10^{-6}	1.8×10^{-4}	8.9×10^{-8}	2.4×10^{-1}	1.2×10^{-4}
			95th percentile	1.7×10^{-2}	6.8×10^{-6}	6.5×10^{-4}	3.2×10^{-7}	1.6	7.8×10^{-4}
Beyond-design-basis earthquake	1.9×10^{1}	Extremely unlikely to beyond extremely unlikely	Mean	4.1×10^{1}	1.6×10^{-2}	1.6	8.1×10^{-4}	2.2×10^{3}	1.1
			95th percentile	1.5×10^{2}	1.6×10^{-2}	5.8	2.9×10^{-3}	1.4×10^{4}	7.1

[a] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single noninvolved worker at a distance of 1,000 m [3,281 ft] or at the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[b] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) if exposed to the indicated dose. The value assumes that the accident has occurred.

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility, HYDOX, hydride oxidation.

Note: Calculated using the source terms in the immobilization data report, as modified in Appendix K.1.5.1, site meteorology, projected regional population, and the MACCS2 computer code.

Source: UC 1999a.

Table K–5. Accident Impacts of Glass Immobilization Facility in FMEF and HLWVF at Hanford (Hybrid Case)

				Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	**Source Term (g)**	**Frequency (per year)**	**Meteorology**	**Dose (rem)**	**Probability of Cancer Fatality[a]**	**Dose (rem)**	**Probability of Cancer Fatality[a]**	**Dose (person-rem)**	**Latent Cancer Fatalities[b]**
Criticality	1.0×10^{19} fissions	Extremely unlikely	Mean	1.1×10^{-2}	4.4×10^{-6}	1.2×10^{-3}	6.0×10^{-7}	8.5×10^{-1}	4.3×10^{-4}
			95th percentile	3.3×10^{-2}	1.3×10^{-5}	3.4×10^{-3}	1.7×10^{-6}	5.4	2.7×10^{-3}
Explosion in HYDOX furnace	3.4×10^{-3}	Unlikely	Mean	1.0×10^{-3}	4.0×10^{-7}	1.9×10^{-4}	9.4×10^{-8}	3.1×10^{-1}	1.6×10^{-4}
			95th percentile	3.8×10^{-3}	1.5×10^{-6}	5.8×10^{-4}	2.9×10^{-7}	1.9	9.4×10^{-4}
Glovebox fire (calcining furnace)	2.7×10^{-7}	Extremely unlikely	Mean	8.0×10^{-8}	3.2×10^{-11}	1.5×10^{-8}	7.4×10^{-12}	2.5×10^{-5}	1.2×10^{-8}
			95th percentile	3.0×10^{-7}	1.2×10^{-10}	4.6×10^{-8}	2.3×10^{-11}	1.5×10^{-4}	7.4×10^{-8}
Hydrogen explosion	3.8×10^{-4}	Unlikely	Mean	1.1×10^{-4}	4.4×10^{-8}	2.1×10^{-5}	1.0×10^{-8}	3.4×10^{-2}	1.7×10^{-5}
			95th percentile	4.2×10^{-4}	1.7×10^{-7}	6.4×10^{-5}	3.2×10^{-8}	2.1×10^{-1}	1.0×10^{-4}
Melter eruption	1.4×10^{-6}	Unlikely	Mean	4.1×10^{-7}	1.6×10^{-10}	7.6×10^{-8}	3.8×10^{-11}	1.3×10^{-4}	6.4×10^{-8}
			95th percentile	1.6×10^{-6}	6.3×10^{-10}	2.4×10^{-7}	1.2×10^{-10}	7.7×10^{-4}	3.8×10^{-7}
Melter spill	3.3×10^{-7}	Unlikely	Mean	9.6×10^{-8}	3.9×10^{-11}	1.8×10^{-8}	9.0×10^{-12}	3.0×10^{-5}	1.5×10^{-8}
			95th percentile	3.7×10^{-7}	1.5×10^{-10}	5.6×10^{-8}	2.8×10^{-11}	1.8×10^{-4}	9.0×10^{-8}
Design basis earthquake	3.3×10^{-4}	Unlikely	Mean	9.7×10^{-5}	3.9×10^{-8}	1.8×10^{-5}	9.1×10^{-9}	3.0×10^{-2}	1.5×10^{-5}
			95th percentile	3.7×10^{-4}	1.5×10^{-7}	5.6×10^{-5}	2.8×10^{-8}	1.8×10^{-1}	9.1×10^{-5}
Beyond-design-basis fire	3.8×10^{-4}	Beyond extremely unlikely	Mean	8.1×10^{-4}	3.3×10^{-7}	3.2×10^{-5}	1.6×10^{-8}	4.4×10^{-2}	2.2×10^{-5}
			95th percentile	3.1×10^{-3}	1.2×10^{-6}	1.2×10^{-4}	5.8×10^{-8}	2.8×10^{-1}	1.4×10^{-4}
Beyond-design-basis earthquake	1.7×10^{1}	Extremely unlikely to beyond extremely unlikely	Mean	3.6×10^{1}	1.4×10^{-2}	1.4	7.1×10^{-4}	1.9×10^{3}	9.7×10^{-1}
			95th percentile	1.4×10^{2}	5.4×10^{-2}	5.1	2.6×10^{-3}	1.2×10^{4}	6.2

[a] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single noninvolved worker at a distance of 1,000 m [3,281 ft] or at the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[b] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) if exposed to the indicated dose. The value assumes that the accident has occurred.

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility; HYDOX, hydride oxidation.

Note: Calculated using the source terms in the immobilization data report, as modified in Appendix K.1.5.1, site meteorology, projected regional population, and the MACCS2 computer code.

Source: UC 1999b.

Table K–6. Accident Impacts of Ceramic Immobilization Facility in FMEF and HLWVF at Hanford (50-t Case)

				Impacts on Noninvolved Worker		**Impacts at Site Boundary**		**Impacts on Population Within 80 km**	
Accident	**Source Term (g)**	**Frequency (per year)**	**Meteorology**	**Dose (rem)**	**Probability of Cancer Fatality[a]**	**Dose (rem)**	**Probability of Cancer Fatality[a]**	**Dose (person-rem)**	**Latent Cancer Fatalities[b]**
Criticality	1.0×10^{19} fissions	Extremely unlikely	Mean	1.1×10^{-2}	4.4×10^{-6}	1.2×10^{-3}	6.0×10^{-7}	8.5×10^{-1}	4.3×10^{-4}
			95th percentile	3.3×10^{-2}	1.3×10^{-5}	3.4×10^{-3}	1.7×10^{-6}	5.4	2.7×10^{-3}
Explosion in HYDOX furnace	3.4×10^{-3}	Unlikely	Mean	1.0×10^{-3}	4.0×10^{-7}	1.9×10^{-4}	9.4×10^{-8}	3.1×10^{-1}	1.6×10^{-4}
			95th percentile	3.8×10^{-3}	1.5×10^{-6}	5.8×10^{-4}	2.9×10^{-7}	1.9	9.4×10^{-4}
Glovebox fire (calcining furnace)	2.7×10^{-7}	Extremely unlikely	Mean	8.0×10^{-8}	3.2×10^{-11}	1.5×10^{-8}	7.4×10^{-12}	2.5×10^{-5}	1.2×10^{-8}
			95th percentile	3.0×10^{-7}	1.2×10^{-10}	4.6×10^{-8}	2.3×10^{-11}	1.5×10^{-4}	7.4×10^{-8}
Hydrogen explosion	3.8×10^{-4}	Unlikely	Mean	1.1×10^{-4}	4.4×10^{-8}	2.1×10^{-5}	1.0×10^{-8}	3.4×10^{-2}	1.7×10^{-5}
			95th percentile	4.2×10^{-4}	1.7×10^{-7}	6.4×10^{-5}	3.2×10^{-8}	2.1×10^{-1}	1.0×10^{-4}
Glovebox fire (sintering furnace)	1.5×10^{-6}	Extremely unlikely	Mean	4.4×10^{-7}	1.8×10^{-10}	8.3×10^{-8}	4.1×10^{-11}	1.4×10^{-4}	6.9×10^{-8}
			95th percentile	1.7×10^{-6}	6.8×10^{-10}	2.6×10^{-7}	1.3×10^{-10}	8.3×10^{-4}	4.1×10^{-7}
Design basis earthquake	3.8×10^{-4}	Unlikely	Mean	1.0×10^{-4}	4.1×10^{-8}	1.9×10^{-5}	9.6×10^{-9}	3.2×10^{-2}	1.6×10^{-5}
			95th percentile	3.9×10^{-4}	1.6×10^{-7}	5.9×10^{-5}	3.0×10^{-8}	1.9×10^{-1}	9.6×10^{-5}
Beyond-design-basis fire	2.1×10^{-3}	Beyond extremely unlikely	Mean	4.5×10^{-3}	1.8×10^{-6}	1.8×10^{-4}	8.9×10^{-8}	2.4×10^{-1}	1.2×10^{-4}
			95th percentile	1.7×10^{-2}	6.8×10^{-6}	6.5×10^{-4}	3.2×10^{-7}	1.6	7.8×10^{-4}
Beyond-design-basis earthquake	1.9×10^{1}	Unlikely to beyond extremely unlikely	Mean	3.8×10^{1}	1.5×10^{-2}	1.5	7.4×10^{-4}	2.0×10^{3}	1.0
			95th percentile	1.4×10^{2}	5.7×10^{-2}	5.4	2.7×10^{-3}	1.3×10^{4}	6.5

[a] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single noninvolved worker at a distance of 1,000 m [3,281 ft] or at the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[b] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) if exposed to the indicated dose. The value assumes that the accident has occurred.

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility, HYDOX, hydride oxidation.

Note: Calculated using the source terms in the immobilization data report, as modified in Appendix K.1.5.1, site meteorology, projected regional population, and the MACCS2 computer code.

Source: UC 1999a.

Table K–7. Accident Impacts of Glass Immobilization Facility in FMEF and HLWVF at Hanford (50-t Case)

				Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	**Source Term (g)**	**Frequency (per year)**	**Meteorology**	**Dose (rem)**	**Probability of Cancer Fatality[a]**	**Dose (rem)**	**Probability of Cancer Fatality[a]**	**Dose (person-rem)**	**Latent Cancer Fatalities[b]**
Criticality	1.0×10^{19} fissions	Extremely unlikely	Mean	1.1×10^{-2}	4.4×10^{-6}	1.2×10^{-3}	6.0×10^{-7}	8.5×10^{-1}	4.3×10^{-4}
			95th percentile	3.3×10^{-2}	1.3×10^{-5}	3.4×10^{-3}	1.7×10^{-6}	5.4	2.7×10^{-3}
Explosion in HYDOX furnace	3.4×10^{-3}	Unlikely	Mean	1.0×10^{-3}	4.0×10^{-7}	1.9×10^{-4}	9.4×10^{-8}	3.1×10^{-1}	1.6×10^{-4}
			95th percentile	3.8×10^{-3}	1.5×10^{-6}	5.8×10^{-4}	2.9×10^{-7}	1.9	9.4×10^{-4}
Glovebox fire (calcining furnace)	2.7×10^{-7}	Extremely unlikely	Mean	8.0×10^{-8}	3.2×10^{-11}	1.5×10^{-8}	7.4×10^{-12}	2.5×10^{-5}	1.2×10^{-8}
			95th percentile	3.0×10^{-7}	1.2×10^{-10}	4.6×10^{-8}	2.3×10^{-11}	1.5×10^{-4}	7.4×10^{-8}
Hydrogen explosion	3.8×10^{-4}	Unlikely	Mean	1.1×10^{-4}	4.4×10^{-8}	2.1×10^{-5}	1.0×10^{-8}	3.4×10^{-2}	1.7×10^{-5}
			95th percentile	4.2×10^{-4}	1.7×10^{-7}	6.4×10^{-5}	3.2×10^{-8}	2.1×10^{-1}	1.0×10^{-4}
Melter eruption	1.4×10^{-6}	Unlikely	Mean	4.1×10^{-7}	1.6×10^{-10}	7.6×10^{-8}	3.8×10^{-11}	1.3×10^{-4}	6.4×10^{-8}
			95th percentile	1.6×10^{-6}	6.3×10^{-10}	2.4×10^{-7}	1.2×10^{-10}	7.7×10^{-4}	3.8×10^{-7}
Melter spill	3.3×10^{-7}	Unlikely	Mean	9.6×10^{-8}	3.9×10^{-11}	1.8×10^{-8}	9.0×10^{-12}	3.0×10^{-5}	1.5×10^{-8}
			95th percentile	3.7×10^{-7}	1.5×10^{-10}	5.6×10^{-8}	2.8×10^{-11}	1.8×10^{-4}	9.0×10^{-8}
Design basis earthquake	3.3×10^{-4}	Unlikely	Mean	9.0×10^{-5}	3.6×10^{-8}	1.7×10^{-5}	8.4×10^{-9}	2.8×10^{-2}	1.4×10^{-5}
			95th percentile	3.5×10^{-4}	1.4×10^{-7}	5.2×10^{-5}	2.6×10^{-8}	1.7×10^{-1}	8.4×10^{-5}
Beyond-design-basis fire	3.8×10^{-4}	Beyond extremely unlikely	Mean	8.1×10^{-4}	3.3×10^{-7}	3.2×10^{-5}	1.6×10^{-8}	4.4×10^{-2}	2.2×10^{-5}
			95th percentile	3.1×10^{-3}	1.2×10^{-6}	1.2×10^{-4}	5.8×10^{-8}	2.8×10^{-1}	1.4×10^{-4}
Beyond-design-basis earthquake	1.7×10^{1}	Extremely unlikely to beyond extremely unlikely	Mean	3.3×10^{1}	1.3×10^{-2}	1.3	6.6×10^{-4}	1.8×10^{3}	9.0×10^{-1}
			95th percentile	1.3×10^{2}	5.0×10^{-2}	4.8	2.4×10^{-3}	1.2×10^{4}	5.8

[a] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single noninvolved worker at a distance of 1,000 m [3,281 ft] or at the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[b] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) if exposed to the indicated dose. The value assumes that the accident has occurred.

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility; HYDOX, hydride oxidation.

Note: Calculated using the source terms in the immobilization data report, as modified in Appendix K.1.5.1, site meteorology, projected regional population, and the MACCS2 computer code.

Source: UC 1999b.

Table K–8. Accident Impacts of MOX Facility in FMEF at Hanford

				Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	**Source Term (g)**	**Frequency (per year)**	**Meteorology**	**Dose (rem)**	**Probability of Cancer Fatality**[a]	**Dose (rem)**	**Probability of Cancer Fatality**[a]	**Dose (person-rem)**	**Latent Cancer Fatalities**[b]
Criticality	1.0×10^{19} fissions	Extremely unlikely	Mean	5.1×10^{-2}	2.0×10^{-5}	6.5×10^{-3}	3.3×10^{-6}	6.2	3.1×10^{-3}
			95th percentile	1.5×10^{-1}	6.0×10^{-5}	1.9×10^{-2}	9.4×10^{-6}	3.9×10^{1}	1.9×10^{-2}
Explosion in sintering furnace	5.5×10^{-4}	Extremely unlikely	Mean	1.3×10^{-4}	5.1×10^{-8}	2.4×10^{-5}	1.2×10^{-8}	4.0×10^{-2}	2.0×10^{-5}
			95th percentile	4.9×10^{-4}	2.0×10^{-7}	7.4×10^{-5}	3.7×10^{-8}	2.4×10^{-1}	1.2×10^{-4}
Ion exchange exotherm	2.4×10^{-5}	Unlikely	Mean	5.6×10^{-6}	2.2×10^{-9}	1.0×10^{-6}	5.2×10^{-10}	1.7×10^{-3}	8.7×10^{-7}
			95th percentile	2.1×10^{-5}	8.6×10^{-9}	3.2×10^{-6}	1.6×10^{-9}	1.1×10^{-2}	5.2×10^{-6}
Fire	4.0×10^{-6}	Unlikely	Mean	9.3×10^{-7}	3.7×10^{-10}	1.7×10^{-7}	8.7×10^{-11}	2.9×10^{-4}	1.4×10^{-7}
			95th percentile	3.6×10^{-6}	1.4×10^{-9}	5.4×10^{-7}	2.7×10^{-10}	1.8×10^{-3}	8.7×10^{-7}
Spill	5.0×10^{-6}	Extremely unlikely	Mean	1.2×10^{-6}	4.7×10^{-10}	2.2×10^{-7}	1.1×10^{-10}	3.6×10^{-4}	1.8×10^{-7}
			95th percentile	4.5×10^{-6}	1.8×10^{-9}	6.7×10^{-7}	3.4×10^{-10}	2.2×10^{-3}	1.1×10^{-6}
Design basis earthquake	7.9×10^{-5}	Unlikely	Mean	1.8×10^{-5}	7.3×10^{-9}	3.4×10^{-6}	1.7×10^{-9}	5.7×10^{-3}	2.8×10^{-6}
			95th percentile	7.0×10^{-5}	2.8×10^{-8}	1.1×10^{-5}	5.3×10^{-9}	3.4×10^{-2}	1.7×10^{-5}
Beyond-design-basis fire	6.0×10^{-2}	Beyond extremely unlikely	Mean	1.0×10^{-1}	4.1×10^{-5}	4.0×10^{-3}	2.0×10^{-6}	5.5	2.8×10^{-3}
			95th percentile	3.8×10^{-1}	1.5×10^{-4}	1.5×10^{-2}	7.3×10^{-6}	3.5×10^{1}	1.8×10^{-2}
Beyond-design-basis earthquake	9.5×10^{1}	Extremely unlikely to beyond extremely unlikely	Mean	1.6×10^{2}	6.5×10^{-2}	6.4	3.2×10^{-3}	8.7×10^{3}	4.4
			95th percentile	6.1×10^{2}	2.4×10^{-1}	2.3×10^{1}	1.2×10^{-2}	5.6×10^{4}	2.8×10^{1}

[a] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single noninvolved worker at a distance of 1,000 m [3,281 ft] or at the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[b] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) if exposed to the indicated dose. The value assumes that the accident has occurred.

Key: FMEF, Fuels and Materials Examination Facility.

Note: Calculated using the source terms in the MOX data report, as modified in Appendix K.1.5.1, site meteorology, projected regional population, and the MACCS2 computer code.

Source: UC 1998b.

Table K–9. Accident Impacts of New MOX Facility at Hanford

				Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	**Source Term (g)**	**Frequency (per year)**	**Meteorology**	**Dose (rem)**	**Probability of Cancer Fatality**[a]	**Dose (rem)**	**Probability of Cancer Fatality**[a]	**Dose (person-rem)**	**Latent Cancer Fatalities**[b]
Criticality	1.0×10^{19} fissions	Extremely unlikely	Mean	1.8×10^{-1}	7.2×10^{-5}	9.9×10^{-3}	4.9×10^{-6}	8.2	4.1×10^{-3}
			95th percentile	6.1×10^{-1}	2.5×10^{-4}	3.5×10^{-2}	1.7×10^{-5}	5.5×10^{1}	2.8×10^{-2}
Explosion in sintering furnace	5.5×10^{-4}	Extremely unlikely	Mean	8.0×10^{-4}	3.2×10^{-7}	3.5×10^{-5}	1.8×10^{-8}	5.0×10^{-2}	2.5×10^{-5}
			95th percentile	2.9×10^{-3}	1.2×10^{-6}	1.1×10^{-4}	5.7×10^{-8}	3.2×10^{-1}	1.6×10^{-4}
Ion exchange exotherm	2.4×10^{-5}	Unlikely	Mean	3.5×10^{-5}	1.4×10^{-8}	1.5×10^{-6}	7.7×10^{-10}	2.2×10^{-3}	1.1×10^{-6}
			95th percentile	1.3×10^{-4}	5.1×10^{-8}	5.0×10^{-6}	2.5×10^{-9}	1.4×10^{-2}	7.0×10^{-6}
Fire	4.0×10^{-6}	Unlikely	Mean	5.8×10^{-6}	2.3×10^{-9}	2.6×10^{-7}	1.3×10^{-10}	3.6×10^{-4}	1.8×10^{-7}
			95th percentile	2.1×10^{-5}	8.4×10^{-9}	8.3×10^{-7}	4.2×10^{-10}	2.3×10^{-3}	1.2×10^{-6}
Spill	5.0×10^{-6}	Extremely unlikely	Mean	7.3×10^{-6}	2.9×10^{-9}	3.2×10^{-7}	1.6×10^{-10}	4.5×10^{-4}	2.3×10^{-7}
			95th percentile	2.6×10^{-5}	1.1×10^{-8}	1.0×10^{-6}	5.2×10^{-10}	2.9×10^{-3}	1.5×10^{-6}
Design basis earthquake	7.9×10^{-5}	Unlikely	Mean	1.1×10^{-4}	4.6×10^{-8}	5.0×10^{-6}	2.5×10^{-9}	7.1×10^{-3}	3.6×10^{-6}
			95th percentile	4.1×10^{-4}	1.7×10^{-7}	1.6×10^{-5}	8.2×10^{-9}	4.6×10^{-2}	2.3×10^{-5}
Beyond-design-basis fire	6.0×10^{-2}	Beyond extremely unlikely	Mean	1.0×10^{-1}	4.1×10^{-5}	4.0×10^{-3}	2.0×10^{-6}	5.5	2.8×10^{-3}
			95th percentile	3.8×10^{-1}	1.5×10^{-4}	1.5×10^{-2}	7.3×10^{-6}	3.5×10^{1}	1.8×10^{-2}
Beyond-design-basis earthquake	9.5×10^{1}	Extremely unlikely to beyond extremely unlikely	Mean	1.6×10^{2}	6.5×10^{-2}	6.4	3.2×10^{-3}	8.7×10^{3}	4.4
			95th percentile	6.1×10^{2}	2.4×10^{-1}	2.3×10^{1}	1.2×10^{-2}	5.6×10^{4}	2.8×10^{1}

[a] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single noninvolved worker at a distance of 1,000 m [3,281 ft] or at the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[b] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) if exposed to the indicated dose. The value assumes that the accident has occurred.

Note: Calculated using the source terms in the MOX data report, as modified in Appendix K.1.5.1, site meteorology, projected regional population, and the MACCS2 computer code.

Source: UC 1998b.

K.3 FACILITY ACCIDENT IMPACTS AT INEEL

The potential source terms and consequences of postulated bounding facility accidents for each facility option for INEEL are presented in Tables K–10 and K–11. Accident scenarios and source terms were developed from data reports prepared for each technology. Consequences were estimated using the MACCS2 computer code and local population and meteorology data. The consequences are presented for mean and 95th percentile meteorological conditions.

Meteorological data are based on 10-m (33-ft) weather readings at INEEL for the 1993 calendar year.[6] In accordance with MACCS2 format requirements, the data set consists of 8,760 consecutive hourly readings of windspeed, wind direction, Pasquill-Gifford stability class, and accumulated rainfall.

Population estimates for INEEL are for the year 2010, are based on the *Census of Population and Housing, 1990* (DOC 1992), and are identical to the estimates used for the analysis of normal operations in the SPD EIS. Population values are formatted into 16 sectors centered around the 16 standard compass directions, which are further subdivided into 10 radial distance intervals out to 80 km (50 mi).

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[6] The choice of calendar year was based primarily on data quality. For some combinations of site and calendar year, the data set contains significant gaps, making that data undesirable for use in dispersion modeling. As a result, not all sites were analyzed using meteorological data for the same calendar year.

Table K–10. Accident Impacts of Pit Conversion Facility in FPF at INEEL

				Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	**Source Term (g)**	**Frequency (per year)**	**Meteorology**	**Dose (rem)**	**Probability of Cancer Fatality[a]**	**Dose (rem)**	**Probability of Cancer Fatality[a]**	**Dose (person-rem)**	**Latent Cancer Fatalities[b]**
Fire	1.2×10^{-5}	Unlikely	Mean	2.5×10^{-6}	1.0×10^{-9}	3.0×10^{-7}	1.5×10^{-10}	5.6×10^{-5}	2.8×10^{-8}
			95th percentile	6.4×10^{-6}	2.5×10^{-9}	1.1×10^{-6}	5.3×10^{-10}	2.1×10^{-4}	1.0×10^{-7}
Explosion	3.2×10^{-3}	Unlikely	Mean	6.5×10^{-4}	2.6×10^{-7}	7.8×10^{-5}	3.9×10^{-8}	1.5×10^{-2}	7.4×10^{-6}
			95th percentile	1.7×10^{-3}	6.7×10^{-7}	2.8×10^{-4}	1.4×10^{-7}	5.5×10^{-2}	2.7×10^{-5}
Leaks/spills of nuclear material	4.4×10^{-6}	Extremely unlikely	Mean	9.1×10^{-7}	3.6×10^{-10}	1.1×10^{-7}	5.4×10^{-11}	2.1×10^{-5}	1.0×10^{-8}
			95th percentile	2.3×10^{-6}	9.3×10^{-10}	3.9×10^{-7}	1.9×10^{-10}	7.7×10^{-5}	3.8×10^{-8}
Tritium release	2.0×10^{1}	Extremely unlikely	Mean	1.0×10^{-1}	4.2×10^{-5}	1.2×10^{-2}	6.2×10^{-6}	2.4	1.2×10^{-3}
			95th percentile	2.7×10^{-1}	1.1×10^{-4}	4.5×10^{-2}	2.2×10^{-5}	8.8	4.4×10^{-3}
Criticality	1.0×10^{19} fissions	Extremely unlikely	Mean	1.1×10^{-2}	4.4×10^{-6}	4.8×10^{-4}	2.4×10^{-7}	2.2×10^{-2}	1.1×10^{-5}
			95th percentile	3.3×10^{-2}	1.3×10^{-5}	1.6×10^{-3}	7.9×10^{-7}	8.5×10^{-2}	4.2×10^{-5}
Design basis earthquake	3.9×10^{-4}	Unlikely	Mean	8.0×10^{-5}	3.2×10^{-8}	9.5×10^{-6}	4.8×10^{-9}	1.8×10^{-3}	9.1×10^{-7}
			95th percentile	2.1×10^{-4}	8.2×10^{-8}	3.4×10^{-5}	1.7×10^{-8}	6.8×10^{-3}	3.4×10^{-6}
Beyond-design-basis fire	1.7×10^{-2}	Beyond extremely unlikely	Mean	3.0×10^{-2}	1.2×10^{-5}	8.1×10^{-4}	4.1×10^{-7}	9.6×10^{-2}	4.8×10^{-5}
			95th percentile	1.1×10^{-1}	4.5×10^{-5}	2.9×10^{-3}	1.5×10^{-6}	3.6×10^{-1}	1.8×10^{-4}
Beyond-design-basis earthquake	3.9×10^{1}	Extremely unlikely to beyond extremely unlikely	Mean	7.0×10^{1}	2.8×10^{-2}	1.9	9.3×10^{-4}	2.2×10^{2}	1.1×10^{-1}
			95th percentile	2.6×10^{2}	1.0×10^{-1}	6.7	3.3×10^{-3}	8.4×10^{2}	4.2×10^{-1}

[a] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single noninvolved worker at a distance of 1,000 m [3,281 mi] or at the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[b] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) if exposed to the indicated dose. The value assumes that the accident has occurred.

Key: FPF, Fuel Processing Facility.

Note: Calculated using the source terms in the pit conversion data report, as modified in Appendix K.1.5.1, site meteorology, projected regional population, and the MACCS2 computer code.

Source: UC 1998f.

Table K–11. Accident Impacts of New MOX Facility at INEEL

				Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	**Source Term (g)**	**Frequency (per year)**	**Meteorology**	**Dose (rem)**	**Probability of Cancer Fatality[a]**	**Dose (rem)**	**Probability of Cancer Fatality[a]**	**Dose (person-rem)**	**Latent Cancer Fatalities[b]**
Criticality	1.0×10^{19} fissions	Extremely unlikely	Mean	1.9×10^{-1}	7.4×10^{-5}	4.3×10^{-3}	2.1×10^{-6}	2.7×10^{-1}	1.4×10^{-4}
			95th percentile	7.5×10^{-1}	3.0×10^{-4}	1.6×10^{-2}	8.2×10^{-6}	1.0	5.2×10^{-4}
Explosion in sintering furnace	5.5×10^{-4}	Extremely unlikely	Mean	8.3×10^{-4}	3.3×10^{-7}	2.2×10^{-5}	1.1×10^{-8}	3.1×10^{-3}	1.5×10^{-6}
			95th percentile	3.6×10^{-3}	1.4×10^{-6}	8.4×10^{-5}	4.2×10^{-8}	1.2×10^{-2}	5.8×10^{-6}
Ion exchange exotherm	2.4×10^{-5}	Unlikely	Mean	3.6×10^{-5}	1.4×10^{-8}	9.5×10^{-7}	4.8×10^{-10}	1.3×10^{-4}	6.7×10^{-8}
			95th percentile	1.6×10^{-4}	6.3×10^{-8}	3.7×10^{-6}	1.8×10^{-9}	5.1×10^{-4}	2.5×10^{-7}
Fire	4.0×10^{-6}	Unlikely	Mean	6.0×10^{-6}	2.4×10^{-9}	1.6×10^{-7}	7.9×10^{-11}	2.2×10^{-5}	1.1×10^{-8}
			95th percentile	2.6×10^{-5}	1.0×10^{-8}	6.1×10^{-7}	3.1×10^{-10}	8.5×10^{-5}	4.2×10^{-8}
Spill	5.0×10^{-6}	Extremely unlikely	Mean	7.5×10^{-6}	3.0×10^{-9}	2.0×10^{-7}	9.9×10^{-11}	2.8×10^{-5}	1.4×10^{-8}
			95th percentile	3.3×10^{-5}	1.3×10^{-8}	7.7×10^{-7}	3.8×10^{-10}	1.1×10^{-4}	5.3×10^{-8}
Design basis earthquake	7.9×10^{-5}	Unlikely	Mean	1.2×10^{-4}	4.7×10^{-8}	3.1×10^{-6}	1.6×10^{-9}	4.4×10^{-4}	2.2×10^{-7}
			95th percentile	5.1×10^{-4}	2.1×10^{-7}	1.2×10^{-5}	6.0×10^{-9}	1.7×10^{-3}	8.3×10^{-7}
Beyond-design-basis fire	6.0×10^{-2}	Beyond extremely unlikely	Mean	1.1×10^{-1}	4.3×10^{-5}	2.9×10^{-3}	1.4×10^{-6}	3.4×10^{-1}	1.7×10^{-4}
			95th percentile	4.1×10^{-1}	1.6×10^{-4}	1.0×10^{-2}	5.2×10^{-6}	1.3	6.5×10^{-4}
Beyond-design-basis earthquake	9.5×10^{1}	Extremely unlikely to beyond extremely unlikely	Mean	1.7×10^{2}	6.8×10^{-2}	4.6	2.3×10^{-3}	5.4×10^{2}	2.7×10^{-1}
			95th percentile	6.5×10^{2}	2.6×10^{-1}	1.6×10^{1}	8.2×10^{-3}	2.1×10^{3}	1.0
			95th percentile						

[a] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single noninvolved worker at a distance of 1,000 m [3,281 ft] or at the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[b] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) if exposed to the indicated dose. The value assumes that the accident has occurred.

Note: Calculated using the source terms in the MOX data report, as modified in Appendix K.1.5.1, site meteorology, projected regional population, and the MACCS2 computer code.

Source: UC 1998g.

K.4 FACILITY ACCIDENT IMPACTS AT PANTEX

The potential source terms and consequences of postulated bounding facility accidents for each facility option for Pantex are presented in Tables K–12 and K–13. Accident scenarios and source terms were developed from data reports prepared for each technology. Consequences were estimated using the MACCS2 computer code and local population and meteorology data. The consequences are presented for mean and 95th percentile meteorological conditions.

Meteorological data are based on 10-m (33-ft) weather readings from the Pantex Tower for the 1996 calendar year.[7] In accordance with MACCS2 format requirements, the data set consists of 8,760 consecutive hourly readings of windspeed, wind direction, Pasquill-Gifford stability class, and accumulated rainfall.

Population estimates for Pantex are for the year 2010, are based on the *Census of Population and Housing, 1990* (DOC 1992), and are identical to the estimates used for the analysis of normal operations in the SPD EIS. Population values are formatted into 16 sectors centered around the 16 standard compass directions, which are further subdivided into 10 radial distance intervals out to 80 km (50 mi).

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[7] The choice of calendar year was based primarily on data quality. For some combinations of site and calendar year, the data set contains significant gaps, making that data undesirable for use in dispersion modeling. As a result, not all sites were analyzed using meteorological data for the same calendar year.

Table K–12. Accident Impacts of New Pit Conversion Facility at Pantex

				Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	**Source Term (g)**	**Frequency (per year)**	**Meteorology**	**Dose (rem)**	**Probability of Cancer Fatality**[a]	**Dose (rem)**	**Probability of Cancer Fatality**[a]	**Dose (person-rem)**	**Latent Cancer Fatalities**[b]
Fire	1.2×10^{-5}	Unlikely	Mean	2.3×10^{-6}	9.1×10^{-10}	7.6×10^{-7}	3.8×10^{-10}	1.8×10^{-4}	9.1×10^{-8}
			95th percentile	5.2×10^{-6}	2.1×10^{-9}	2.1×10^{-6}	1.0×10^{-9}	8.6×10^{-4}	4.3×10^{-7}
Explosion	3.2×10^{-3}	Unlikely	Mean	6.0×10^{-4}	2.4×10^{-7}	2.0×10^{-4}	9.9×10^{-8}	4.8×10^{-2}	2.4×10^{-5}
			95th percentile	1.4×10^{-3}	5.4×10^{-7}	5.4×10^{-4}	2.7×10^{-7}	2.2×10^{-1}	1.1×10^{-4}
Leaks/spills of nuclear material	4.4×10^{-6}	Extremely unlikely	Mean	8.4×10^{-7}	3.3×10^{-10}	2.8×10^{-7}	1.4×10^{-10}	6.7×10^{-5}	3.3×10^{-8}
			95th percentile	1.9×10^{-6}	7.6×10^{-10}	7.6×10^{-7}	3.8×10^{-10}	3.1×10^{-4}	1.6×10^{-7}
Tritium release	2.0×10^{1}	Extremely unlikely	Mean	9.6×10^{-2}	3.8×10^{-5}	3.2×10^{-2}	1.6×10^{-5}	7.7	3.8×10^{-3}
			95th percentile	2.2×10^{-1}	8.7×10^{-5}	8.7×10^{-2}	4.4×10^{-5}	3.6×10^{1}	1.8×10^{-2}
Criticality	1.0×10^{19} Fissions	Extremely unlikely	Mean	6.1×10^{-3}	2.5×10^{-6}	2.7×10^{-3}	1.3×10^{-6}	2.7×10^{-1}	1.4×10^{-4}
			95th percentile	1.5×10^{-2}	6.0×10^{-6}	6.0×10^{-3}	3.0×10^{-6}	1.6	7.9×10^{-4}
Design basis earthquake	3.9×10^{-4}	Unlikely	Mean	7.4×10^{-5}	2.9×10^{-8}	2.4×10^{-5}	1.2×10^{-8}	5.9×10^{-3}	2.9×10^{-6}
			95th percentile	1.7×10^{-4}	6.7×10^{-8}	6.7×10^{-5}	3.3×10^{-8}	2.8×10^{-2}	1.4×10^{-5}
Beyond-design-basis fire	1.7×10^{-2}	Beyond extremely unlikely	Mean	9.6×10^{-3}	3.8×10^{-6}	1.5×10^{-3}	7.5×10^{-7}	2.8×10^{-1}	1.4×10^{-4}
			95th percentile	2.8×10^{-2}	1.1×10^{-5}	4.4×10^{-3}	2.2×10^{-6}	1.3	6.3×10^{-4}
Beyond-design-basis earthquake	3.9×10^{1}	Extremely unlikely to beyond extremely unlikely	Mean	2.2×10^{1}	8.8×10^{-3}	3.5	1.7×10^{-3}	6.4×10^{2}	3.2×10^{-1}
			95th percentile	6.4×10^{1}	2.6×10^{-2}	1.0×10^{1}	5.1×10^{-3}	3.0×10^{3}	1.5
Aircraft crash	1.2×10^{2}	Beyond extremely unlikely	Mean	6.8×10^{1}	2.7×10^{-2}	1.1×10^{1}	5.4×10^{-3}	2.0×10^{3}	1.0
			95th percentile	2.0×10^{2}	7.9×10^{-2}	3.1×10^{1}	1.6×10^{-2}	9.2×10^{3}	4.5

[a] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single noninvolved worker at a distance of 1,000 m [3,281 ft] or at the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[b] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) if exposed to the indicated dose. The value assumes that the accident has occurred.

Note: Calculated using the source terms in the pit conversion data report, as modified in Appendix K.1.5.1, site meteorology, projected regional population, and the MACCS2 computer code.

Source: UC 1998e.

Table K–13. Accident Impacts of New MOX Facility at Pantex

				Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	**Source Term (g)**	**Frequency (per year)**	**Meteorology**	**Dose (rem)**	**Probability of Cancer Fatality[a]**	**Dose (rem)**	**Probability of Cancer Fatality[a]**	**Dose (person-rem)**	**Latent Cancer Fatalities[b]**
Criticality	1.0×10^{19} fissions	Extremely unlikely	Mean	7.5×10^{-2}	3.0×10^{-5}	1.9×10^{-2}	9.3×10^{-6}	1.9	9.4×10^{-4}
			95th percentile	2.4×10^{-1}	9.5×10^{-5}	4.7×10^{-2}	2.3×10^{-5}	1.1×10^{1}	5.4×10^{-3}
Explosion in sintering furnace	5.5×10^{-4}	Extremely unlikely	Mean	2.8×10^{-4}	1.1×10^{-7}	4.8×10^{-5}	2.4×10^{-8}	9.1×10^{-3}	4.5×10^{-6}
			95th percentile	8.9×10^{-4}	3.5×10^{-7}	1.3×10^{-4}	6.6×10^{-8}	4.2×10^{-2}	2.1×10^{-5}
Ion exchange exotherm	2.4×10^{-5}	Unlikely	Mean	1.2×10^{-5}	5.0×10^{-9}	2.1×10^{-6}	1.0×10^{-9}	4.0×10^{-4}	2.0×10^{-7}
			95th percentile	3.9×10^{-5}	1.5×10^{-8}	5.8×10^{-6}	2.9×10^{-9}	1.8×10^{-3}	9.0×10^{-7}
Fire	4.0×10^{-6}	Unlikely	Mean	2.1×10^{-6}	8.3×10^{-10}	3.5×10^{-7}	1.7×10^{-10}	6.6×10^{-5}	3.3×10^{-8}
			95th percentile	6.4×10^{-6}	2.6×10^{-9}	9.6×10^{-7}	4.8×10^{-10}	3.0×10^{-4}	1.5×10^{-7}
Spill	5.0×10^{-6}	Extremely unlikely	Mean	2.6×10^{-6}	1.0×10^{-9}	4.4×10^{-7}	2.2×10^{-10}	8.3×10^{-5}	4.1×10^{-8}
			95th percentile	8.1×10^{-6}	3.2×10^{-9}	1.2×10^{-6}	6.0×10^{-10}	3.8×10^{-4}	1.9×10^{-7}
Design basis earthquake	7.9×10^{-5}	Unlikely	Mean	4.1×10^{-5}	1.6×10^{-8}	6.8×10^{-6}	3.4×10^{-9}	1.3×10^{-3}	6.5×10^{-7}
			95th percentile	1.3×10^{-4}	5.1×10^{-8}	1.9×10^{-5}	9.4×10^{-9}	5.9×10^{-3}	3.0×10^{-6}
Beyond-design-basis fire	6.0×10^{-2}	Beyond extremely unlikely	Mean	3.4×10^{-2}	1.4×10^{-5}	5.4×10^{-3}	2.7×10^{-6}	1.0	5.0×10^{-4}
			95th percentile	9.9×10^{-2}	4.0×10^{-5}	1.6×10^{-2}	7.8×10^{-6}	4.6	2.3×10^{-3}
Beyond-design-basis earthquake	9.5×10^{1}	Extremely unlikely to beyond extremely unlikely	Mean	5.4×10^{1}	2.2×10^{-2}	8.5	4.3×10^{-3}	1.6×10^{3}	7.9×10^{-1}
			95th percentile	1.6×10^{2}	6.3×10^{-2}	2.5×10^{1}	1.2×10^{-2}	7.3×10^{3}	3.6
Aircraft crash	7.1×10^{2}	Beyond extremely unlikely	Mean	4.0×10^{2}	1.6×10^{-1}	6.3×10^{1}	3.2×10^{-2}	1.2×10^{4}	5.9
			95th percentile	1.2×10^{3}	4.7×10^{-1}	1.9×10^{2}	9.3×10^{-2}	5.4×10^{4}	2.7×10^{1}

[a] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single noninvolved worker at a distance of 1,000 m [3,281 ft] or at the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[b] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) if exposed to the indicated dose. The value assumes that the accident has occurred.

Note: Calculated using the source terms in the MOX data report, as modified in Appendix K.1.5.1, site meteorology, projected regional population, and the MACCS2 computer code.

Source: UC 1998h.

K.5 FACILITY ACCIDENT IMPACTS AT SRS

The potential source terms and consequences of postulated bounding facility accidents for each facility option for SRS are presented in Tables K–14 through K–19. Accident scenarios and source terms were developed from data reports prepared for each technology. Consequences were estimated using the MACCS2 computer code and local population and meteorology data. The consequences are presented for both mean and 95th percentile meteorological conditions.

Meteorological data are based on 10-m (33-ft) weather readings at SRS, are identical to the data used in *F-Canyon Plutonium Solutions Environmental Impact Statement*, and included in Sample Problem D of the MACCS2 User's Guide (Chanin and Young 1997:4-4). In accordance with MACCS2 format requirements, the data set consists of 8,760 consecutive hourly readings of windspeed, wind direction, Pasquill-Gifford stability class, and accumulated rainfall.

Population estimates for SRS are for the year 2010, are based on the *Census of Population and Housing, 1990* (DOC 1992), and are identical to the estimates used for the analysis of normal operations in the SPD EIS. Population values are formatted into 16 sectors centered around the 16 standard compass directions, which are further subdivided into 10 radial distance intervals out to 80 km (50 mi).

[Tables deleted.]

Table K–14. Accident Impacts of New Pit Conversion Facility at SRS

				Impacts on Noninvolved Worker		**Impacts at Site Boundary**		**Impacts on Population Within 80 km**	
Accident	**Source Term (g)**	**Frequency (per year)**	**Meteorology**	**Dose (rem)**	**Probability of Cancer Fatality[a]**	**Dose (rem)**	**Proability of Cancer Fatality[a]**	**Dose (person-rem)**	**Latent Cancer Fatalities[b]**
Fire	1.2×10^{-5}	Unlikely	Mean	2.6×10^{-6}	1.1×10^{-9}	2.1×10^{-7}	1.0×10^{-10}	5.4×10^{-4}	2.7×10^{-7}
			95th percentile	6.2×10^{-6}	2.5×10^{-9}	6.7×10^{-7}	3.3×10^{-10}	2.4×10^{-3}	1.2×10^{-6}
Explosion	3.2×10^{-3}	Unlikely	Mean	6.9×10^{-4}	2.8×10^{-7}	5.4×10^{-5}	2.7×10^{-8}	1.4×10^{-1}	7.0×10^{-5}
			95th percentile	1.6×10^{-3}	6.5×10^{-7}	1.8×10^{-4}	8.8×10^{-8}	6.2×10^{-1}	3.1×10^{-4}
Leaks/spills of nuclear material	4.4×10^{-6}	Extremely unlikely	Mean	9.6×10^{-7}	3.9×10^{-10}	7.5×10^{-8}	3.8×10^{-11}	2.0×10^{-4}	9.8×10^{-8}
			95th percentile	2.3×10^{-6}	9.1×10^{-10}	2.5×10^{-7}	1.2×10^{-10}	8.7×10^{-4}	4.3×10^{-7}
Tritium release	2.0×10^{1}	Extremely unlikely	Mean	1.1×10^{-1}	4.4×10^{-5}	8.6×10^{-3}	4.3×10^{-6}	2.3×10^{1}	1.1×10^{-2}
			95th percentile	2.6×10^{-1}	1.0×10^{-4}	2.8×10^{-2}	1.4×10^{-5}	1.0×10^{2}	5.0×10^{-2}
Criticality	1.0×10^{19} fissions	Extremely unlikely	Mean	7.9×10^{-3}	3.2×10^{-6}	5.8×10^{-4}	2.9×10^{-7}	4.2×10^{-1}	2.1×10^{-4}
			95th percentile	1.7×10^{-2}	6.7×10^{-6}	1.8×10^{-3}	9.2×10^{-7}	1.8	9.0×10^{-4}
Design basis earthquake	3.9×10^{-4}	Unlikely	Mean	8.5×10^{-5}	3.4×10^{-8}	6.6×10^{-6}	3.3×10^{-9}	1.7×10^{-2}	8.6×10^{-6}
			95th percentile	2.0×10^{-4}	8.0×10^{-8}	2.2×10^{-5}	1.1×10^{-8}	7.7×10^{-2}	3.8×10^{-5}
Beyond-design-basis fire	1.7×10^{-2}	Beyond extremely unlikely	Mean	1.1×10^{-2}	4.4×10^{-6}	4.8×10^{-4}	2.4×10^{-7}	8.8×10^{-1}	4.4×10^{-4}
			95th percentile	4.0×10^{-2}	1.6×10^{-5}	1.6×10^{-3}	7.8×10^{-7}	3.7	1.9×10^{-3}
Beyond-design-basis earthquake	3.9×10^{1}	Extremely unlikely to beyond extremely unlikely	Mean	2.5×10^{1}	1.0×10^{-2}	1.1	5.5×10^{-4}	2.0×10^{3}	1.0
			95th percnetile	9.2×10^{1}	3.7×10^{-2}	3.6	1.8×10^{-3}	8.5×10^{3}	4.3

[a] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single noninvolved worker at a distance of 1,000 m [3,281 ft] (or at the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[b] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) if exposed to the indicated dose. The value assumes that the accident has occurred.

Note: Calculated using the source terms in the pit conversion data report, as modified in Appendix K.1.5.1, site meteorology, projected regional population, and the MACCS2 computer code.

Source: UC 1998c.

Table K–15. Accident Impacts of Ceramic Immobilization Facility in New Construction and DWPF at SRS (Hybrid Case)

				Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	**Source Term (g)**	**Frequency (per year)**	**Meteorology**	**Dose (rem)**	**Probability of Cancer Fatality**[a]	**Dose (rem)**	**Probability of Cancer Fatality**[a]	**Dose (person-rem)**	**Latent Cancer Fatalities**[b]
Criticality	1.0×10^{19} fissions	Extremely unlikely	Mean	5.3×10^{-3}	2.1×10^{-6}	4.6×10^{-4}	2.3×10^{-7}	3.5×10^{-1}	1.8×10^{-4}
			95th percentile	1.0×10^{-2}	4.2×10^{-6}	1.6×10^{-3}	7.8×10^{-7}	1.5	7.5×10^{-4}
Explosion in HYDOX furnace	3.4×10^{-3}	Unlikely	Mean	3.9×10^{-4}	1.6×10^{-7}	5.3×10^{-5}	2.7×10^{-8}	1.6×10^{-1}	7.8×10^{-5}
			95th percentile	8.6×10^{-4}	3.4×10^{-7}	1.6×10^{-4}	8.1×10^{-8}	7.1×10^{-1}	3.5×10^{-4}
Glovebox fire (calcining furnace)	2.7×10^{-7}	Extremely unlikely	Mean	3.1×10^{-8}	1.2×10^{-11}	4.2×10^{-9}	2.1×10^{-12}	1.2×10^{-5}	6.2×10^{-9}
			95th percentile	6.8×10^{-8}	2.7×10^{-11}	1.3×10^{-8}	6.5×10^{-12}	5.6×10^{-5}	2.8×10^{-8}
Hydrogen explosion	3.8×10^{-4}	Unlikely	Mean	4.3×10^{-5}	1.7×10^{-8}	5.9×10^{-6}	2.9×10^{-9}	1.7×10^{-2}	8.6×10^{-6}
			95th percentile	9.5×10^{-5}	3.8×10^{-8}	1.8×10^{-5}	9.0×10^{-9}	7.8×10^{-2}	3.8×10^{-5}
Glovebox fire (sintering furnace)	1.5×10^{-6}	Extremely unlikely	Mean	1.7×10^{-7}	6.9×10^{-11}	2.4×10^{-8}	1.2×10^{-11}	6.9×10^{-5}	3.4×10^{-8}
			95th percentile	3.8×10^{-7}	1.5×10^{-10}	7.2×10^{-8}	3.6×10^{-11}	3.1×10^{-4}	1.5×10^{-7}
Design basis earthquake	3.8×10^{-4}	Unlikely	Mean	4.4×10^{-5}	1.7×10^{-8}	5.9×10^{-6}	3.0×10^{-9}	1.7×10^{-2}	8.7×10^{-6}
			95th percentile	9.6×10^{-5}	3.8×10^{-8}	1.8×10^{-5}	9.1×10^{-9}	7.9×10^{-2}	3.9×10^{-5}
Beyond-design-basis fire	2.1×10^{-3}	Beyond extremely unlikely	Mean	1.7×10^{-3}	6.9×10^{-7}	7.6×10^{-5}	3.8×10^{-8}	1.4×10^{-1}	7.0×10^{-5}
			95th percentile	6.3×10^{-3}	2.5×10^{-6}	2.5×10^{-4}	1.2×10^{-7}	5.8×10^{-1}	2.9×10^{-4}
Beyond-design-basis earthquake	1.9×10^{1}	Extremely unlikely to beyond extremely unlikely	Mean	1.6×10^{1}	6.3×10^{-3}	6.8×10^{-1}	3.4×10^{-4}	1.3×10^{3}	6.3×10^{-1}
			95th percentile	5.7×10^{1}	2.3×10^{-2}	2.2	1.1×10^{-3}	5.3×10^{3}	2.7

[a] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single noninvolved worker at a distance of 1,000 m [3,281 ft] or at the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[b] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) if exposed to the indicated dose. The value assumes that the accident has occurred.

Key: DWPF, Defense Waste Processing Facility; HYDOX, hydride oxidation.

Note: Calculated using the source terms in the immobilization data report, as modified in Appendix K.1.5.1, site meteorology, projected regional population, and the MACCS2 computer code.

Source: UC 1999c.

Table K–16. Accident Impacts of Glass Immobilization Facility in New Construction and DWPF at SRS (Hybrid Case)

				Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	**Source Term (g)**	**Frequency (per year)**	**Meteorology**	**Dose (rem)**	**Probability of Cancer Fatality**[a]	**Dose (rem)**	**Probability of Cancer Fatality**[a]	**Dose (person-rem)**	**Latent Cancer Fatalities**[b]
Criticality	1.0×10^{19} fissions	Extremely unlikely	Mean	5.3×10^{-3}	2.1×10^{-6}	4.6×10^{-4}	2.3×10^{-7}	3.5×10^{-1}	1.8×10^{-4}
			95th percentile	1.0×10^{-2}	4.2×10^{-6}	1.6×10^{-3}	7.8×10^{-7}	1.5	7.5×10^{-4}
Explosion in HYDOX furnace	3.4×10^{-3}	Unlikely	Mean	3.9×10^{-4}	1.6×10^{-7}	5.3×10^{-5}	2.7×10^{-8}	1.6×10^{-1}	7.8×10^{-5}
			95th percentile	8.6×10^{-4}	3.4×10^{-7}	1.6×10^{-4}	8.1×10^{-8}	7.1×10^{-1}	3.5×10^{-4}
Glovebox fire (calcining furnace)	2.7×10^{-7}	Extremely unlikely	Mean	3.1×10^{-8}	1.2×10^{-11}	4.2×10^{-9}	2.1×10^{-12}	1.2×10^{-5}	6.2×10^{-9}
			95th percentile	6.8×10^{-8}	2.7×10^{-11}	1.3×10^{-8}	6.5×10^{-12}	5.6×10^{-5}	2.8×10^{-8}
Hydrogen explosion	3.8×10^{-4}	Unlikely	Mean	4.3×10^{-5}	1.7×10^{-8}	5.9×10^{-6}	2.9×10^{-9}	1.7×10^{-2}	8.6×10^{-6}
			95th percentile	9.5×10^{-5}	3.8×10^{-8}	1.8×10^{-5}	9.0×10^{-9}	7.8×10^{-2}	3.8×10^{-5}
Melter eruption	1.4×10^{-6}	Unlikely	Mean	1.6×10^{-7}	6.4×10^{-11}	2.2×10^{-8}	1.1×10^{-11}	6.4×10^{-5}	3.2×10^{-8}
			95th percentile	3.5×10^{-7}	1.4×10^{-10}	6.7×10^{-8}	3.3×10^{-11}	2.9×10^{-4}	1.4×10^{-7}
Melter spill	3.3×10^{-7}	Unlikely	Mean	3.8×10^{-8}	1.5×10^{-11}	5.1×10^{-9}	2.6×10^{-12}	1.5×10^{-5}	7.5×10^{-9}
			95th percentile	8.3×10^{-8}	3.3×10^{-11}	1.6×10^{-8}	7.8×10^{-12}	6.8×10^{-5}	3.3×10^{-8}
Design basis earthquake	3.3×10^{-4}	Unlikely	Mean	3.8×10^{-5}	1.5×10^{-8}	5.2×10^{-6}	2.6×10^{-9}	1.5×10^{-2}	7.6×10^{-6}
			95th percentile	8.3×10^{-5}	3.3×10^{-8}	1.6×10^{-5}	7.9×10^{-9}	6.9×10^{-2}	3.4×10^{-5}
Beyond-design-basis fire	3.8×10^{-4}	Beyond extremely unlikely	Mean	3.1×10^{-4}	1.2×10^{-7}	1.4×10^{-5}	6.8×10^{-9}	2.5×10^{-2}	1.3×10^{-5}
			95th percentile	1.1×10^{-3}	4.6×10^{-7}	4.4×10^{-5}	2.2×10^{-8}	1.0×10^{-1}	5.3×10^{-5}
Beyond-design-basis earthquake	1.7×10^{1}	Extremely unlikely to beyond extremely unlikely	Mean	1.4×10^{1}	5.5×10^{-3}	6.0×10^{-1}	3.0×10^{-4}	1.1×10^{3}	5.5×10^{-1}
			95th percentile	5.0×10^{1}	2.0×10^{-2}	2.0	9.8×10^{-4}	4.6×10^{3}	2.3

[a] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single noninvolved worker at a distance of 1,000 m [3,281 ft] or at the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[b] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) if exposed to the indicated dose. The value assumes that the accident has occurred.

Key: DWPF, Defense Waste Processing Facility; HYDOX, hydride oxidation.

Note: Calculated using the source terms in the immobilization data report, as modified in Appendix K.1.5.1, site meteorology, projected regional population, and the MACCS2 computer code.

Source: UC 1999d.

Table K–17. Accident Impacts of Ceramic Immobilization Facility in New Construction and DWPF at SRS (50-t Case)

				Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	**Source Term (g)**	**Frequency (per year)**	**Meteorology**	**Dose (rem)**	**Probability of Cancer Fatality[a]**	**Dose (rem)**	**Probability of Cancer Fatality[s]**	**Dose (person-rem)**	**Latent Cancer Fatalities[b]**
Criticality	1.0×10^{19} fissions	Extremely unlikely	Mean	5.3×10^{-3}	2.1×10^{-6}	4.6×10^{-4}	2.3×10^{-7}	3.5×10^{-1}	1.8×10^{-4}
			95th percentile	1.0×10^{-2}	4.2×10^{-6}	1.6×10^{-3}	7.8×10^{-7}	1.5	7.5×10^{-4}
Explosion in HYDOX furnace	3.4×10^{-3}	Unlikely	Mean	3.9×10^{-4}	1.6×10^{-7}	5.3×10^{-5}	2.7×10^{-8}	1.6×10^{-1}	7.8×10^{-5}
			95th percentile	8.6×10^{-4}	3.4×10^{-7}	1.6×10^{-4}	8.1×10^{-8}	7.1×10^{-1}	3.5×10^{-4}
Glovebox fire (calcining furnace)	2.7×10^{-7}	Extremely unlikely	Mean	3.1×10^{-8}	1.2×10^{-11}	4.2×10^{-9}	2.1×10^{-12}	1.2×10^{-5}	6.2×10^{-9}
			95th percentile	6.8×10^{-8}	2.7×10^{-11}	1.3×10^{-8}	6.5×10^{-12}	5.6×10^{-5}	2.8×10^{-8}
Hydrogen explosion	3.8×10^{-4}	Unlikely	Mean	4.3×10^{-5}	1.7×10^{-8}	5.9×10^{-6}	2.9×10^{-9}	1.7×10^{-2}	8.6×10^{-6}
			95th percentile	9.5×10^{-5}	3.8×10^{-8}	1.8×10^{-5}	9.0×10^{-9}	7.8×10^{-2}	3.8×10^{-5}
Glovebox fire (sintering furnace)	1.5×10^{-6}	Extremely unlikely	Mean	1.7×10^{-7}	6.9×10^{-11}	2.4×10^{-8}	1.2×10^{-11}	6.9×10^{-5}	3.4×10^{-8}
			95th percentile	3.8×10^{-7}	1.5×10^{-10}	7.2×10^{-8}	3.6×10^{-11}	3.1×10^{-4}	1.5×10^{-7}
Design basis earthquake	3.8×10^{-4}	Unlikely	Mean	4.0×10^{-5}	1.6×10^{-8}	5.5×10^{-6}	2.7×10^{-9}	1.6×10^{-2}	8.0×10^{-6}
			95th percentile	8.8×10^{-5}	3.5×10^{-8}	1.7×10^{-5}	8.3×10^{-9}	7.2×10^{-2}	3.6×10^{-5}
Beyond-design-basis fire	2.1×10^{-3}	Beyond extremely unlikely	Mean	1.7×10^{-3}	6.9×10^{-7}	7.6×10^{-5}	3.8×10^{-8}	1.4×10^{-1}	7.0×10^{-5}
			95th percentile	6.3×10^{-3}	2.5×10^{-6}	2.5×10^{-4}	1.2×10^{-7}	5.8×10^{-1}	2.9×10^{-4}
Beyond-design-basis earthquake	1.9×10^{1}	Extremely unlikely to beyond extremely unlikely	Mean	1.4×10^{1}	5.7×10^{-3}	6.3×10^{-1}	3.1×10^{-4}	1.2×10^{3}	5.8×10^{-1}
			95th percentile	5.3×10^{1}	2.1×10^{-2}	2.1	1.0×10^{-3}	4.8×10^{3}	2.5

[a] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single noninvolved worker at a distance of 1,000 m [3,281 ft] or at the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[b] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) if exposed to the indicated dose. The value assumes that the accident has occurred.

Key: DWPF, Defense Waste Processing Facility; HYDOX, hydride oxidation.

Note: Calculated using the source terms in the immobilization data report, as modified in Appendix K.1.5.1, site meteorology, projected regional population, and the MACCS2 computer code.

Source: UC 1999c.

Table K–18. Accident Impacts of Glass Immobilization Facility in New Construction and DWPF at SRS (50-t Case)

				Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	**Source Term (g)**	**Frequency (per year)**	**Meteorology**	**Dose (rem)**	**Probability of Cancer Fatality[a]**	**Dose (rem)**	**Probability of Cancer Fatality[a]**	**Dose (person-rem)**	**Latent Cancer Fatalities[b]**
Criticality	1.0×10^{19} fissions	Extremely unlikely	Mean	5.3×10^{-3}	2.1×10^{-6}	4.6×10^{-4}	2.3×10^{-7}	3.5×10^{-1}	1.8×10^{-4}
			95th percentile	1.0×10^{-2}	4.2×10^{-6}	1.6×10^{-3}	7.8×10^{-7}	1.5	7.5×10^{-4}
Explosion in HYDOX furnace	3.4×10^{-3}	Unlikely	Mean	3.9×10^{-4}	1.6×10^{-7}	5.3×10^{-5}	2.7×10^{-8}	1.6×10^{-1}	7.8×10^{-5}
			95th percentile	8.6×10^{-4}	3.4×10^{-7}	1.6×10^{-4}	8.1×10^{-8}	7.1×10^{-1}	3.5×10^{-4}
Glovebox fire (calcining furnace)	2.7×10^{-7}	Extremely unlikely	Mean	3.1×10^{-8}	1.2×10^{-11}	4.2×10^{-9}	2.1×10^{-12}	1.2×10^{-5}	6.2×10^{-9}
			95th percentile	6.8×10^{-8}	2.7×10^{-11}	1.3×10^{-8}	6.5×10^{-12}	5.6×10^{-5}	2.8×10^{-8}
Hydrogen explosion	3.8×10^{-4}	Unlikely	Mean	4.3×10^{-5}	1.7×10^{-8}	5.9×10^{-6}	2.9×10^{-9}	1.7×10^{-2}	8.6×10^{-6}
			95th percentile	9.5×10^{-5}	3.8×10^{-8}	1.8×10^{-5}	9.0×10^{-9}	7.8×10^{-2}	3.8×10^{-5}
Melter eruption	1.4×10^{-6}	Unlikely	Mean	1.6×10^{-7}	6.4×10^{-11}	2.2×10^{-8}	1.1×10^{-11}	6.4×10^{-5}	3.2×10^{-8}
			95th percentile	3.5×10^{-7}	1.4×10^{-10}	6.7×10^{-8}	3.3×10^{-11}	2.9×10^{-4}	1.4×10^{-7}
Melter spill	3.3×10^{-7}	Unlikely	Mean	3.8×10^{-8}	1.5×10^{-11}	5.1×10^{-9}	2.6×10^{-12}	1.5×10^{-5}	7.5×10^{-9}
			95th percentile	8.3×10^{-8}	3.3×10^{-11}	1.6×10^{-8}	7.8×10^{-12}	6.8×10^{-5}	3.3×10^{-8}
Design basis earthquake	3.3×10^{-4}	Unlikely	Mean	3.5×10^{-5}	1.4×10^{-8}	4.8×10^{-6}	2.4×10^{-9}	1.4×10^{-2}	7.0×10^{-6}
			95th percentile	7.7×10^{-5}	3.1×10^{-8}	1.5×10^{-5}	7.3×10^{-9}	6.4×10^{-2}	3.1×10^{-5}
Beyond-design-basis fire	3.8×10^{-4}	Beyond extremely unlikely	Mean	3.1×10^{-4}	1.2×10^{-7}	1.4×10^{-5}	6.8×10^{-9}	2.5×10^{-2}	1.3×10^{-5}
			95th percentile	1.1×10^{-3}	4.6×10^{-7}	4.4×10^{-5}	2.2×10^{-8}	1.0×10^{-1}	5.3×10^{-5}
Beyond-design-basis earthquake	1.7×10^{1}	Extremely unlikely to beyond extremely unlikely	**Mean**	1.3×10^{1}	5.1×10^{-3}	5.6×10^{-1}	2.8×10^{-4}	1.0×10^{3}	5.1×10^{-1}
			95th percentile	4.7×10^{1}	1.9×10^{-2}	1.8	9.1×10^{-4}	4.3×10^{3}	2.2

[a] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single noninvolved worker at a distance of 1,000 m [3,281 ft] or at the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[b] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) if exposed to the indicated dose. The value assumes that the accident has occurred.

Key: DWPF, Defense Waste Processing Facility; HYDOX, hydride oxidation.

Note: Calculated using the source terms in the immobilization data report, as modified in Appendix K.1.5.1, site meteorology, projected regional population, and the MACCS2 computer code.

Source: UC 1999d.

Table K–19. Accident Impacts of New MOX Facility at SRS

				Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	**Source Term (g)**	**Frequency (per year)**	**Meteorology**	**Dose (rem)**	**Probability of Cancer Fatality**[s]	**Dose (rem)**	**Probability of Cancer Fatality**[a]	**Dose (person-rem)**	**Latent Cancer Fatalities**[b]
Criticality	1.0×10^{19} fissions	Extremely unlikely	Mean	8.8×10^{-2}	3.5×10^{-5}	4.0×10^{-3}	2.0×10^{-6}	3.9	1.9×10^{-3}
			95th percentile	3.0×10^{-1}	1.2×10^{-4}	1.6×10^{-2}	8.0×10^{-6}	1.6×10^{1}	8.0×10^{-3}
Explosion in sintering furnace	5.5×10^{-4}	Extremely unlikely	Mean	3.3×10^{-4}	1.3×10^{-7}	1.2×10^{-5}	6.1×10^{-9}	2.9×10^{-2}	1.4×10^{-5}
			95th percentile	1.2×10^{-3}	4.6×10^{-7}	4.8×10^{-5}	2.4×10^{-8}	1.2×10^{-1}	6.1×10^{-5}
Ion exchange exotherm	2.4×10^{-5}	Unlikely	Mean	1.4×10^{-5}	5.7×10^{-9}	5.3×10^{-7}	2.7×10^{-10}	1.2×10^{-3}	6.2×10^{-7}
			95th percentile	5.1×10^{-5}	2.0×10^{-8}	2.1×10^{-6}	1.1×10^{-9}	5.3×10^{-3}	2.7×10^{-6}
Fire	4.0×10^{-6}	Unlikely	Mean	2.4×10^{-6}	9.5×10^{-10}	8.9×10^{-8}	4.4×10^{-11}	2.1×10^{-4}	1.0×10^{-7}
			95th percentile	8.4×10^{-6}	3.4×10^{-9}	3.5×10^{-7}	1.8×10^{-10}	8.8×10^{-4}	4.4×10^{-7}
Spill	5.0×10^{-6}	Extremely unlikely	Mean	3.0×10^{-6}	1.2×10^{-9}	1.1×10^{-7}	5.6×10^{-11}	2.6×10^{-4}	1.3×10^{-7}
			95th percentile	1.1×10^{-5}	4.2×10^{-9}	4.4×10^{-7}	2.2×10^{-10}	1.1×10^{-3}	5.5×10^{-7}
Design basis earthquake	7.9×10^{-5}	Unlikely	Mean	4.6×10^{-5}	1.9×10^{-8}	1.7×10^{-6}	8.7×10^{-10}	4.1×10^{-3}	2.0×10^{-6}
			95th percentile	1.7×10^{-4}	6.6×10^{-8}	6.9×10^{-6}	3.5×10^{-9}	1.7×10^{-2}	8.7×10^{-6}
Beyond-design-basis fire	6.0×10^{-2}	Beyond extremely unlikely	Mean	3.9×10^{-2}	1.6×10^{-5}	1.7×10^{-3}	8.5×10^{-7}	3.2	1.6×10^{-3}
			95th percentile	1.4×10^{-1}	5.7×10^{-5}	5.6×10^{-3}	2.8×10^{-6}	1.3×10^{1}	6.7×10^{-3}
Beyond-design-basis earthquake	9.5×10^{1}	Extremely unlikely to beyond extremely unlikely	Mean	6.2×10^{1}	2.5×10^{-2}	2.7	1.4×10^{-3}	5.0×10^{3}	2.5
			95th percentile	2.3×10^{2}	9.1×10^{-2}	8.8	4.4×10^{-3}	2.1×10^{4}	1.1×10^{1}

[a] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single noninvolved worker at a distance of 1,000 m [3,281 ft] or at the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[b] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) if exposed to the indicated dose. The value assumes that the accident has occurred.

Note: Calculated using the source terms in the MOX data report, as modified in Appendix K.1.5.1, site meteorology, projected regional population, and the MACCS2 computer code.

Source: UC 1998d.

K.6 LEAD ASSEMBLY ACCIDENT IMPACTS

Tables K–20 through K–25 present the source terms and accident impacts of fabrication of lead assemblies for the candidate sites.

Table K–20. Accident Impacts of Lead Assembly Fabrication at ANL–W

				Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	**Source Term (g)**	**Frequency (per year)**	**Meteorology**	**Dose (rem)**	**Probability of Cancer Fatality**[a]	**Dose (rem)**	**Probability of Cancer Fatality**[a]	**Dose (person-rem)**	**Latent Cancer Fatalities**[b]
Criticality	1.0×10^{19} fissions	Extremely unlikely	Mean	2.5×10^{-2}	9.9×10^{-6}	1.3×10^{-3}	6.4×10^{-7}	6.8×10^{-2}	3.4×10^{-5}
			95th percentile	7.7×10^{-2}	3.1×10^{-5}	4.9×10^{-3}	2.5×10^{-6}	3.4×10^{-1}	1.7×10^{-4}
Design basis earthquake	3.9×10^{-5}	Unlikely	Mean	5.0×10^{-5}	2.0×10^{-8}	2.0×10^{-6}	1.0×10^{-9}	5.1×10^{-4}	2.6×10^{-7}
			95th percentile	1.7×10^{-4}	6.8×10^{-8}	7.7×10^{-6}	3.9×10^{-9}	2.7×10^{-3}	1.4×10^{-6}
Design basis fire	1.7×10^{-5}	Unlikely	Mean	2.2×10^{-5}	8.6×10^{-9}	8.7×10^{-7}	4.4×10^{-10}	2.2×10^{-4}	1.1×10^{-7}
			95th percentile	7.4×10^{-5}	2.9×10^{-8}	3.3×10^{-6}	1.7×10^{-9}	1.2×10^{-3}	5.9×10^{-7}
Design basis explosion	2.7×10^{-4}	Extremely unlikely	Mean	3.5×10^{-4}	1.4×10^{-7}	1.4×10^{-5}	7.1×10^{-9}	3.6×10^{-3}	1.8×10^{-6}
			95th percentile	1.2×10^{-3}	4.8×10^{-7}	5.4×10^{-5}	2.7×10^{-8}	1.9×10^{-2}	9.6×10^{-6}
Beyond-design-basis earthquake	1.1×10^{1}	Extremely unlikely to beyond extremely unlikely	Mean	2.0×10^{1}	7.9×10^{-3}	7.7×10^{-1}	3.8×10^{-4}	1.5×10^{2}	7.4×10^{-2}
			95th percentile	7.4×10^{1}	3.0×10^{-2}	2.8	1.4×10^{-3}	7.9×10^{2}	3.9×10^{-1}
Beyond-design-basis fire	2.4×10^{-2}	Beyond extremely unlikely	Mean	4.4×10^{-2}	1.8×10^{-5}	1.7×10^{-3}	8.5×10^{-7}	3.3×10^{-1}	1.6×10^{-4}
			95th percentile	1.7×10^{-1}	6.6×10^{-5}	6.2×10^{-3}	3.1×10^{-6}	1.8	8.7×10^{-4}

[a] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single noninvolved worker at a distance of 1,000 m [3,281 ft] or the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[b] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) if exposed to the indicated dose. The value assumes that the accident has occurred.

Key: ANL–W, Argonne National Laboratory–West.

Source: O'Connor et al. 1998a.

Table K–21. Accident Impacts of Lead Assembly Fabrication at Hanford (27-m Stack Height)

				Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	**Source Term (g)**	**Frequency (per year)**	**Meteorology**	**Dose (rem)**	**Probability of Cancer Fatality**[a]	**Dose (rem)**	**Probability of Cancer Fatalities**[a]	**Dose (person-rem)**	**Latent Cancer Fatalities**[b]
Criticality	1.0×10^{19} fissions	Extremely unlikely	Mean	1.4×10^{-2}	5.6×10^{-6}	1.4×10^{-3}	6.8×10^{-7}	8.7×10^{-1}	4.3×10^{-4}
			95th percentile	4.0×10^{-2}	1.6×10^{-5}	4.2×10^{-3}	2.1×10^{-6}	5.5	2.7×10^{-3}
Design basis earthquake	3.9×10^{-5}	Unlikely	Mean	1.6×10^{-5}	6.5×10^{-9}	1.9×10^{-6}	9.6×10^{-10}	2.9×10^{-3}	1.4×10^{-6}
			95th percentile	4.8×10^{-5}	1.9×10^{-8}	6.3×10^{-6}	3.2×10^{-9}	1.7×10^{-2}	8.6×10^{-6}
Design basis fire	1.7×10^{-5}	Unlikely	Mean	7.1×10^{-6}	2.8×10^{-9}	8.4×10^{-7}	4.2×10^{-10}	1.2×10^{-3}	6.2×10^{-7}
			95th percentile	2.1×10^{-5}	8.4×10^{-9}	2.7×10^{-6}	1.4×10^{-9}	7.4×10^{-3}	3.7×10^{-6}
Design basis explosion	2.7×10^{-4}	Extremely unlikely	Mean	1.1×10^{-4}	4.6×10^{-8}	1.4×10^{-5}	6.8×10^{-9}	2.0×10^{-2}	1.0×10^{-5}
			95th percentile	3.4×10^{-4}	1.4×10^{-7}	4.4×10^{-5}	2.2×10^{-8}	1.2×10^{-1}	6.0×10^{-5}
Beyond-design-basis earthquake	1.1×10^{1}	Extremely unlikely to beyond extremely unlikely	Mean	1.9×10^{1}	7.5×10^{-3}	7.4×10^{-1}	3.7×10^{-4}	1.0×10^{3}	5.1×10^{-1}
			95th percentile	7.1×10^{1}	8×10^{-2}	2.7	1.3×10^{-3}	6.5×10^{3}	3.2
Beyond-design-basis fire	2.4×10^{-2}	Beyond extremely unlikely	Mean	4.1×10^{-2}	1.7×10^{-5}	1.6×10^{-3}	8.2×10^{-7}	2.2	1.1×10^{-3}
			95th percentile	1.6×10^{-1}	6.3×10^{-5}	5.9×10^{-3}	3.0×10^{-6}	1.4×10^{1}	7.2×10^{-3}

[a] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single noninvolved worker at a distance of 1,000 m [3,281 ft] or the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[b] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) if exposed to the indicated dose. The value assumes that the accident has occurred.

Source: O'Connor et al. 1998b.

Table K–22. Accident Impacts of Lead Assembly Fabrication at Hanford (36-m Stack Height)

				Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	**Source Term (g)**	**Frequency (per year)**	**Meteorology**	**Dose (rem)**	**Probability of Cancer Fatality[a]**	**Dose (rem)**	**Probability of Cancer Fatalities[a]**	**Dose (person-rem)**	**Latent Cancer Fatalities[b]**
Criticality	1.0×10^{19} fissions	Extremely unlikely	Mean	1.1×10^{-2}	4.4×10^{-6}	1.2×10^{-3}	6.0×10^{-7}	8.5×10^{-1}	4.3×10^{-4}
			95th percentile	3.3×10^{-2}	1.3×10^{-5}	3.4×10^{-3}	1.7×10^{-6}	5.4	2.7×10^{-3}
Design basis earthquake	3.9×10^{-5}	Unlikely	Mean	9.1×10^{-6}	3.6×10^{-9}	1.7×10^{-6}	8.5×10^{-10}	2.8×10^{-3}	1.4×10^{-6}
			95th percentile	3.5×10^{-5}	1.4×10^{-8}	5.2×10^{-6}	2.6×10^{-9}	1.7×10^{-2}	8.5×10^{-6}
Design basis fire	1.7×10^{-5}	Unlikely	Mean	3.9×10^{-6}	1.6×10^{-9}	7.3×10^{-7}	3.7×10^{-10}	1.2×10^{-3}	6.1×10^{-7}
			95th percentile	1.5×10^{-5}	6.0×10^{-9}	2.3×10^{-6}	1.1×10^{-9}	7.4×10^{-3}	3.7×10^{-6}
Design basis explosion	2.7×10^{-4}	Extremely unlikely	Mean	6.4×10^{-5}	2.5×10^{-8}	1.2×10^{-5}	5.9×10^{-9}	2.0×10^{-2}	9.9×10^{-6}
			95th percentile	2.4×10^{-4}	9.8×10^{-8}	3.7×10^{-5}	1.8×10^{-8}	1.2×10^{-1}	5.9×10^{-5}
Beyond-design-basis earthquake	1.1×10^{1}	Extremely unlikely to beyond extremely unlikely	Mean	1.9×10^{1}	7.5×10^{-3}	7.4×10^{-1}	3.7×10^{-4}	1.0×10^{3}	5.1×10^{-1}
			95th percentile	7.1×10^{1}	2.8×10^{-2}	2.7	1.3×10^{-3}	6.5×10^{3}	3.2
Beyond-design-basis fire	2.4×10^{-2}	Beyond extremely unlikely	Mean	4.1×10^{-2}	1.7×10^{-5}	1.6×10^{-3}	8.2×10^{-7}	2.2	1.1×10^{-3}
			95th percentile	1.6×10^{-1}	6.3×10^{-5}	5.9×10^{-3}	3.0×10^{-6}	1.4×10^{1}	7.2×10^{-3}

[a] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (single noninvolved worker at a distance of 1,000 m [3,281 ft] or the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[b] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) if exposed to the indicated dose. The value assumes that the accident has occurred.

Source: O'Connor et al. 1998b.

Table K–23. Accident Impacts of Lead Assembly Fabrication at LLNL

				Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	**Source Term (g)**	**Frequency (per year)**	**Meteorology**	**Dose (rem)**	**Probability of Cancer Fatality[a]**	**Dose (rem)**	**Probability of Cancer Fatalities[a]**	**Dose (person-rem)**	**Latent Cancer Fatalities[b]**
Criticality	1.0×10^{19} fissions	Extremely unlikely	Mean	7.0×10^{-2}	2.8×10^{-5}	6.7×10^{-2}	3.3×10^{-5}	1.1×10^{1}	5.7×10^{-3}
			95th percentile	5.3×10^{-1}	2.1×10^{-4}	5.3×10^{-1}	2.7×10^{-4}	6.4×10^{1}	3.2×10^{-2}
Design basis earthquake	3.9×10^{-5}	Unlikely	Mean	1.8×10^{-4}	7.2×10^{-8}	2.2×10^{-4}	1.1×10^{-7}	5.5×10^{-2}	2.8×10^{-5}
			95th percentile	1.3×10^{-3}	5.3×10^{-7}	1.7×10^{-3}	8.5×10^{-7}	2.8×10^{-1}	1.4×10^{-4}
Design basis fire	1.7×10^{-5}	Unlikely	Mean	7.8×10^{-5}	3.1×10^{-8}	9.3×10^{-5}	4.7×10^{-8}	2.4×10^{-2}	1.2×10^{-5}
			95th percentile	5.7×10^{-4}	2.3×10^{-7}	7.4×10^{-4}	3.7×10^{-7}	1.2×10^{-1}	6.0×10^{-5}
Design basis explosion	2.7×10^{-4}	Extremely unlikely	Mean	1.3×10^{-3}	5.0×10^{-7}	1.5×10^{-3}	7.6×10^{-7}	3.9×10^{-1}	1.9×10^{-4}
			95th percentile	9.3×10^{-3}	3.7×10^{-6}	1.2×10^{-2}	6.0×10^{-6}	1.9	9.7×10^{-4}
Beyond-design-basis fire	2.4×10^{-2}	Beyond extremely unlikely	Mean	1.4×10^{-1}	5.7×10^{-5}	1.3×10^{-1}	6.7×10^{-5}	3.5×10^{1}	1.8×10^{-2}
			95th percentile	1.1	4.3×10^{-4}	1.1	5.3×10^{-4}	1.7×10^{2}	8.7×10^{-2}

[a] The closest point to the site boundary is 563 m (1,847 ft), which is less than 1,000 m (3,281 ft). Therefore, doses to the onsite worker are assessed at 1,000 m [3,281 ft] only in those directions where the site boundary is greater than 1,000 m (3,281 ft) away. For other directions, doses are assessed at the site boundary.

[b] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single noninvolved worker at a distance of 1,000 m (3,281 ft) or the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

Key: LLNL, Lawrence Livermore National Laboratory.

Note: A beyond-design-basis earthquake was not evaluated for Building 332 at LLNL because extensive analyses of the seismic hazard at the site and the response of the building to those hazards indicate that the scenario is beyond the range of “reasonably foreseeable.” Current estimates are that the frequency of collapse is on the order of 1.0×10^{-7} per year or less.

Source: Murray 1998; O’Connor et al. 1998c.

Table K–24. Accident Impacts of Lead Assembly Fabrication at LANL

				Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	**Source Term (g)**	**Frequency (per year)**	**Meteorology**	**Dose (rem)**	**Probability of Cancer Fatality[a]**	**Dose (rem)**	**Probability of Cancer Fatalities[a]**	**Dose (person-rem)**	**Latent Cancer Fatalities[b]**
Criticality	1.0×10^{19} fissions	Extremely unlikely	Mean	2.2×10^{-2}	8.7×10^{-6}	1.1×10^{-2}	5.7×10^{-6}	1.5	7.5×10^{-4}
			95th percentile	6.5×10^{-2}	2.6×10^{-5}	2.8×10^{-2}	1.4×10^{-5}	6.6	3.2×10^{-3}
Design basis earthquake	3.9×10^{-5}	Unlikely	Mean	3.4×10^{-5}	1.4×10^{-8}	1.3×10^{-5}	6.5×10^{-9}	3.1×10^{-3}	1.5×10^{-6}
			95th percentile	1.1×10^{-4}	4.3×10^{-8}	4.1×10^{-5}	2.1×10^{-8}	1.4×10^{-2}	6.8×10^{-6}
Design basis fire	1.7×10^{-5}	Unlikely	Mean	1.5×10^{-5}	6.0×10^{-9}	5.7×10^{-6}	2.8×10^{-9}	1.3×10^{-3}	6.7×10^{-7}
			95th percentile	4.7×10^{-5}	1.9×10^{-8}	1.8×10^{-5}	9.0×10^{-9}	5.9×10^{-3}	2.9×10^{-6}
Design basis explosion	2.7×10^{-4}	Extremely unlikely	Mean	2.4×10^{-4}	9.7×10^{-8}	9.2×10^{-5}	4.6×10^{-8}	2.2×10^{-2}	1.1×10^{-5}
			95th percentile	7.6×10^{-4}	3.0×10^{-7}	2.9×10^{-4}	1.5×10^{-7}	9.5×10^{-2}	4.8×10^{-5}
Beyond-design-basis earthquake	1.1×10^{1}	Extremely unlikely to beyond extremely unlikely	Mean	1.3×10^{1}	5.3×10^{-3}	4.4	2.2×10^{-3}	9.5×10^{2}	4.8×10^{-1}
			95th percentile	5.1×10^{1}	2.1×10^{-2}	1.4×10^{1}	7.0×10^{-3}	4.2×103	2.1
Beyond-design-basis fire	2.4×10^{-2}	Beyond extremely unlikely	Mean	2.9×10^{-2}	1.2×10^{-5}	9.7×10^{-3}	4.9×10^{-6}	2.1	1.1×10^{-3}
			95th percentile	1.1×10^{-1}	4.6×10^{-5}	3.1×10^{-2}	1.6×10^{-5}	9.2	4.6×10^{-3}

[a] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single noninvolved worker at a distance of 1,000 m [3,281 ft] or the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[b] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) if exposed to the indicated dose. The value assumes that the accident has occurred.

Key: LANL, Los Alamos National Laboratory.

Source: O'Connor et al. 1998d.

Table K–25. Accident Impacts of Lead Assembly Fabrication at SRS H-Area

Accident	Source Term (g)	Frequency (per year)	Meteorology	Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
				Dose (rem)	**Probability of Cancer Fatality[a]**	**Dose (rem)**	**Probability of Cancer Fatalities[a]**	**Dose (person-rem)**	**Latent Cancer Fatalities[b]**
Criticality	1.0×10^{19} fissions	Extremely unlikely	Mean	5.2×10^{-3}	2.1×10^{-6}	3.4×10^{-4}	1.7×10^{-7}	3.0×10^{-1}	1.5×10^{-4}
			95th percentile	1.0×10^{-2}	4.0×10^{-6}	9.3×10^{-4}	4.6×10^{-7}	1.3	6.5×10^{-4}
Design basis earthquake	3.9×10^{-5}	Unlikely	Mean	3.5×10^{-6}	1.4×10^{-9}	4.4×10^{-7}	2.2×10^{-10}	1.3×10^{-3}	6.3×10^{-7}
			95th percentile	7.8×10^{-6}	3.1×10^{-9}	1.3×10^{-6}	6.7×10^{-10}	5.6×10^{-3}	2.8×10^{-6}
Design basis fire	1.7×10^{-5}	Unlikely	Mean	1.5×10^{-6}	6.1×10^{-10}	1.9×10^{-7}	9.5×10^{-11}	5.4×10^{-4}	2.7×10^{-7}
			95th percentile	3.4×10^{-6}	1.3×10^{-9}	5.8×10^{-7}	2.9×10^{-10}	2.4×10^{-3}	1.2×10^{-6}
Design basis explosion	2.7×10^{-4}	Extremely unlikely	Mean	2.5×10^{-5}	9.9×10^{-9}	3.1×10^{-6}	1.5×10^{-9}	8.8×10^{-3}	4.4×10^{-6}
			95th percentile	5.5×10^{-5}	2.2×10^{-8}	9.5×10^{-6}	4.7×10^{-9}	3.9×10^{-2}	2.0×10^{-5}
Beyond-design-basis earthquake	1.1×10^{1}	Extremely unlikely to beyond extremely unlikely	Mean	7.1	2.9×10^{-3}	2.0×10^{-1}	9.8×10^{-5}	5.1×10^{2}	2.6×10^{-1}
			95th percentile	2.6×10^{1}	1.0×10^{-2}	8.8×10^{-1}	4.4×10^{-4}	2.2×10^{3}	1.1
			95th percentile						
Beyond-design-basis fire	2.4×10^{-2}	Beyond extremely unlikely	Mean	1.6×10^{-2}	6.3×10^{-6}	4.4×10^{-4}	2.2×10^{-7}	1.1	5.7×10^{-4}
			95th percentile	5.8×10^{-2}	2.3×10^{-5}	2.0×10^{-3}	9.8×10^{-7}	4.9	2.4×10^{-3}

[a] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single noninvolved worker at a distance of 1,000 m [3,281 ft] or the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[b] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) if exposed to the indicated dose. The value assumes that the accident has occurred.

Source: O'Connor et al. 1998e.

K.7 COMMERCIAL REACTOR ACCIDENT ANALYSIS

K.7.1 Introduction

Postulated design basis and beyond-design-basis accidents were analyzed using the MACCS2 computer code for each of the three proposed reactor sites, Catawba Nuclear Station, McGuire Nuclear Station, and North Anna Power Station (NRC 1990, SNL 1997). Only those accidents with the potential for substantial radiological releases to the environment were evaluated. Two design basis accidents (a loss-of-coolant accident [LOCA] and a fuel-handling accident) and four beyond-design-basis accidents (a steam generator tube rupture, an early containment failure, a late containment failure, and an interfacing systems loss-of-coolant accident [ISLOCA]) meet this criteria. Each of these accidents was analyzed twice, once using the current low-enriched uranium (LEU) core, and again, assuming a partial (40 percent) MOX core. Doses (consequences) and risks to a noninvolved worker, the offsite MEI, and the general public within 80 km (50 mi) of each plant from each accident scenario were calculated. These results were then compared, by plant, for each postulated accident.

The MEI dose is calculated at the exclusion area boundary of each plant. The exclusion area boundary is that area surrounding the reactor in which the reactor licensee has the authority to determine all activities, including exclusion or removal of personnel and property from the area. This area may be traversed by a highway, railroad, or waterway, provided any one of these is not so close to the facility that it interferes with normal operation of the facility, and appropriate and effective arrangements are made to control traffic and protect public health and safety on the highway, railroad, or waterway in an emergency. There are generally no residences within an exclusion area. However, if there were residents, they would be subject to ready removal in case of necessity. Activities unrelated to operation of the reactor may be permitted in an exclusion area under appropriate limitations, provided that no significant hazards to the public health and safety would result.

K.7.2 Reactor Accident Identification and Quantification

Catawba and McGuire are similar plants, both with two 3,411-MWt Westinghouse pressurized water reactors (PWRs) with ice condenser containments. Because of these similarities, the release paths and mitigating mechanisms for the two plants are almost identical. The conservative assumptions of the NRC regulatory guidance produce identical radiological releases to the environment (source terms) for the two plants. However, site-specific population and meteorological inputs result in different consequences from the two plants. The North Anna site has two 2,893 MWt Westinghouse PWRs with subatmospheric containments.

Both the design basis and beyond-design-basis accidents were identified from plant documents. Design basis accidents were selected by reviewing the Updated Final Safety Analysis Report (UFSAR) for each plant (Duke Power 1996, 1997; Virginia Power 1998). Beyond-design-basis accidents were identified from the submittals (Duke Power 1991, 1992; Virginia Power 1992) in response to the NRC's Generic Letter 88–20 (NRC 1988), which required reactor licensees to perform Individual Plant Examinations (IPEs) for severe accident vulnerabilities. Source terms for each accident for LEU-only cores were identified from these documents, source terms for partial MOX cores were developed based on these LEU source terms, and analyses were performed assuming both the current LEU-only cores and partial MOX cores containing 40 percent MOX fuel and 60 percent LEU fuel. After the source term is developed, the consequences (in terms of LCFs and prompt fatalities) can be determined. To determine the risk, however, the frequency (probability) of occurrence of the accident must be determined. Then the consequences are multiplied by the frequency to determine the risk.

For this analysis, the frequencies of occurrence for the accidents with a 40 percent MOX core are assumed to be the same as those with an LEU core. The National Academy of Sciences reported (NAS 1995) that "any approach to the use of MOX fuel in U.S. power reactors must and will receive a thorough, formal safety review before it is licensed. While we are not in a position to predict what if any modifications to existing reactor types will be required as a result of such licensing reviews, we expect that the final outcome will be certification that whatever LWR type is chosen will be able, with modifications if appropriate, to operate within prevailing reactivity and thermal margins using sufficient plutonium loadings to accomplish the disposition mission in a small number of reactors. We believe, further, that under these circumstances no important overall adverse impact of MOX use ion the accident probabilities of the LWRs involved will occur; if there are adequate reactivity and thermal margins in the fuel, as licensing review should ensure, the main remaining determinants of accident probabilities will involve factors not related to fuel composition and hence unaffected by the use of MOX rather than LEU fuel." Considering the National Academy of Sciences statements, the lack of empirical data, and the degree of uncertainty associated with accident frequencies, this analysis assumes that the accident frequencies are the same for a 40 percent MOX core as those for a 100 percent LEU core.

K.7.2.1 MOX Source Term Development

MOX source terms were developed by applying the calculated ratio for individual radioisotopes present in both the MOX and LEU cores to the source term for each of the LEU accidents. MOX source term development required several steps. The analysis assumes that the initial isotopic composition of the plutonium is that delivered to the MOX facility for fabrication into MOX fuel. The MOX facility includes a polishing step that removes impurities, including americium 241, a major contributor to the dose from plutonium 235. This analysis conservatively assumes that the polishing step reduces the americium 241 to 1 part per million (ppm), then ages the plutonium for 1 year after polishing prior to being loaded into a reactor. Table K–26 provides the assumed isotopic composition for the plutonium source material.

Table K–26. Isotopic Breakdown of Plutonium

Isotope	Prior to Polishing (wt %)	After Polishing and Aging (wt %)
Plutonium 236	<1 ppb	1 ppb
Plutonium 238	0.03	0.03
Plutonium 239	92.2	93.28
Plutonium 240	6.46	6.54
Plutonium 241	0.05	0.05
Plutonium 242	0.1	0.1
Americium 241	0.9	25 ppm

Key: ppb, parts per billion; ppm, parts per million; wt %, weight percent.

The SPD EIS assumes that MOX fuel would be fabricated using depleted uranium (0.25 weight percent uranium 235) (White 1997). The MOX assemblies are assumed to be 4.37 percent plutonium/americium and the LEU assemblies are assumed to be 4.37 percent uranium 235. To simulate a normal plant refueling cycle, the MOX portion was assumed to be 50 percent once-burned and 50 percent twice-burned assemblies. The LEU portion of the MOX was assumed to be 33.3 percent once-burned, 33.3 percent twice-burned, and 33.3 percent thrice-burned assemblies. The LEU-only cores were assumed to be equally divided between once-, twice-, and thrice-burned assemblies. All analyses assumed end-of-cycle inventories to produce the highest consequences. Fuel cycles were based on an 18-month refueling schedule with a 40-day downtime between cycles. The source terms for the LEU-only accident analyses were those identified in plant documents. Source terms for the partial MOX cores were developed using the isotopic ratios in Table K–27 provided by Oak Ridge National Laboratory (ORNL 1999). The MOX core inventory for each isotope was divided by the LEU core inventory for that isotope to provide a MOX/LEU ratio for each isotope. These ratios were then applied to LEU releases for each accident to estimate the MOX releases.

Table K–27. MOX/LEU Core Inventory Isotopic Ratios

Isotope	Ratio	Isotope	Ratio	Isotope	Ratio
Americium 241	2.06	Krypton 85m	0.86	Strontium 91	0.86
Antimony 127	1.15	Krypton 87	0.85	Strontium 92	0.89
Antimony 129	1.07	Krypton 88	0.84	Technetium 99m	0.99
Barium 139	0.97	Lanthanum 140	0.97	Tellurium 127	1.16
Barium 140	0.98	Lanthanum 141	0.97	Tellurium 127m	1.20
Cerium 141	0.98	Lanthanum 142	0.97	Tellurium 129	1.08
Cerium 143	0.95	Molybdenum 99	0.99	Tellurium 129m	1.09
Cerium 144	0.91	Neodymium 147	0.98	Tellurium 131m	1.11
Cesium 134	0.85	Neptunium 239	0.99	Tellurium 132	1.01
Cesium 136	1.09	Niobium 95	0.94	Tritium	0.95
Cesium 137	0.91	Plutonium 238	0.76	Xenon 131m	1.02
Cobalt 58	0.86	Plutonium 239	2.06	Xenon 133	1.00
Cobalt 60	0.72	Plutonium 240	2.20	Xenon 133m	1.01
Curium 242	1.43	Plutonium 241	1.79	Xenon 135	1.28
Curium 244	0.94	Praseodymium 143	0.95	Xenon 135m	1.04
Iodine 131	1.03	Rhodium 105	1.19	Xenon 138	0.96
Iodine 132	1.02	Rubidium 86	0.77	Yttrium 90	0.76
Iodine 133	1.00	Ruthenium 103	1.11	Yttrium 91	0.85
Iodine 134	0.98	Ruthenium 105	1.18	Yttrium 92	0.89
Iodine 135	1.00	Ruthenium 106	1.28	Yttrium 93	0.91
Krypton 83m	0.89	Strontium 89	0.83	Zirconium 95	0.94
Krypton 85	0.78	Strontium 90	0.75	Zirconium 97	0.98

The NRC licensing process will thoroughly review precise enrichments and fuel management schemes. The enrichments and fuel management schemes analyzed in the SPD EIS were chosen as realistic upper bounds. The accidents also assumed a maximum 40 percent MOX core. Taken together, these assumptions are sufficiently conservative to account for uncertainties associated with the MOX/LEU ratios.

K.7.2.2 Meteorological Data

Meteorological data for each specific reactor site were used. The meteorological data characteristic of the site region are described by 1 year of hourly data (8,760 measurements). This data includes wind speed, wind direction, atmospheric stability, and rainfall (DOE 1999b).

K.7.2.3 Population Data

The population distribution around each plant was determined using 1990 census data extrapolated to the year 2015. The population was then split into segments that correspond to the chosen polar coordinate grid. The polar coordinate grid for this analysis consists of 12 radial intervals aligned with the 16 compass directions. For Catawba and McGuire, the distances (in kilometers) of the 12 radial intervals are: 0.64, 0.762, 1.61, 3.22, 4.83, 6.44, 8.05, 16.09, 32.18, 48.27, 64.36, 80.45. For North Anna, these distances (in kilometers) are: 0.64, 1.350, 1.61, 3.22, 4.83, 6.44, 8.05, 16.09, 32.18, 48.27, 64.36, 80.45. The first of the 12 segments represents the location of the noninvolved worker and the second is the location of the site boundary. Projected population data for the year 2015 corresponding to the grid segments at Catawba, McGuire, and North Anna are presented in Tables K–28, K–29, and K–30, respectively.

Table K–28. Projected Catawba Population for Year 2015

	Distance in Kilometers From Release Point											
Direction	**0.64**	**0.762**	**1.61**	**3.22**	**4.83**	**6.44**	**8.05**	**16.09**	**32.18**	**48.27**	**64.36**	**80.45**
N	0	0	6	14	73	469	800	2,642	51,540	31,112	49,551	33,306
NNE	0	0	6	112	250	334	362	9,394	173,036	135,229	102,558	66,298
NE	0	0	7	119	239	394	595	6,442	212,814	143,650	22,571	20,108
ENE	0	0	11	81	504	1,409	1,042	5,842	72,488	52,784	32,588	10,919
E	0	0	21	5	863	1,059	570	7,959	12,144	27,800	22,844	10,995
ESE	0	0	23	47	295	388	679	7,449	8,607	18,196	12,293	9,290
SE	0	0	20	25	284	893	1,060	37,300	14,279	14,657	12,776	3,692
SSE	0	0	6	80	278	706	891	16,458	10,249	4,190	1,599	11,376
S	0	0	24	165	275	606	819	4,529	4,457	15,062	1,579	1,874
SSW	0	0	17	137	245	238	346	2,268	3,563	2,093	12,970	4,245
SW	0	0	20	114	162	208	267	5,538	9,559	2,040	11,272	12,302
WSW	0	0	21	84	159	205	257	2,493	4,756	8,947	31,712	80,518
W	0	0	23	113	202	272	345	4,979	6,978	17,182	26,070	35,091
WNW	0	0	23	103	199	283	363	3,011	17,814	32,751	29,031	8,706
NW	0	0	23	96	165	274	363	3,099	65,856	28,474	33,819	45,793
NNW	0	0	21	85	125	1,153	1,296	3,404	48,431	24,219	32,537	52,530

Table K–29. Projected McGuire Population for Year 2015

	Distance in Kilometers From Release Point											
Direction	**0.64**	**0.762**	**1.61**	**3.22**	**4.83**	**6.44**	**8.05**	**16.09**	**32.18**	**48.27**	**64.36**	**80.45**
N	0	0	44	0	269	110	203	3,153	14,870	28,254	12,987	15,726
NNE	0	0	28	0	124	569	1,728	9,493	21,903	12,317	24,826	43,937
NE	0	0	30	0	5	832	1,016	6,944	30,939	44,064	55,186	44,691
ENE	0	0	184	144	405	684	591	4,289	51,928	37,373	13,039	28,160
E	0	0	217	180	448	381	493	7,575	26,495	21,992	16,957	14,635
ESE	0	0	65	69	271	381	507	7,423	119,345	79,039	36,221	26,552
SE	0	0	15	59	130	244	273	8,387	219,183	204,614	46,100	24,527
SSE	0	0	15	59	99	138	100	9,530	90,900	95,688	79,859	15,954
S	0	0	14	83	165	182	165	6,429	35,178	21,241	41,638	9,071
SSW	0	0	18	101	169	240	221	3,261	61,514	29,814	10,774	9,327
SW	0	0	26	101	169	236	305	5,338	20,195	31,064	47,641	43,067
WSW	0	0	19	101	169	236	296	2,741	20,873	17,334	15,815	15,077
W	6	0	14	112	184	252	312	2,048	24,932	11,715	12,705	43,357
WNW	0	0	3	101	444	811	338	2,187	14,985	57,262	74,708	60,953
NW	0	0	0	224	200	1,005	793	4,260	8,528	22,380	26,093	12,511
NNW	0	0	0	0	4	0	36	1,989	8,570	40,993	13,101	10,686

Table K–30. Projected North Anna Population for Year 2015

Direction	Distance in Kilometers From Release Point											
	0.64	1.35	1.61	3.22	4.83	6.44	8.05	16.09	32.18	48.27	64.36	80.45
N	0	0	0	39	98	122	153	576	7,816	5,149	17,803	42,233
NNE	0	0	2	37	58	160	206	1,236	7,634	10,765	25,976	172,658
NE	0	0	2	30	43	94	100	1,122	38,833	90,820	34,429	77,097
ENE	0	0	0	15	103	40	64	1,373	5,822	6,693	11,426	17,324
E	0	0	0	17	112	42	34	1,183	6,128	5,175	1,839	4,296
ESE	0	0	2	7	17	97	135	950	5,595	5,454	5,161	7,909
SE	0	0	1	18	77	9	12	575	2,989	19,343	59,057	76,396
SSE	0	0	3	50	29	27	40	919	5,051	15,259	443,326	392,420
S	0	0	0	42	20	30	40	669	4,413	11,763	20,254	34,375
SSW	0	0	0	10	12	54	65	554	3,098	5,803	5,616	6,222
SW	0	0	0	4	14	54	86	1,186	2,678	2,845	5,482	4,576
WSW	0	0	0	19	42	31	63	1,381	4,402	6,729	8,905	8,094
W	0	0	0	31	24	24	29	466	2,883	4,529	109,205	21,748
WNW	0	0	0	30	79	52	29	606	2,725	8,371	17,931	9,934
NW	0	0	1	35	52	92	81	662	3,327	11,604	11,816	3,090
NNW	0	0	0	28	64	13	25	771	4,725	9,040	25,534	10,041

K.7.2.4 Design Basis Events

Design basis events are defined by the American Nuclear Society as Condition IV occurrences or limiting faults. Condition IV occurrences are faults which are not expected to take place, but are postulated because their consequences would include the potential for the release of substantial radioactive material. These are the most serious events which must be designed against and represent limiting design cases.

The accident analyses presented in the UFSARs are conservative design basis analyses and therefore the dose consequences are bounding (i.e., a realistically based analysis would result in lower doses). The results, however, provide a comparison of the potential consequences resulting from design basis accidents. The consequences also provide insight into which design basis accidents should be analyzed in an environmental impact statement, such as the SPD EIS. After reviewing the UFSAR accident analyses, the design basis accidents chosen for evaluation in the SPD EIS are a large-break LOCA and a fuel-handling accident.

LOCA. A design basis large-break LOCA was chosen for evaluation because it is the limiting reactor design basis accident at each of the three plants. The analysis was performed in accordance with the methodology and assumptions in Regulatory Guide 1.4 (NRC 1974). The large-break LOCA is defined as a break equivalent in size to a double-ended rupture of the largest pipe of the reactor coolant system. Following a postulated double-ended rupture of a reactor coolant pipe, the emergency core cooling system keeps cladding temperatures well below melting, ensuring that the core remains intact and in a coolable geometry. As a result of the increase in cladding temperature and rapid depressurization of the core, however, some cladding failure may occur in the hottest regions of the core. Thus, a fraction of the fission products accumulated in the pellet-cladding gap may be released to the reactor coolant system and thereby to the containment. Although no core melting would occur for the design basis LOCA, a gross release of fission products is evaluated. The only postulated mechanism for such a release would require a number of simultaneous and extended failures to occur in the engineered safety feature systems, producing severe physical degradation of core geometry and partial melting of the fuel.

Development of the LOCA source term is based on the conservative assumptions specified in Regulatory Guide 1.4. Consistent with this Regulatory Guide, 100 percent of the noble gas inventory and 25 percent of the iodine inventory in the core are assumed to be immediately available for leakage from the primary containment.

However, all of this radioactivity is not released directly to the environment because there are a number of mitigating mechanisms which can delay or retain radioisotopes. The principal mechanism, the primary containment, substantially restricts the release rate of the radioisotopes. Following a postulated LOCA, another potential source of fission product release to the environment is the leakage of radioactive water from engineered safety feature equipment located outside containment. The fission products could then be released from the water into the atmosphere, resulting in offsite radiological consequences that contribute to the total dose from the LOCA.

The LOCA radiological consequence analysis for the LEU cores was performed assuming a ground-level release based on offeror-supplied plant-specific radioisotope release data. All possible leak paths (containment, bypass, and the emergency core cooling system) were included. Were a LOCA to occur, a substantial percentage of the releases would be expected to be elevated, which would be expected to reduce the consequences from those calculated in this analysis. To analyze the accident for a partial MOX core, the LEU isotopic activity was multiplied by the MOX/LEU ratios (from Table K–27) to provide a MOX core activity for each isotope. The LEU and MOX LOCA releases for Catawba and McGuire are provided in Table K–31 and for North Anna in Table K–32.

Table K–31. Catawba and McGuire LOCA Source Term

Isotope	LEU LOCA Release (Ci)	MOX/LEU Ratio	40% MOX Core Release (Ci)
Iodine 131	2.42×10^4	1.03	2.49×10^4
Iodine 132	7.76×10^2	1.02	7.92×10^2
Iodine 133	3.22×10^3	1.00	3.22×10^3
Iodine 134	6.55×10^2	0.98	6.42×10^2
Iodine 135	2.51×10^3	1.00	2.51×10^3
Krypton 83m	3.62×10^3	0.89	3.22×10^3
Krypton 85	1.96×10^4	0.78	1.53×10^4
Krypton 85m	1.96×10^4	0.86	1.68×10^4
Krypton 87	1.04×10^4	0.85	8.82×10^3
Krypton 88	3.23×10^4	0.84	2.72×10^4
Xenon 131m	2.79×10^4	1.02	2.84×10^4
Xenon 133	2.33×10^6	1.00	2.33×10^6
Xenon 133m	3.45×10^4	1.01	3.49×10^4
Xenon 135	2.90×10^5	1.28	3.71×10^5
Xenon 135m	1.40×10^3	1.04	1.46×10^3
Xenon 138	7.21×10^3	0.96	6.92×10^3

Key: LEU, low-enriched uranium; LOCA, loss-of-coolant accident.

Fuel-Handling Accident. The fuel-handling accident analysis was performed in a conservative manner, in accordance with Regulatory Guide 1.25 methodology (NRC 1972). In the fuel-handling accident scenario, a spent fuel assembly is dropped. The drop results in a breach of the fuel rod cladding, and a portion of the volatile fission gases from the damaged fuel rods is released. A fuel-handling accident would realistically result in only a fraction of the fuel rods being damaged. However, consistent with NRC methodology, all the fuel rods in the assembly are assumed to be damaged.

Table K–32. North Anna LOCA Source Term

Isotope	LEU LOCA Release (Ci)	MOX/LEU Ratio	40% MOX Core Release (Ci)
Iodine 131	3.68×10^{2}	1.03	3.79×10^{2}
Iodine 132	3.45×10^{2}	1.02	3.52×10^{2}
Iodine 133	5.87×10^{2}	1.00	5.87×10^{2}
Iodine 134	5.10×10^{2}	0.98	5.00×10^{2}
Iodine 135	5.01×10^{2}	1.00	5.01×10^{2}
Krypton 83m	4.26×10^{2}	0.89	3.79×10^{2}
Krypton 85	5.06×10^{1}	0.78	3.95×10^{1}
Krypton 85m	1.48×10^{3}	0.86	1.27×10^{3}
Krypton 87	2.22×10^{3}	0.85	1.89×10^{3}
Krypton 88	3.50×10^{3}	0.84	2.94×10^{3}
Xenon 131m	3.20×10^{1}	1.02	3.26×10^{1}
Xenon 133	6.91×10^{3}	1.00	6.91×10^{3}
Xenon 133m	1.70×10^{2}	1.01	1.72×10^{2}
Xenon 135	6.37×10^{3}	1.28	8.15×10^{3}
Xenon 135m	6.72×10^{2}	1.04	6.99×10^{2}
Xenon 138	1.90×10^{3}	0.96	1.82×10^{3}

Key: LEU, low-enriched uranium; LOCA, loss-of-coolant accident.

The accident is assumed to occur at the earliest time fuel-handling operations may begin after shutdown as identified in each plant's Technical Specifications.[8] The assumed accident time is 72 hr after shutdown at Catawba and McGuire. North Anna Technical Specifications require a minimum of 150 hr between shutdown and the initiation of fuel movement, but assumed an accident time of 100 hr.

As assumed in Regulatory Guide 1.25, the damaged assembly is the highest powered assembly being removed from the reactor. The values for individual fission product inventories in the damaged assembly are calculated assuming full power operation at the end of core life immediately preceding shutdown. All of the gap activity in the damaged rods is assumed to be released to the spent fuel pool. Noble gases released to the spent fuel pool are immediately released at ground level to the environment, but the water in the spent fuel pool greatly reduces the iodine available for release to the environment. It is assumed that all of the iodine escaping from the spent fuel pool is released to the environment at ground level over a 2-hr time period through the fuel-handling building ventilation system. The Catawba and McGuire UFSARs assume iodine filter efficiencies of 95 percent for both the inorganic and organic species. The North Anna UFSAR assumes a filter efficiency of 90 percent for the inorganic iodine and 70 percent for the organic iodine. The LEU and MOX source terms for Catawba and McGuire are provided in Table K–33 and the source terms for North Anna are provided in Table K–34.

The frequencies for the design basis LOCAs, obtained from the IPEs, are Catawba, 7.50×10^{-6}; McGuire, 1.50×10^{-5}; and North Anna, 2.10×10^{-5}. The frequencies of the fuel-handling accidents were estimated in lieu of plant-specific data. For conservatism, a frequency of 1×10^{-4} was chosen for the analysis.

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[8] Technical Specifications are plant-specific operating conditions that control safety-related parameters of plant operation. Technical Specifications are part of the operating license and require an operating license amendment to change.

Table K–33. Catawba and McGuire Fuel-Handling Accident Source Term

Nuclide	LEU Release (Ci)	MOX/LEU Ratio	40% MOX Core Release
Iodine 131	3.83×10^{1}	1.03	3.94×10^{1}
Iodine 132	5.55×10^{1}	1.02	5.66×10^{1}
Iodine 133	8.00×10^{1}	1.00	8.00×10^{1}
Iodine 134	8.80×10^{1}	0.98	8.62×10^{1}
Iodine 135	7.55×10^{1}	1.00	7.55×10^{1}
Krypton 83m	9.47×10^{3}	0.89	8.43×10^{3}
Krypton 85	1.11×10^{3}	0.78	8.66×10^{2}
Krypton 85m	2.16×10^{4}	0.86	1.86×10^{4}
Krypton 87	4.04×10^{4}	0.85	3.43×10^{4}
Krypton 88	5.58×10^{4}	0.84	4.69×10^{4}
Xenon 133	1.60×10^{5}	1.00	1.60×10^{5}
Xenon 133m	4.81×10^{3}	1.01	4.86×10^{3}
Xenon 135	1.65×10^{5}	1.28	2.11×10^{5}
Xenon 135m	2.96×10^{4}	1.04	3.08×10^{4}
Xenon 138	1.34×10^{5}	0.96	1.29×10^{5}

Key: LEU, low-enriched uranium; LOCA, loss-of-coolant accident.

Table K–34. North Anna Fuel-Handling Accident Source Term

Nuclide	LEU Release (Ci)	MOX/LEU Ratio	40% MOX Core Release
Iodine 131	9.05×10^{1}	1.03	9.32×10^{1}
Iodine 132	1.37×10^{2}	1.02	1.40×10^{2}
Iodine 133	2.01×10^{2}	1.00	2.01×10^{2}
Iodine 134	2.36×10^{2}	0.98	2.31×10^{2}
Iodine 135	1.82×10^{2}	1.00	1.82×10^{2}
Krypton 85	2.60×10^{3}	0.78	2.03×10^{3}
Krypton 85m	2.65×10^{4}	0.86	2.28×10^{4}
Krypton 87	5.10×10^{4}	0.85	4.34×10^{4}
Krypton 88	7.25×10^{4}	0.84	6.09×10^{4}
Xenon 131m	4.56×10^{2}	1.02	4.65×10^{2}
Xenon 133	1.36×10^{5}	1.00	1.36×10^{5}
Xenon 133m	3.46×10^{3}	1.01	3.49×10^{3}
Xenon 135	3.70×10^{4}	1.28	4.74×10^{4}
Xenon 135m	3.74×10^{4}	1.04	3.89×10^{4}
Xenon 138	1.22×10^{5}	0.96	1.17×10^{5}

Key: LEU, low-enriched uranium; LOCA, loss-of-coolant accident.

K.7.2.5 Beyond-Design-Basis Events

Beyond-design-basis accidents (severe reactor accidents) are less likely to occur than reactor design basis accidents. In the reactor design basis accidents, the mitigating systems are assumed to be available. In the severe reactor accidents, even though the initiating event could be a design basis event (e.g., large-break LOCA), additional failures of mitigating systems would cause some degree of physical deterioration of the fuel in the reactor core and a possible breach of the containment structure leading to the direct release of radioactive materials to the environment.

The beyond-design-basis accident evaluation in the SPD EIS included a review of each plant's IPE. In 1988, the NRC required all licensees of operating plants to perform IPEs for severe accident vulnerabilities (Generic Letter 88-20) (NRC 1988), and indicated that a Probabalistic Risk Assessment (PRA) would be an acceptable approach to performing the IPE. A PRA evaluates, in full detail (quantitatively), the consequences of all potential events caused by the operating disturbances (known as internal initiating events) within each plant. The state-of-the-art PRA uses realistic criteria and assumptions in evaluating the accident progression and the systems required to mitigate each accident.

A plant-specific PRA for severe accident vulnerabilities starts with identification of initiating events (i.e., challenges to normal plant operation or accidents) that require successful mitigation to prevent core damage. These events are grouped into initiating event classes that have similar characteristics and require the same overall plant response.

Event trees are developed for each initiating event class. These event trees depict the possible sequence of events that could occur during the plant's response to each initiating event class. The trees delineate the possible combinations (sequences) of functional and/or system successes and failures that lead to either successful mitigation of the initiating event or core damage. Functional and/or system success criteria are developed based on the plant response to the class of accident sequences. Failure modes of systems that are functionally important to preventing core damage are modeled. This modeling process is usually done with fault trees that define the combinations of equipment failures, equipment outages, and human errors that could cause the failure of systems to perform the desired functions.

Quantification of the event trees leads to hundreds, or even thousands, of different end states representing various accident sequences that are either mitigated or lead to core damage. Each accident sequence and its associated end state has a unique "signature" because of the particular combination of system successes and failures. These end states are grouped together into plant damage states, each of which collects sequences for which the progression of core damage, the release of fission products from the fuel, the status of containment and its systems, and the potential for mitigating source terms are similar. The sum of all core damage accident sequences will then represent an estimate of plant core damage frequency. The analysis of core damage frequency calculations is called a Level 1 PRA, or front-end analysis.

Next, an analysis of accident progression, containment loading[9] resulting from the accident, and the structural response to the accident loading is performed. The primary objective of this analysis, which is called a Level 2 PRA, is to characterize the potential for, and magnitude of, a release of radioactive material from the reactor fuel to the environment, given the occurrence of an accident that damages the core. The analysis includes an assessment of containment performance in response to a series of severe accidents. Analysis of the progression of an accident (an accident sequence within a plant damage state) generates a time history of loads imposed on the containment pressure boundary. These loads would then be compared against the containment's structural performance limits. If the loads exceed the performance limits, the containment would be expected to fail; conversely, if the containment performance limits exceed the calculated loads, the containment would be expected to survive. Four modes of containment failure are defined: containment isolation failure, containment bypass, early containment failure, and late containment failure.

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[9] Challenges to containment integrity such as elevated temperature or pressure are referred to as containment loading.

The magnitude of the radioactive release to the atmosphere in an accident is dependent on the timing of the reactor vessel failure and the containment failure. To determine the magnitude of the release, a containment event tree representing the time sequence of major phenomenological events that could occur during the formation and relocation of core debris (after core melt), availability of the containment heat removal system, and the expected mode of containment failures (i.e., bypass, early, and late), is developed. A reduced set of plant damage states is defined by culling the lower frequency plant damage states into higher frequency ones that have relatively similar severity and consequence potential. This condensed set is known as the key plant damage states. These key plant damage states would then become the initiating events for the containment event tree. The outcome of each sequence in this event tree represents a specific release category. Release categories that can be represented by similar source terms are grouped. Source terms associated with various release categories describe the fractional releases for representative radionuclide groups, as well as the timing, duration, and energy of release.

Beyond-design-basis accidents evaluated in the SPD EIS included only those scenarios that lead to containment bypass or failure because the public and environmental consequences would be significantly less for accident scenarios that do not lead to containment bypass or failure. The accidents evaluated consisted of a steam generator tube rupture, an early containment failure, a late containment failure, and an ISLOCA.

Steam Generator Tube Rupture. A beyond-design-basis steam generator tube rupture induced by high temperatures represents a containment bypass event. Analyses have indicated a potential for very high gas temperatures in the reactor coolant system during accidents involving core damage when the primary system is at high pressure. The high temperature could fail the steam generator tubes. As a result of the tube rupture, the secondary side may be exposed to full Reactor Coolant System pressures. These pressures are likely to cause relief valves to lift on the secondary side as they are designed to do. If these valves fail to close after venting, an open pathway from the reactor vessel to the environment can result.

Early Containment Failure. This accident is defined as the failure of containment prior to or very soon (within a few hours) after breach of the reactor vessel. A variety of mechanisms such as direct contact of core debris with the containment, rapid pressure and temperature loads, hydrogen combustion, and fuel-coolant interactions can cause structural failure of the containment. Early containment failure can be important because it tends to result in shorter warning times for initiating public protective measures, and because radionuclide releases would generally be more severe than if the containment fails late.

Late Containment Failure. A late containment failure involves structural failure of the containment several hours after breach of the reactor vessel. A variety of mechanisms such as gradual pressure and temperature increase, hydrogen combustion, and basemat melt-through by core debris can cause late containment failure.

ISLOCA. An ISLOCA refers to a class of accidents in which the reactor coolant system pressure boundary interfacing with a supporting system of lower design pressure is breached. If this occurs, the lower pressure system will be overpressurized and could rupture outside the containment. This failure would establish a flow path directly to the environment or, sometimes, to another building of small-pressure capacity.

For each of the proposed reactors, an assessment was made of the pre-accident inventories of each radioactive species in the reactor fuel, using information on the thermal power and refueling cycles. For the source term and offsite consequence analysis, the radioactive species were collected into groups that exhibit similar chemical behavior. The following groups represent the radionuclides considered to be most important to offsite consequences: noble gases, iodine, cesium, tellurium, strontium, ruthenium, lanthanum, cerium, and barium.

The LEU end-of-cycle isotopic activities (inventories) were multiplied by the MOX/LEU ratio to provide a MOX end-of-cycle activity for each isotope. The LEU and MOX core activities for Catawba and McGuire are provided in Table K–35. The activities for North Anna are provided in Table K–36.

Table K–35. Catawba and McGuire End-of-Cycle Core Activities

Isotope	LEU Core Activity (Ci)	MOX/ LEU Ratio	40% MOX Core Activity (Ci)	Isotope	LEU Core Activity (Ci)	MOX/ LEU Ratio	40% MOX Core Activity (Ci)
Americium 241	3.13×10^{3}	2.06	6.45×10^{3}	Niobium 95	1.41×10^{8}	0.94	1.33×10^{8}
Antimony 127	7.53×10^{6}	1.15	8.66×10^{6}	Plutonium 238	9.90×10^{4}	0.76	7.53×10^{4}
Antimony 129	2.67×10^{7}	1.07	2.85×10^{7}	Plutonium 239	2.23×10^{4}	2.06	4.60×10^{4}
Barium 139	1.70×10^{8}	0.97	1.65×10^{8}	Plutonium 240	2.82×10^{4}	2.20	6.20×10^{4}
Barium 140	1.68×10^{8}	0.98	1.65×10^{8}	Plutonium 241	4.74×10^{6}	1.79	8.49×10^{6}
Cerium 141	1.53×10^{8}	0.98	1.50×10^{8}	Praseodymium 143	1.46×10^{8}	0.95	1.39×10^{8}
Cerium 143	1.48×10^{8}	0.95	1.41×10^{8}	Rhodium 105	5.53×10^{7}	1.19	6.58×10^{7}
Cerium 144	9.20×10^{7}	0.91	8.37×10^{7}	Rubidium 86	5.10×10^{4}	0.77	3.93×10^{4}
Cesium 134	1.17×10^{7}	0.85	9.93×10^{6}	Ruthenium 103	1.23×10^{8}	1.11	1.36×10^{8}
Cesium 136	3.56×10^{6}	1.09	3.88×10^{6}	Ruthenium 105	7.98×10^{7}	1.18	9.42×10^{7}
Cesium 137	6.53×10^{6}	0.91	5.94×10^{6}	Ruthenium 106	2.79×10^{7}	1.28	3.57×10^{7}
Cobolt 58	8.71×10^{5}	0.86	7.49×10^{5}	Strontium 89	9.70×10^{7}	0.83	8.05×10^{7}
Cobolt 60	6.66×10^{5}	0.72	4.80×10^{5}	Strontium 90	5.24×10^{6}	0.75	3.93×10^{6}
Curium 242	1.20×10^{6}	1.43	1.71×10^{6}	Strontium 91	1.25×10^{8}	0.86	1.07×10^{8}
Curium 244	7.02×10^{4}	0.94	6.60×10^{4}	Strontium 92	1.30×10^{8}	0.89	1.16×10^{8}
Iodine 131	8.66×10^{7}	1.03	8.92×10^{7}	Technetium 99m	1.42×10^{8}	0.99	1.41×10^{8}
Iodine 132	1.28×10^{8}	1.02	1.30×10^{8}	Tellurium 127	7.28×10^{6}	1.16	8.44×10^{6}
Iodine 133	1.83×10^{8}	1.00	1.83×10^{8}	Tellurium 127m	9.63×10^{5}	1.20	1.16×10^{6}
Iodine 134	2.01×10^{8}	0.98	1.97×10^{8}	Tellurium 129	2.50×10^{7}	1.08	2.70×10^{7}
Iodine 135	1.73×10^{8}	1.00	1.73×10^{8}	Tellurium 129m	6.60×10^{6}	1.09	7.20×10^{6}
Krypton 85	6.69×10^{5}	0.78	5.22×10^{5}	Tellurium 131m	1.26×10^{7}	1.11	1.40×10^{7}
Krypton 85m	3.13×10^{7}	0.86	2.69×10^{7}	Tellurium 132	1.26×10^{8}	1.01	1.27×10^{8}
Krypton 87	5.72×10^{7}	0.85	4.87×10^{7}	Xenon 133	1.83×10^{8}	1.00	1.83×10^{8}
Krypton 88	7.74×10^{7}	0.84	6.50×10^{7}	Xenon 135	3.44×10^{7}	1.28	4.40×10^{7}
Lanthanum 140	1.72×10^{8}	0.97	1.67×10^{8}	Yttrium 90	5.62×10^{6}	0.76	4.27×10^{6}
Lanthanum 141	1.57×10^{8}	0.97	1.53×10^{8}	Yttrium 91	1.18×10^{8}	0.85	1.00×10^{8}
Lanthanum 142	1.52×10^{8}	0.97	1.47×10^{8}	Yttrium 92	1.30×10^{8}	0.89	1.16×10^{8}
Molybdenum 99	1.65×10^{8}	0.99	1.63×10^{8}	Yttrium 93	1.47×10^{8}	0.91	1.34×10^{8}
Neodymium 147	6.52×10^{7}	0.98	6.39×10^{7}	Zirconium 95	1.49×10^{8}	0.94	1.40×10^{8}
Neptunium 239	1.75×10^{9}	0.99	1.73×10^{9}	Zirconium 97	1.56×10^{8}	0.98	1.53×10^{8}

Key: LEU, low-enriched uranium.

Table K–36. North Anna End-of-Cycle Core Activities

Isotope	LEU Core Activity (Ci)	MOX/ LEU Ratio	40% MOX Core Activity (Ci)	Isotope	LEU Core Activity (Ci)	MOX/ LEU Ratio	40% MOX Core Activity (Ci)
Americium 241	1.03×10^{4}	2.06	2.13×10^{4}	Plutonium 238	1.99×10^{5}	0.76	1.51×10^{5}
Antimony 127	6.36×10^{6}	1.15	7.31×10^{6}	Plutonium 239	2.70×10^{4}	2.06	5.57×10^{4}
Antimony 129	2.41×10^{7}	1.07	2.58×10^{7}	Plutonium 240	3.43×10^{4}	2.20	7.54×10^{4}
Barium 139	1.39×10^{8}	0.97	1.35×10^{8}	Plutonium 241	9.82×10^{6}	1.79	1.76×10^{7}
Barium 140	1.37×10^{8}	0.98	1.34×10^{8}	Praseodymium 143	1.17×10^{8}	0.95	1.11×10^{8}
Cerium 141	1.25×10^{8}	0.98	1.22×10^{8}	Rhodium 105	7.22×10^{7}	1.19	8.59×10^{7}
Cerium 143	1.18×10^{8}	0.95	1.12×10^{8}	Rubidium 86	1.45×10^{4}	0.77	1.12×10^{4}
Cerium 144	9.70×10^{7}	0.91	8.82×10^{7}	Rubidium 103	1.16×10^{8}	1.11	1.28×10^{8}
Cesium 134	1.28×10^{7}	0.85	1.09×10^{7}	Rubidium 105	7.84×10^{7}	1.18	9.25×10^{7}
Cesium 136	3.42×10^{6}	1.09	3.72×10^{6}	Rubidium 106	3.83×10^{7}	1.28	4.90×10^{7}
Cesium 137	8.41×10^{6}	0.91	7.66×10^{6}	Strontium 89	7.48×10^{7}	0.83	6.21×10^{7}
Curium 242	2.72×10^{6}	1.43	3.88×10^{6}	Strontium 90	6.22×10^{6}	0.75	4.66×10^{6}
Curium 244	2.75×10^{5}	0.94	2.58×10^{5}	Strontium 91	9.36×10^{7}	0.86	8.05×10^{7}
Iodine 131	7.33×10^{7}	1.03	7.55×10^{7}	Strontium 92	1.04×10^{8}	0.89	9.23×10^{7}
Iodine 132	1.07×10^{8}	1.02	1.09×10^{8}	Technetium 99m	1.26×10^{8}	0.99	1.25×10^{8}
Iodine 133	1.52×10^{8}	1.00	1.52×10^{8}	Tellurium 127	6.21×10^{6}	1.16	7.21×10^{6}
Iodine 134	1.75×10^{8}	0.98	1.71×10^{8}	Tellurium 127m	9.87×10^{5}	1.20	1.18×10^{6}
Iodine 135	1.49×10^{8}	1.00	1.49×10^{8}	Tellurium 129	2.29×10^{7}	1.08	2.47×10^{7}
Krypton 85	3.51×10^{6}	0.78	2.74×10^{6}	Tellurium 129m	4.20×10^{6}	1.09	4.58×10^{6}
Krypton 85m	8.69×10^{5}	0.86	7.48×10^{5}	Tellurium 132	1.07×10^{8}	1.01	1.08×10^{8}
Krypton 87	3.86×10^{7}	0.85	3.28×10^{7}	Xenon 133	1.59×10^{8}	1.00	1.59×10^{8}
Krypton 88	5.46×10^{7}	0.84	4.59×10^{7}	Xenon 133m	4.69×10^{6}	1.01	4.73×10^{6}
Lanthanum 140	1.42×10^{8}	0.97	1.37×10^{8}	Xenon 135	4.47×10^{7}	1.28	5.72×10^{7}
Lanthanum 141	1.28×10^{8}	0.97	1.24×10^{8}	Yttrium 90	6.21×10^{6}	0.76	4.72×10^{6}
Lanthanum 142	1.24×10^{8}	0.97	1.21×10^{8}	Yttrium 91	9.93×10^{7}	0.85	8.44×10^{7}
Molybdenum 99	1.43×10^{8}	0.99	1.42×10^{8}	Yttrium 92	1.01×10^{8}	0.89	8.97×10^{7}
Neodymium 147	5.12×10^{7}	0.98	5.02×10^{7}	Yttrium 93	1.16×10^{8}	0.91	1.05×10^{8}
Neptunium 239	1.51×10^{9}	0.99	1.50×109	Zirconium 95	1.27×10^{8}	0.94	1.20×10^{8}
Niobium 95	1.31×10^{8}	0.94	1.23×10^{8}	Zirconium 97	1.28×10^{8}	0.98	1.26×10^{8}

Key: LEU, low-enriched uranium.

The source term for each accident, taken from each plant's PRA, is described by the release height, timing, duration, and heat content of the plume, the fraction of each isotope group released, and the warning time (time when offsite officials are warned that an emergency response should be initiated). The PRAs included several release categories for each bypass and failure scenario. These release categories were screened for each accident scenario to determine which release category resulted in the highest risk. The risk was determined by multiplying the consequences by the frequency for each release category. The release category with the highest risk for each scenario was used in the SPD EIS analysis. The highest risk release category source terms for Catawba, McGuire, and North Anna are presented in Table K–37. Also included in each release category characterization is the frequency of occurrence.

The overall risk from beyond-design-basis accidents can be described by the sum of risks from all beyond-design-basis accidents. The group of accidents derived from the screening process results in the highest risks from the containment bypass and failure scenarios. The screened-out accidents in these categories not only

Table K–37. Beyond-Design-Basis Accident Source Terms

				Release Fractions								
Accident	**Parameters**	**Release Category**	**Frequency**	**Xe/Kr**	**I**	**Cs/Rb**	**Te/Sb**	**Sr**	**Ru/Mo**	**La**	**Ce**	**Ba**
				CATAWBA								
SG tube rupture[a]	Time: 20 hr Duration: 1.0 hr Energy: 1.0×10^{4} cal/sec (4.2×10^{4} W) Elevation: 10.0 m Warning time: 7.5 hr	1.04	6.31×10^{-10}	1.0	7.7×10^{-1}	7.9×10^{-1}	7.3×10^{-1}	5.0×10^{-3}	9.4×10^{-2}	1.3×10^{-4}	NA	4.0×10^{-2}
Early containment failure	Time: 6.0 hr Duration: 0.5 hr Energy: 2.0×10^{7} cal/sec (8.37×10^{7} W) Elevation: 10.0 m Warning time: 5.5 hr	5.01	3.42×10^{-8}	1.0	5.5×10^{-2}	4.8×10^{-2}	3.0×10^{-2}	2.5×10^{-4}	2.2×10^{-3}	1.2×10^{-4}	NA	1.7×10^{-3}
Late containment failure	Time: 18.5 hr Duration: 0.5 hr Energy: 1.0×10^{7} cal/sec (4.2×10^{7} W) Elevation: 10.0 m Warning time: 18.0 hr	6.01	1.21×10^{-5}	1.0	3.6×10^{-3}	3.9×10^{-3}	1.8×10^{-3}	5.2×10^{-5}	3.8×10^{-4}	2.6×10^{-5}	NA	1.6×10^{-4}
Interfacing systems LOCA	Time: 6.0 hr Duration: 1.0 hr Energy: 1.0×10^{4} cal/sec (4.2×10^{4} W) Elevation: 10.0 m Warning time: 5.5 hr	2.04	6.9×10^{-8}	1.0	8.2×10^{-1}	8.2×10^{-1}	7.9×10^{-1}	5.8×10^{-2}	2.1×10^{-1}	3.1×10^{-2}	NA	1.4×10^{-1}

Table K–37. Beyond-Design-Basis Accident Source Terms (Continued)

Accident	Parameters	Release Category	Frequency	Release Fractions Xe/Kr	I	Cs/Rb	Te/Sb	Sr	Ru/Mo	La	Ce	Ba
				McGUIRE								
SG tube rupture	Time: 20.0 hr Duration: 1.0 hr Energy: 1.0×10^{4} cal/sec (4.2×10^{4} W) Elevation: 10.0 m Warning time: 7.5 hr	1.04	5.81×10^{-9}	1.0	7.7×10^{-1}	7.9×10^{-1}	7.3×10^{-1}	5.0×10^{-3}	9.4×10^{-2}	1.3×10^{-4}	NA	4.0×10^{-2}
Early containment failure	Time: 6.0 hr Duration: 0.5 hr Energy: 2.0×10^{7} cal/sec (8.37×10^{7} W) Elevation: 10.0 m Warning time: 5.5 hr	5.01	9.89×10^{-8}	1.0	4.4×10^{-2}	3.5×10^{-2}	2.1×10^{-2}	1.4×10^{-4}	4.3×10^{-3}	2.0×10^{-5}	NA	1.4×10^{-3}
Late containment failure	Time: 32.0 hr Duration: 0.5 hr Energy: 1.0×10^{7} cal/sec (4.2×10^{7} W) Elevation: 10.0 m Warning time: 31.5 hr	6.01	7.21×10^{-6}	1.0	3.2×10^{-3}	2.4×10^{-3}	3.3×10^{-3}	1.0×10^{-8}	5.8×10^{-8}	1.0×10^{-9}	NA	1.8×10^{-7}
Interfacing systems LOCA	Time: 3.0 hr Duration: 1.0 hr Energy: 1.0×10^{4} cal/sec (4.2×10^{4} W) Elevation: 10.0 m Warning time: 2.0 hr	2.04	6.35×10^{-7}	1.0	7.5×10^{-1}	7.5×10^{-1}	6.6×10^{-1}	4.2×10^{-2}	1.5×10^{-1}	2.0×10^{-2}	NA	9.8×10^{-2}

Table K–37. Beyond-Design-Basis Accident Source Terms (Continued)

				Release Fractions								
Accident	**Parameters**	**Release Category**	**Frequency**	**Xe/Kr**	**I**	**Cs/Rb**	**Te/Sb**	**Sr**	**Ru/Mo**	**La**	**Ce**	**Ba**
				NORTH ANNA								
SG tube rupture	Time: 20.3 hr Duration: 1.0 hr Energy: 8.48×10^{3} cal/sec (3.55×10^{4} W) Elevation: 10.0 m Warning time: 7.8 hr	24	7.38×10^{-6}	9.96×10^{-1}	5.2×10^{-1}	5.4×10^{-1}	2.6×10^{-3}/ 6.8×10^{-1}	3.4×10^{-2}	1.4×10^{-1}	5.5×10^{-5}	5.2×10^{-3}	2.1×10^{-2}
Early containment failure	Time: 3.056 hr Duration: 0.5 hr Energy: 1.696×10^{7} cal/sec (7.1×10^{7} W) Elevation: 10.0 m Warning time: 2.556 hr	7	1.60×10^{-7}	9.0×10^{-1}	7.4×10^{-2}	9.7×10^{-2}	1.4×10^{-2}/ 1.3×10^{-1}	1.5×10^{-2}	2.5×10^{-2}	8.1×10^{-6}	9.7×10^{-5}	8.7×10^{-3}
Late containment failure	Time: 8.33 hr Duration: 0.5 hr Energy: 8.48×10^{6} cal/sec (3.55×10^{7} W) Elevation: 10.0 m Warning time: 7.83 hr	9	2.46×10^{-6}	8.2×10^{-1}	2.3×10^{-6}	1.4×10^{-5}	1.6×10^{-5}/ 1.2×10^{-4}	3.2×10^{-4}	3.9×10^{-4}	1.8×10^{-11}	1.4×10^{-11}	1.3×10^{-5}
Interfacing systems LOCA[b]	Time: 5.56 hr Duration: 1.0 hr Energy: 8.48×10^{3} cal/sec (3.55×10^{4} W) Elevation: 10.0 m Warning time: 4.56 hr	23	2.40×10^{-7}	9.4×10^{-1}	2.9×10^{-1}	3.1×10^{-1}	1.6×10^{-5}/ 5.0×10^{-1}	2.3×10^{-1}	2.8×10^{-1}	3.6×10^{-4}	3.7×10^{-2}	1.5×10^{-1}

[a] McGuire data was used for the Catawba steam generator tube rupture event to compare similar scenarios.

[b] McGuire release duration, elevation, and warning time span were used for North Anna in lieu of plant-specific information.

Key: LOCA, loss-of-coolant accident; NA, not applicable; SG, steam generator.

result in lower consequences, but also have much lower probabilities, often resulting in risks several orders of magnitude lower. The other type of severe accident scenario for these reactors results in an intact containment. The risks from these events are several orders of magnitude lower than the risks from the bypass and failure scenarios. Therefore, a summation of the severe accident risks presented in the SPD EIS is a good indicator of overall risk.

Evacuation Information. This analysis conservatively assumes that 95 percent of the population within the 16-km (10-mi) emergency planning zone participated in an evacuation. It was also assumed that the five percent of the population that did not participate in the initial evacuation was relocated within 12 to 24 hr after plume passage, based on the measured concentrations of radioactivity in the surrounding area and the comparison of projected doses with Environmental Protection Agency (EPA) guidelines. Longer term countermeasures (e.g., crop or land interdiction) were based on EPA Protective Action Guides.

Each beyond-design-basis accident scenario has a warning time and a subsequent release time. The warning time is the time at which notification is given to offsite emergency response officials to initiate protective measures for the surrounding population. The release time is the time when the release to the environment begins. The minimum time between the warning time and the release time is one-half hour. The minimum time of one-half hour is enough time to evacuate onsite personnel (i.e., noninvolved workers). This also conservatively assumes that an onsite emergency has not been declared prior to initiating an offsite notification. Intact containment severe accident scenarios, which were not analyzed because of their insignificant offsite consequences, take place on an even longer time frame.

K.7.2.6 Accident Impacts

Accident impacts are presented in terms of increased risk. Increased risk is defined as the additional risk resulting from using a partial MOX core rather than an LEU core. For example, if the risk of an LCF from an accident with an LEU core is 1.0×10^{-6} and the risk of an LCF from the same accident with a MOX core is 1.1×10^{-6}, then the increased risk of an LCF is 1.0×10^{-7} ($1.1\times10^{-6} - 1.0\times10^{-6} = 1.0\times10^{-7}$).

Tables K–38 through K–43 present the consequences and risks of the postulated set of accidents at Catawba, McGuire, and North Anna, respectively. The receptors include a noninvolved worker located 640 m (0.4 mi) from the release point, the MEI, and the population within an 80-km (50-mi) radius of the reactor site. The consequences and risks are presented for both the current LEU-only and the proposed 40 percent MOX core configurations.

Table K–44 shows the ratios of accident impacts with the proposed 40 percent MOX core to the impacts with the current LEU core. This table shows that the increased risk from accidents to the surrounding population from a MOX core is, on average, less than 5 percent. For the fuel-handling accident at all three plants, the risk is reduced when using MOX fuel.

Severe accident scenarios that postulate large abrupt releases could result in prompt fatalities if the radiation dose is sufficiently high. Of the accidents analyzed in the SPD EIS, the ISLOCA and steam generator tube rupture at Catawba and McGuire, and the ISLOCA at North Anna were the only accidents that resulted in doses high enough to cause prompt fatalities. However, the number of prompt fatalities is expected to increase only for the ISLOCA scenarios. Table K–45 shows the estimated number of prompt fatalities estimated to result from these accidents.

Table K–38. Design Basis Accident Impacts for Catawba With LEU and MOX Fuels

			Impacts on Noninvolved Worker			Impacts at Site Boundary			Impacts on Population Within 80 km		
Accident	**Frequency (per year)**	**LEU or MOX Core**	**Dose (rem)**	**Probability of Latent Cancer Fatality[a]**	**Risk of Latent Cancer Fatality (over campaign)[b]**	**Dose (rem)**	**Probability of Latent Cancer Fatality[a]**	**Risk of Latent Cancer Fatality (over campaign)[b]**	**Dose (person-rem)**	**Latent Cancer Fatalities[c]**	**Risk of Latent Cancer Fatalities (over campaign)[d]**
Loss-of-coolant accident	7.50×10^{-6}	LEU	3.78	1.51×10^{-3}	1.81×10^{-7}	1.44	7.20×10^{-4}	8.64×10^{-8}	3.64×10^{3}	1.82	2.19×10^{-4}
		MOX	3.85	1.54×10^{-3}	1.86×10^{-7}	1.48	7.40×10^{-4}	8.88×10^{-8}	3.75×10^{3}	1.88	2.26×10^{-4}
Spent-fuel-handling accident[e]	1.00×10^{-4}	LEU	0.275	1.10×10^{-4}	1.78×10^{-7}	0.138	6.90×10^{-5}	1.10×10^{-7}	1.12×10^{2}	5.61×10^{-2}	8.98×10^{-5}
		MOX	0.262	1.05×10^{-4}	1.68×10^{-7}	0.131	6.55×10^{-5}	1.05×10^{-7}	1.10×10^{2}	5.48×10^{-2}	8.77×10^{-5}

[a] Likelihood (or probability) of cancer fatality for a hypothetical individual—a noninvolved worker at a distance of 640 m (2,100 ft) or the maximally exposed offsite individual at the site boundary—given exposure (762 m [2,500 ft]) to the indicated dose.

[b] Risk of cancer fatality over the estimated 16-year campaign to a hypothetical individual—a noninvolved worker at a distance of 640 m (2,100 ft) or the maximally exposed offsite individual at the site boundary (762 m [2,500 ft]).

[c] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) given exposure to the indicated dose.

[d] Risk of a cancer fatality over the estimated 16-year campaign in the entire offsite population out to a distance of 80 km (50 mi).

[e] Postulated design basis accidents at commercial reactors are considered extremely unlikely events. They are estimated to have a frequency of between 1.0×10^{-4} and 1.0×10^{-6} per year. Because a spent-fuel-handling accident does not have a calculated frequency associated with it, it has been estimated to have the highest frequency for the purposes of this analysis.

Key: LEU, low-enriched uranium.

Table K–39. Beyond-Design-Basis Accident Impacts for Catawba With LEU and MOX Fuels

			Impacts at Site Boundary			Impacts on Population Within 80 km		
Accident	**Frequency (per year)**	**LEU or MOX Core**	**Dose (rem)**	**Probability of Latent Cancer Fatality**[a]	**Risk of Latent Cancer Fatality (over campaign)**[b]	**Dose (person-rem)**	**Latent Cancer Fatalities**[c]	**Risk of Latent Cancer Fatalities (over campaign)**[d]
SG tube rupture[e]	6.31×10^{-10}	LEU	3.46×10^{2}	0.346	3.49×10^{-9}	5.71×10^{6}	5.20×10^{3}	5.25×10^{-5}
		MOX	3.67×10^{2}	0.367	3.71×10^{-9}	5.93×10^{6}	5.42×10^{3}	5.47×10^{-5}
Early containment failure	3.42×10^{-8}	LEU	5.97	2.99×10^{-3}	1.63×10^{-9}	7.70×10^{5}	4.62×10^{2}	2.53×10^{-4}
		MOX	6.01	3.01×10^{-3}	1.65×10^{-9}	8.07×10^{5}	4.84×10^{2}	2.66×10^{-4}
Late containment failure	1.21×10^{-5}	LEU	3.25	1.63×10^{-3}	3.15×10^{-7}	3.93×10^{5}	1.97×10^{2}	3.81×10^{-2}
		MOX	3.48	1.74×10^{-3}	3.38×10^{-7}	3.78×10^{5}	1.90×10^{2}	3.68×10^{-2}
ISLOCA	6.90×10^{-8}	LEU	1.40×10^{4}	1	1.10×10^{-6}	2.64×10^{7}	1.56×10^{4}	1.73×10^{-2}
		MOX	1.60×10^{4}	1	1.10×10^{-6}	2.96×10^{7}	1.69×10^{4}	1.87×10^{-2}

[a] Likelihood (or probability) of cancer fatality to a hypothetical individual—the maximally exposed offsite individual at the site boundary (762 m [2,500 ft])—given exposure to the indicated dose.

[b] Risk of cancer fatality over the estimated 16-year campaign to a hypothetical individual—the maximally exposed offsite individual at the site boundary (762 m [2,500 ft]).

[c] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) given exposure to the indicated dose.

[d] Risk of cancer fatality over the estimated 16-year campaign in the entire offsite population out to a distance of 80 km (50 mi).

[e] McGuire timing and release fractions were used to compare like scenarios.

Key: ISLOCA, interfacing systems loss-of-coolant accident; LEU, low-enriched uranium; SG, steam generator.

Table K–40. Design Basis Accident Impacts for McGuire With LEU and MOX Fuels

			Impacts on Noninvolved Worker			Impacts at Site Boundaries			Impacts on Population Within 80 km		
Accident	**Frequency (per year)**	**LEU or MOX Core**	**Dose (rem)**	**Probability of Latent Cancer Fatality[a]**	**Risk of Latent Cancer Fatality (over campaign)[b]**	**Dose (rem)**	**Probability of Latent Cancer Fatality[a]**	**Risk of Latent Cancer Fatality (over campaign)[b]**	**Dose (person-rem)**	**Latent Cancer Fatalities[c]**	**Risk of Latent Cancer Fatalities (over campaign)[d]**
Loss-of-coolant accident	1.50×10^{-5}	LEU	5.31	2.12×10^{-3}	5.10×10^{-7}	2.28	1.14×10^{-3}	2.74×10^{-7}	3.37×10^{3}	1.69	4.06×10^{-4}
		MOX	5.46	2.18×10^{-3}	5.25×10^{-7}	2.34	1.17×10^{-3}	2.82×10^{-7}	3.47×10^{3}	1.74	4.18×10^{-4}
Spent-fuel-handling accident[e]	1.00×10^{-4}	LEU	0.392	1.57×10^{-4}	2.51×10^{-7}	0.212	1.06×10^{-4}	1.70×10^{-7}	99.1	4.96×10^{-2}	7.94×10^{-5}
		MOX	0.373	1.49×10^{-4}	2.38×10^{-7}	0.201	1.01×10^{-4}	1.62×10^{-7}	97.3	4.87×10^{-2}	7.79×10^{-5}

[a] Likelihood (or probability) of cancer fatality for a hypothetical individual–a noninvolved worker at a distance of 640 m (2,100 ft) or the maximally exposed offsite individual at the site boundary (762 m [2,500 ft])—given exposure to the indicated dose.

[b] Risk of cancer fatality over the estimated 16-year campaign to a hypothetical individual—a noninvolved worker at a distance of 640 m (2,100 ft) or the maximally exposed offsite individual at the site boundary (762 m [2,500 ft]).

[c] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) given exposure to the indicated dose.

[d] Risk of a cancer fatality over the estimated 16-year campaign in the entire offsite population out to a distance of 80 km (50 mi).

[e] Postulated design basis accidents at commercial reactors are considered extremely unlikely events. They are estimated to have a frequency of between 1.0×10^{-4} and 1.0×10^{-6} per year. Because a spent-fuel-handling accident does not have a calculated frequency associated with it, it has been estimated to have the highest frequency for the purposes of this analysis.

Key: LEU, low-enriched uranium.

Table K–41. Beyond-Design-Basis Accident Impacts for McGuire With LEU and MOX Fuels

			Impacts at Site Boundary			**Impacts on Population Within 80 km**		
Accident	**Frequency (per year)**	**LEU or MOX Core**	**Dose (rem)**	**Probability of Latent Cancer Fatality[a]**	**Risk of Latent Cancer Fatality (over campaign)[b]**	**Dose (person-rem)**	**Latent Cancer Fatalities[c]**	**Risk of Latent Cancer Fatalities (over campaign)[d]**
SG tube rupture[e]	5.81×10^{-9}	LEU	6.10×10^{2}	0.610	5.66×10^{-8}	5.08×10^{6}	4.65×10^{3}	4.32×10^{-4}
		MOX	6.47×10^{2}	0.647	6.02×10^{-8}	5.28×10^{6}	4.85×10^{3}	4.51×10^{-4}
Early containment failure	9.89×10^{-8}	LEU	12.2	6.10×10^{-3}	9.65×10^{-9}	7.90×10^{5}	4.57×10^{2}	7.23×10^{-4}
		MOX	12.6	6.30×10^{-3}	9.97×10^{-9}	8.04×10^{5}	4.67×10^{2}	7.39×10^{-4}
Late containment failure	7.21×10^{-6}	LEU	2.18	1.09×10^{-3}	1.26×10^{-7}	3.04×10^{5}	1.52×10^{2}	1.76×10^{-2}
		MOX	2.21	1.11×10^{-3}	1.28×10^{-7}	2.96×10^{5}	1.48×10^{2}	1.71×10^{-2}
ISLOCA	6.35×10^{-7}	LEU	1.95×10^{4}	1	1.02×10^{-5}	1.79×10^{7}	1.19×10^{4}	0.121
		MOX	2.19×10^{4}	1	1.02×10^{-5}	1.97×10^{7}	1.27×10^{4}	0.129

[a] Likelihood (or probability) of cancer fatality to a hypothetical individual—the maximally exposed offsite individual at the site boundary (762 m [2,500 ft])—given exposure to the indicated dose.

[b] Risk of cancer fatality over the estimated 16-year campaign to a hypothetical individual—the maximally exposed offsite individual at the site boundary (762 m [2,500 ft]).

[c] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) given exposure to the indicated dose.

[d] Risk of cancer fatalities over the estimated 16-year campaign in the entire offsite population out to a distance of 80 km (50 mi).

[e] McGuire timing and release fractions were used to compare like scenarios.

Key: ISLOCA, interfacing systems loss-of-coolant accident; LEU, low-enriched uranium; SG, steam generator.

Table K–42. Design Basis Accident Impacts for North Anna With LEU and MOX Fuels

			Impacts on Noninvolved Worker			Impacts at Site Boundary			Impacts on Population Within 80 km		
Accident	**Frequency (per year)**	**LEU or MOX Core**	**Dose (rem)**	**Probability of Latent Cancer Fatality**[a]	**Risk of Latent Cancer Fatality (over campaign)**[b]	**Dose (rem)**	**Probability of Latent Cancer Fatality**[a]	**Risk of Latent Cancer Fatality (over campaign)**[b]	**Dose (person-rem)**	**Latent Cancer Fatalities**[c]	**Risk of Latent Cancer Fatalities (over campaign)**[d]
Loss-of-coolant accident	2.10×10^{-5}	LEU	0.114	4.56×10^{-5}	1.53×10^{-8}	3.18×10^{-2}	1.59×10^{-5}	5.34×10^{-9}	39.4	1.97×10^{-2}	6.62×10^{-6}
		MOX	0.115	4.60×10^{-5}	1.55×10^{-8}	3.20×10^{-2}	1.60×10^{-5}	5.38×10^{-9}	40.3	2.02×10^{-2}	6.78×10^{-6}
Spent-fuel-handling accident[e]	1.00×10^{-4}	LEU	0.261	1.04×10^{-4}	1.66×10^{-7}	9.54×10^{-2}	4.77×10^{-5}	7.63×10^{-8}	29.4	1.47×10^{-2}	2.35×10^{-5}
		MOX	0.239	9.56×10-5	1.53×10^{-7}	8.61×10^{-2}	4.31×10^{-5}	6.90×10^{-8}	27.5	1.38×10^{-2}	2.21×10^{-5}

[a] Likelihood (or probability) of cancer fatality for a hypothetical individual—a noninvolved worker at a distance of 640 m (2,100 ft) or the maximally exposed offsite individual at the site boundary (1,349 m [4,426 ft])—given exposure to the indicated dose.

[b] Risk of cancer fatality over the estimated 16-year campaign to a hypothetical individual—a noninvolved worker at a distance of 640 m (2,100 ft) or the maximally exposed offsite individual at the site boundary (1,349 m [4,426 ft]).

[c] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) given exposure to the indicated dose.

[d] Risk of a cancer fatality over the estimated 16-year campaign in the entire offsite population out to a distance of 80 km (50 mi).

[e] Postulated design basis accidents at commercial reactors are considered extremely unlikely events. They are estimated to have a frequency of between 1.0×10^{-4} and 1.0×10^{-6} per year. Because a spent-fuel-handling accident does not have a calculated frequency associated with it, it has been estimated to have the highest frequency for the purposes of this analysis.

Key: LEU, low-enriched uranium.

Table K–43. Beyond-Design-Basis Accident Impacts for North Anna With LEU and MOX Fuels

			Impacts on Site Boundary			Impacts on Population Within 80 km		
Accident	**Frequency (per year)**	**LEU or MOX Core**	**Dose (rem)**	**Probability of Latent Cancer Fatality[a]**	**Risk of Latent Cancer Fatality (over campaign)[b]**	**Dose (person-rem)**	**Latent Cancer Fatalities[c]**	**Risk of Latent Cancer Fatalities (over campaign)[d]**
SG tube rupture[e]	7.38×10^{-6}	LEU	2.09×10^{2}	0.209	2.46×10^{-5}	1.73×10^{6}	1.22×10^{3}	0.144
		MOX	2.43×10^{2}	0.243	2.86×10^{-5}	1.84×10^{6}	1.33×10^{3}	0.157
Early containment failure[e]	1.60×10^{-7}	LEU	19.6	1.96×10^{-2}	5.02×10^{-8}	8.33×10^{5}	4.52×10^{2}	1.16×10^{-3}
		MOX	21.6	2.16×10^{-2}	5.54×10^{-8}	8.42×10^{5}	4.61×10^{2}	1.18×10^{-3}
Late containment failure[e]	2.46×10^{-6}	LEU	1.12	5.60×10^{-4}	2.21×10^{-8}	4.04×10^{4}	20.2	7.95×10^{-4}
		MOX	1.15	5.75×10^{-4}	2.26×10^{-8}	4.43×10^{4}	22.1	8.70×10^{-4}
ISLOCA[e]	2.40×10^{-7}	LEU	1.00×10^{4}	1	3.84×10^{-6}	4.68×10^{6}	2.98×10^{3}	1.14×10^{-2}
		MOX	1.22×10^{4}	1	3.84×10^{-6}	5.41×10^{6}	3.39×10^{3}	1.30×10^{-2}

[a] Likelihood (or probability) of cancer fatality to a hypothetical individual—the maximally exposed offsite individual at the site boundary (1,349 m [4,426 ft])—given exposure to the indicated dose.

[b] Risk of cancer fatality over the estimated 16-year campaign to a hypothetical individual—the maximally exposed offsite individual at the site boundary (1,349 m [4,426 ft]).

[c] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) given exposure to the indicated dose.

[d] Risk of cancer fatalities over the estimated 16-year campaign in the entire offsite population out to a distance of 80 km (50 mi).

[e] McGuire release durations and warning times were used in lieu of site specific data.

Key: ISLOCA, interfacing systems loss-of-coolant accident; LEU, low-enriched uranium; SG, steam generator.

Table K–44. Ratio of Accident Impacts for MOX-Fueled and LEU-Fueled Reactors (MOX Impacts/Uranium Impacts)

	Catawba			McGuire			North Anna		
Accident	**Worker**	**MEI**	**Population**	**Worker**	**MEI**	**Population**	**Worker**	**MEI**	**Population**
LOCA	1.019	1.028	1.033	1.028	1.026	1.030	1.009	1.006	1.025
FHA	0.953	0.949	0.977	0.952	0.948	0.982	0.916	0.903	0.939
SGTR	NA	1.061	1.042	NA	1.061	1.043	NA	1.163	1.090
Early	NA	1.007	1.048	NA	1.033	1.022	NA	1.102	1.020
Late	NA	1.071	0.964	NA	1.014	0.974	NA	1.027	1.094
ISLOCA	NA	1.143	1.083	NA	1.123	1.067	NA	1.220	1.138

Key: Early, early containment; FHA, fuel-handling accident; ISLOCA, interfacing systems loss-of-coolant accident; Late, late containment; LEU, low-enriched uranium; LOCA, loss-of-coolant accident; MEI, maximally exposed individual; NA, not applicable; SGTR, steam generator tube rupture.

K.7.2.6.1 Catawba

Design Basis Accidents. Table K–38 shows the risks and consequences associated with a LOCA and spent-fuel-handling accident at Catawba. The greatest risk increase to the surrounding population for a design basis accident with a MOX core configuration is approximately 3.3 percent from the LOCA. If this accident were to occur, the consequences in terms of LCFs in the surrounding population within 80 km (50 mi) would be 1.82 LCFs for an LEU core and 1.88 LCFs for a partial MOX core. The increased risk, in terms of an LCF, to the noninvolved worker is 1 in 200 million (5.0×10^{-9}) per 16-year campaign; the MEI, one 1 in 420 million (2.4×10^{-9}) per 16-year campaign; and the population, 1 in 140,000 (7.0×10^{-6}) per 16-year campaign.

Table K–45. Prompt Fatalities for MOX-Fueled and LEU-Fueled Reactors

Accident Scenario	LEU	MOX
Steam generator tube rupture		
Catawba	1	1
McGuire	1	1
North Anna	0	0
Interfacing systems loss-of-coolant accident		
Catawba	815	843
McGuire	398	421
North Anna	54	60

Key: LEU, low-enriched uranium.

Beyond-Design-Basis Accidents. Table K–39 shows the risks and consequences associated with four beyond-design-basis accidents at Catawba. Table K–45 shows prompt fatalities. The greatest risk increase to the surrounding population from a beyond-design-basis accident with a MOX core configuration is approximately 8.3 percent from the ISLOCA. If this accident were to occur, the consequences in terms of LCFs and prompt fatalities in the surrounding population within 80 km (50 mi) would be approximately 16,400 fatalities for an LEU core and 17,700 fatalities for a partial MOX core. The increased risk, in terms of an LCF, to the population is 1 in 710 (1.4×10^{-3}) per 16-year campaign. The increased risk of a prompt fatality is 1 in 32,000 (3.1×10^{-5}) per 16-year campaign.

K.7.2.6.2 McGuire

Design Basis Accidents. Table K–40 shows the risks and consequences associated with a LOCA and spent-fuel-handling accident at McGuire. The greatest risk increase to the surrounding population for a design basis accident with a MOX core configuration is 3.0 percent from the LOCA. If this accident were to occur, the consequences in terms of LCFs in the surrounding population within 80 km (50 mi) would be 1.69 LCFs for an LEU core and 1.74 LCFs for a partial MOX core. The increased risk, in terms of an LCF, to the noninvolved worker is 1 in 67 million (1.5×10^{-8}) per 16-year campaign; the MEI, 1 in 120 million (8.0×10^{-9}) per 16-year campaign; and the population, 1 in 83,000 (1.2×10^{-5}) per 16-year campaign.

Beyond-Design-Basis Accidents. Table K–41 shows the risks and consequences associated with four beyond-design-basis accidents at McGuire. Table K–45 shows prompt fatalities. The greatest risk increase to the surrounding population for a beyond-design-basis accident with a MOX core configuration is approximately 6.6 percent from the ISLOCA. If this accident were to occur, the consequences in terms of LCFs and prompt fatalities in the surrounding population within 80 km (50 mi) would be approximately 12,300 fatalities with an LEU core and 13,100 with a partial MOX core. The increased risk of an LCF to the population is 1 in 120 (8.0×10^{-3}) per 16-year campaign. The increased risk of a prompt fatality is 1 in 4,300 (2.3×10^{-4}) per 16-year campaign.

K.7.2.6.3 North Anna

Design Basis Accidents. Table K–42 shows the risks and consequences associated with a LOCA and spent-fuel-handling accident at North Anna. The greatest risk increase to the surrounding population for a design-basis-accident with a MOX core configuration is approximately 2.5 percent from the LOCA. If this accident were to occur, the consequences in terms of LCFs in the surrounding population within 80 km (50 mi) would be 1.97×10^{-2} LCF for an LEU core and 2.02×10^{-2} LCF for a partial MOX core. The increased risk, in terms of an LCF, to the noninvolved worker is 1 in 5.0 billion (2.0×10^{-10}) per 16-year campaign; the MEI, 1 in 25 billion (4.0×10^{-11}) per 16-year campaign; and the population, 1 in 6.2 million (1.6×10^{-7}) per 16-year campaign.

Beyond-Design-Basis Accidents. Table K–43 shows the risks and consequences associated with four beyond-design-basis accidents at North Anna. Table K–45 shows prompt fatalities. The greatest risk increase to the surrounding population from a beyond-design-basis accident with a MOX core configuration is approximately 14 percent from the ISLOCA. If this accident were to occur, the consequences in terms of LCFs and prompt fatalities in the surrounding populations within 80 km (50 mi) would be approximately 3,000 fatalities for an LEU core and 3,450 fatalities for a partial MOX core. The increased risk of an LCF to the population is 1 in 620 (1.6×10^{-3}) per 16-year campaign. The increased risk of a prompt fatality is 1 in 43,000 (2.3×10^{-5}) per 16-year campaign.

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Appendix L
Evaluation of Human Health Effects From Transportation

L.1 INTRODUCTION

The overland transportation of any commodity involves a risk to both transportation crew members and members of the public. This risk results directly from transportation-related accidents and indirectly from the increased levels of pollution from vehicle emissions, regardless of the cargo. The transportation of certain materials, such as hazardous or radioactive waste, can pose an additional risk due to the unique nature of the material. In order to permit a complete appraisal of the environmental impacts of the proposed action and alternatives, the human health risks associated with the overland transportation of plutonium and other hazardous materials have been assessed.

This appendix provides an overview of the approach used to assess the human health risks that may result from the overland transportation. The appendix includes a discussion of the scope of the assessment, analytical methods used for the risk assessment (i.e., computer models), important assessment assumptions, and a determination of potential transportation routes. It also presents the results of the assessment. In addition, to aid in the understanding and interpretation of the results, specific areas of uncertainty are described, with an emphasis on how the uncertainties may affect comparisons of the alternatives.

The approach used in this appendix is modeled after that used in the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement* (PEIS) (DOE 1996a). The fundamental assumptions used in the analysis for the *Surplus Plutonium Disposition Environmental Impact Statement* are consistent with those used in the PEIS, and the same computer codes and generic release and accident data are used.

The risk assessment results are presented in this appendix in terms of "per-shipment" risk factors, as well as for the total risks associated with each alternative. Per-shipment risk factors provide an estimate of the risk from a single hazardous material shipment between a specific origin and destination. The total risks for a given alternative are found by multiplying the expected number of shipments by the appropriate per-shipment risk factors.

L.2 SCOPE OF ASSESSMENT

The scope of the overland transportation human health risk assessment, including the alternatives and options, transportation activities, potential radiological and nonradiological impacts, transportation modes considered, and receptors, is described below. Additional details of the assessment are provided in the remaining sections of the appendix.

- Proposed Action and Alternatives—The transportation risk assessment conducted for the SPD EIS estimates the human health risks associated with the transportation of plutonium and other hazardous materials for a number of disposition alternatives.

- Radiological Impacts—For each alternative, radiological risks (i.e., those risks that result from the radioactive nature of the plutonium and other hazardous materials) are assessed for both incident-free (i.e., normal) and accident transportation conditions. The radiological risk associated with incident-free transportation conditions would result from the potential exposure of people to external radiation in the vicinity of a loaded shipment. The radiological risk from transportation accidents would come from the potential release and dispersal of radioactive material into the environment during an accident and the subsequent exposure of people through multiple exposure pathways (i.e., exposure to contaminated ground or air, or ingestion of contaminated food).

- All radiological impacts are calculated in terms of effective dose and associated health effects in the exposed populations. The radiation dose calculated is the total effective dose equivalent, which is the sum of the effective dose equivalent from external radiation exposure and the 50-year committed effective dose equivalent from internal radiation exposure (NRC 1998). Radiation doses are presented in units of roentgen equivalent man (rem) for individuals and person-rem for collective populations. The impacts are further expressed as health risks in terms of latent cancer fatalities (LCFs) and cancer incidence in exposed populations. The health risk conversion factors (expected health effects per dose absorbed) were taken from the *1990 Recommendations of the International Commission on Radiological Protection* (ICRP 1991).

- Nonradiological Impacts—In addition to the radiological risks posed by overland transportation activities, vehicle-related risks are also assessed for nonradiological causes (i.e., related to the transport vehicles and not the radioactive cargo) for the same transportation routes. The nonradiological transportation risks are independent of the radioactive nature of the cargo and would be incurred for similar shipments of any commodity. The nonradiological risks are assessed for both incident-free and accident conditions. Nonradiological risks during incident-free transportation conditions would be caused by potential exposure to increased vehicle exhaust emissions. The nonradiological accident risk refers to the potential occurrence of transportation accidents that directly result in fatalities unrelated to the cargo. State-specific transportation fatality rates are used in the assessment. Nonradiological risks are presented in terms of estimated fatalities.

- Transportation Modes—All overland shipments were assumed to take place by truck.

- Receptors—Transportation-related risks are calculated and presented separately for workers and members of the general public. The workers considered are truck crew members involved in the actual overland transportation. The general public includes all persons who could be exposed to a shipment while it is moving or stopped enroute. Potential risks are estimated for the collective populations of exposed people, as well as for the hypothetical maximally exposed individual. The collective population risk is a measure of the radiological risk posed to society as a whole by the alternative being considered. As such, the collective population risk is used as the primary means of comparing various alternatives.

L.3 PACKAGING AND REPRESENTATIVE SHIPMENT CONFIGURATIONS

Regulations that govern the transportation of radioactive materials are designed to protect the public from the potential loss or dispersal of radioactive materials as well as from routine radiation doses during transit. The primary regulatory approach to promote safety is through the specification of standards for the packaging of radioactive materials. Because packaging represents the primary barrier between the radioactive material being transported and radiation exposure to the public and the environment, packaging requirements are an important consideration for the transportation risk assessment. Regulatory packaging requirements are discussed briefly below and in Chapter 5. In addition, the representative packaging and shipment configurations assumed for the SPD EIS are described.

L.3.1 Packaging Overview

Although several Federal and State organizations are involved in the regulation of radioactive materials transportation, primary regulatory responsibility resides with the U.S. Department of Transportation (DOT) and the U.S. Nuclear Regulatory Commission (NRC). All transportation activities must take place in accordance with the applicable regulations of these agencies specified in Title 49 of the Code of Federal Regulations (CFR) Part 173 (DOT 1992a) and 10 CFR 71 (NRC 1996).

Transportation packaging for small quantities of radioactive materials must be designed, constructed, and maintained to contain and shield their contents during normal transport conditions. For large quantities and for more highly radioactive material, such as spent nuclear fuel or plutonium, they must contain and shield their contents in the event of severe accident conditions. The type of packaging used is determined by the total radioactive hazard presented by the material within the packaging; 10 CFR 71 (NRC 1996) provides the rules for this determination. Four basic types of packaging are used: Excepted, Industrial, Type A, and Type B. Another packaging option, Strong and Tight, is still available for some domestic shipments.

Excepted packagings are limited to transporting materials with extremely low levels of radioactivity. Industrial packagings are used to transport materials that, because of their low concentration of radioactive materials, present a limited hazard to the public and the environment. Type A packagings are designed to protect and retain their contents under normal transport conditions and must maintain sufficient shielding to limit radiation exposure to handling personnel. These packagings are used to transport radioactive materials with higher concentrations or amounts of radioactivity than Excepted or Industrial packagings. Strong and Tight packagings are used in the United States for shipment of certain materials with low levels of radioactivity, such as natural uranium and rubble from the decommissioning of nuclear reactors. Type B packages are described in detail in Appendix L.3.1.6.

L.3.1.1 Uranium Hexafluoride Packaging

DOE would ship uranium hexafluoride in a commercial vehicle from the Portsmouth Gaseous Diffusion Plant to a fuel fabrication facility in Model 30B cylinders, which are Type A packages (for the purposes of the SPD EIS). Uranium hexafluoride shipments are regulated under 49 CFR 173.420, which requires the packaging to be in accordance with ANSI N14.1, *Uranium Hexafluoride–Packaging for Transport*. Because uranium hexafluoride breaks down into hydrofluoric acid and uranyl fluoride when exposed to air, packages would be marked with the primary hazard label as “Radioactive Yellow-II” and a secondary hazard label as “Corrosive.” The transport vehicle would be required to show the primary placard “Radioactive” and the secondary placard “Corrosive.”

L.3.1.2 Uranium Dioxide Packaging

DOE would ship uranium dioxide in a commercial vehicle from the fuel fabrication facility to DOE’s mixed oxide (MOX) facility in gasketed, open-head, 208-l (55-gal) drums with heavy plastic liners, which are Industrial Package Type 1 packages. Uranium dioxide shipments are regulated under 49 CFR 173.425. Because uranium dioxide is a low-specific-activity material, no primary hazard label would be required, and because it is chemically stable, no secondary hazard label would be required. The transport vehicle would be required to show the primary placard “Radioactive” and no secondary placard.

L.3.1.3 MOX Fuel Packaging

DOE will design the container for the MOX fuel assemblies. For analysis purposes, it is assumed that DOE would ship the unirradiated MOX fuel bundles in a safe, secure trailer/SafeGuards Transport (SST/SGT) to the reactor site(s) in Type B packages. Two conceptual packaging ideas are end-loading and lateral-loading packages (Ludwig et al. 1997). The fuel assembly weight per container is approximately 2800 kg (6,000 lb) for either pressurized water reactor (PWR) or boiling water reactor (BWR) fuel. The container could hold either four PWR or eight BWR assemblies.

L.3.1.4 Highly Enriched Uranium Packaging

| DOE would ship highly enriched uranium (HEU) in an SST/SGT from the pit conversion facility to the Y–12 facility near Oak Ridge, Tennessee. The DOE-approved container type for these shipments is the DT–22.

L.3.1.5 Plutonium Packaging

| DOE would ship all plutonium in Type B containers. DOE would ship nonpit plutonium in an SST/SGT from | DOE sites (Hanford, Idaho National Engineering and Environmental Laboratory [INEEL], Lawrence Livermore National Laboratory [LLNL], Los Alamos National Laboratory [LANL], Rocky Flats Environmental Technology Site [RFETS], and Savannah River Site [SRS]) to the immobilization facility (Hanford or SRS) in a variety of containers, such as Type 3013, Type 2R, and Foodpac containers, which would be transported inside various | casks, such as radial reflector, SAFEKEG (Type 9517), Model 60 FFTA DFA pins shipping or Specification 6M packages. DOE would ship plutonium pits from DOE sites to the pit conversion facility in DOE-approved FL containers and the piece parts resulting from pit disassembly in DOE-approved UC–609 and | USA/9975 containers. Plutonium dioxide produced at the pit conversion facility would be loaded into packaging that meets DOE-STD-3013-96, *Criteria for Preparing and Packaging Plutonium Metals and Oxides for Long-Term Storage* (DOE 1996b) or equivalent. This package provides for safe storage of plutonium oxides for at least 50 years or until final disposition and serves as the primary containment vessel for shipping. DOE-STD-3013-96 specifies a design goal that the Type 3013 container could be shipped in a qualified shipping container without further reprocessing or repackaging. The Type 3013 primary containment vessel is designed for shipping and would be compatible with a Type B package. No Type B package has been specifically constructed or licensed for shipping DOE-STD-3013-96 primary containment vessels.

A Type B package is required when transporting commercial quantities of plutonium materials, including unirradiated MOX fuel assemblies. DOE is developing a conceptual design for a MOX container that optimizes SST/SGT load-carrying capacity and ensures compatibility with fuel-handling systems at commercial reactors (Ludwig et al. 1997).

L.3.1.6 Overview of Type B Containers

The transportation of highway-route controlled quantities of plutonium (more than a few grams, depending on activity level) requires the use of Type B packaging. In addition to meeting the standards for Type A packaging, Type B packaging must provide a high degree of assurance that, even in severe accidents, the integrity of the package will be maintained with essentially no loss of the radioactive contents or serious impairment of the shielding and maintain subcriticality capability. Type B packaging must satisfy stringent testing criteria specified in 10 CFR 71 (NRC 1996). The testing criteria were developed to simulate severe accident conditions, including impact, puncture, fire, and water immersion.

Beyond meeting DOT standards showing it can withstand normal conditions of transport without loss or dispersal of its radioactive contents or allowance of significant radiation fields, Type B packaging must also meet the 10 CFR 71 requirements administered by the NRC. The complete sequence of tests is listed below:

- Free-Drop Test—A 9-m (30-ft) free-drop onto a flat, essentially unyielding, horizontal surface, striking the surface in a position for which maximum damage to the package is expected.

- Puncture Test—A 1-m (40-in) drop onto the upper end of a 15-cm (6-in) diameter solid, vertical, cylindrical, mild steel bar (at least 20-cm [8-in] long) mounted on an essentially unyielding, horizontal surface.

- Thermal Test—Exposure to a heat flux of no less than that of a thermal radiation environment of 800 °C (1,475 °F) with an emissivity coefficient of at least 0.9 for a period of 30 minutes.

- Water Immersion Test—A separate, undamaged package specimen is subjected to water pressure equivalent to immersion under a head of water of at least 15-m (50-ft) for no less than 8 hours.

Effective April 1, 1996, 10 CFR 71 was revised to require an additional immersion test in 200 m (660 ft) of water for Type B casks designed to contain material with activity levels greater than 1 million curies (Ci) (NRC 1996). Containers used for shipping plutonium will not necessarily be subject to this test because they will contain much less than one million curies. The packaging may also be required to undergo the crush test if it is considered a light-weight, low-density package as most drum-type packages are. The crush test consists of dropping a 500-kg (1100-lb) steel plate from 9 m (30 ft) onto the package, which is resting on an essentially unyielding surface.

Additional restrictions apply to package surface contamination levels, but these restrictions are not limiting for the transportation radiological risk assessment. For risk assessment purposes, it is important to note that all packaging of a given type is designed to meet the same performance criteria. Therefore, two different Type B designs would be expected to perform similarly during incident-free and accident transportation conditions. The specific containers selected, however, will determine the total number of shipments necessary to transport a given quantity of plutonium.

External radiation from a package must be below specified limits that minimize the exposure of the handling personnel and general public. For these types of shipments, the external radiation dose rate during normal transportation conditions must be maintained below the following limits of 49 CFR 173 (DOT 1992a):

- 10 mrem/hr at any point 2 m (6.6 ft) from the vertical planes projected by the outer lateral surfaces of the transport vehicle (referred to as the regulatory limit throughout this document)

- 2 mrem/hr in any normally occupied position in the transport vehicle

L.3.2 Safe, Secure Transportation

DOE anticipates that any transportation of plutonium pits, nonpit plutonium, plutonium dioxide, MOX fuel, or HEU would be required to be made through use of the Transportation Safeguards System and shipped using SST/SGTs. The SST/SGT is a fundamental component of the Transportation Safeguards System. The Transportation Safeguards System is operated by the DOE Transportation Safeguards Division of the Albuquerque Operations Office for the DOE Headquarters Office of Defense Programs. Based on operational experience between FY84 and FY98, the mean probability of an accident requiring the tow-away of the SST/SGT was 0.058 accident per million kilometers (0.096 accident per million miles). By contrast, the rate for commercial trucking in 1989 was about 0.3 accident per million kilometers (0.5 accident per million miles). Commercial trucking accident rates (Saricks and Kvitek 1994) were used in the human health effects analysis. Since its establishment in 1975, the Transportation Safeguards Division has accumulated more than 151 million km (94 million mi) of over-the-road experience transporting DOE-owned cargo with no accidents resulting in a fatality or release of radioactive material.

The SST/SGT is a specially designed component of an 18-wheel tractor-trailer vehicle. Although details of vehicle enhancements and some operational aspects are classified, key characteristics of the SST/SGT system include the following:

- Enhanced structural characteristics and a highly reliable tie-down system to protect cargo from impact
- Heightened thermal resistance to protect the cargo in case of fire (newer SST/SGT models)
- Established operational and emergency plans and procedures governing the shipment of nuclear materials
- Various deterrents to prevent unauthorized removal of cargo
- An armored tractor component that provides courier protection against attack and contains advanced communications equipment
- Specially designed escort vehicles containing advanced communications and additional couriers
- 24-hour-a-day real-time communications to monitor the location and status of all SST/SGT shipments via DOE's Security Communication system
- Couriers who are armed Federal Officers, receive rigorous specialized training, and who are closely monitored through DOE's Personnel Assurance Program
- Significantly more stringent maintenance standards than those for commercial transport equipment
- Conduct of periodic appraisals of the Transportation Safeguards System operations by the DOE Office of Defense Programs to ensure compliance with DOE orders and management directives, and continuous improvement in transportation and emergency management programs

L.3.3 Ground Transportation Route Selection Process

According to DOE guidelines, plutonium shipments must comply with both NRC and DOT regulatory requirements. Commercial shipments are also required by law to comply with both NRC and DOT requirements. NRC regulations cover the packaging and transport of plutonium, whereas DOT specifically regulates the carriers and the conditions of transport, such as routing, handling and storage, and vehicle and driver requirements. The highway routing of nuclear material is systematically determined according to DOT regulations 49 CFR 171–179 and 49 CFR 397 for commercial shipments. The dates and times that specific transportation routes would be used are classified information and would not be publicized before a shipment.

The DOT routing regulations require that a shipment of a "highway route-controlled quantity" of radioactive material be transported over a preferred highway network including interstate highways, with preference toward interstate system bypasses around cities, and State-designated preferred routes. A State or tribe may designate a preferred route to replace or supplement the interstate highway system in accordance with DOT guidelines (DOT 1992b).

Carriers of highway route-controlled quantities are required to use the preferred network, unless moving from origin to the nearest interstate or from the interstate to the destination, when making necessary repair or rest stops, or when emergency conditions render the interstate unsafe or impassible. The primary criterion for selecting the preferred route for a shipment is travel time. Preferred routing takes into consideration accident rate, transit time, population density, activities, time of day, and day of week.

The HIGHWAY computer code (Johnson et al. 1993) may be used for selecting highway routes in the United States. The HIGHWAY database is a computerized road atlas that currently describes about 386,400 km (240,000 mi) of roads. The Interstate System and all U.S. (U.S.-designated) highways are completely described in the database. In addition, most of the principal State highways and many local and community roads are also identified. The code is updated periodically to reflect current road conditions and has been benchmarked against reported mileages and observations of commercial truck firms. Features in the HIGHWAY code allow the user to select routes that conform to DOT regulations. Additionally, the HIGHWAY code contains data on the population densities along the routes. The distance and population data from the HIGHWAY code are part of the information used for the transportation impact analysis in the SPD EIS.

L.4 METHODS FOR CALCULATING TRANSPORTATION RISKS

The overland transportation risk assessment methodology is summarized in Figure L–1. After the alternatives were identified and goals of the shipping campaign were understood, the first step was to collect data on material characteristics and accident parameters. Physical, radiological, and packaging data were provided in reports from the DOE national laboratories. Accident parameters are largely based on the DOE-funded study of transportation accidents (Saricks and Kvitek 1994).

Representative routes that may be used for the shipment of plutonium were selected using the HIGHWAY code. These routes were selected for risk assessment purposes. They do not necessarily represent the actual routes that would be used to transport nuclear materials. Specific routes cannot be identified in advance because the routes would not be finalized until DOE has actually planned the shipping campaign. The selection of the actual route would be responsive to environmental and other conditions that would be in effect or could be predicted at the time of shipment. Such conditions could include adverse weather conditions, road conditions, bridge closures, and local traffic problems. For security reasons, details about a planned shipment would not be publicized before the shipment.

The first analytic step in the ground transportation analysis was to determine the incident-free and accident risk factors, on a per-shipment basis, for transportation. Risk factors, as any risk estimate, are the product of the probability of exposure and the magnitude of the exposure. Accident risk factors were calculated for radiological and nonradiological traffic accidents. The probabilities, which are much lower than 1, and the magnitudes of exposure were multiplied, yielding risk numbers. Incident-free risk factors were calculated for crew and public exposure to radiation emanating from the shipping container (cask) and public exposure to the chemical toxicity of the transportation vehicle exhaust. The probability of incident-free exposure is unity (one).

Radiological risk factors are expressed in units of rem. Later in the analysis, they are multiplied by the *1990 Recommendations of the International Commission on Radiological Protection* (ICRP 1991) conversion factors and estimated number of shipments to give risk estimates in units of LCFs. The vehicle emission risk factors are calculated in LCFs, and the vehicle accident risk factors are calculated in fatalities.

For each alternative, risks were assessed for both incident-free transportation and accident conditions. For the incident-free assessment, risks were calculated for collective populations of potentially exposed individuals and for maximally exposed individuals. The accident assessment consists of two components: (1) a probabilistic accident risk assessment that considers the probabilities and consequences of a range of possible transportation accident environments, including low-probability accidents that have high consequences and

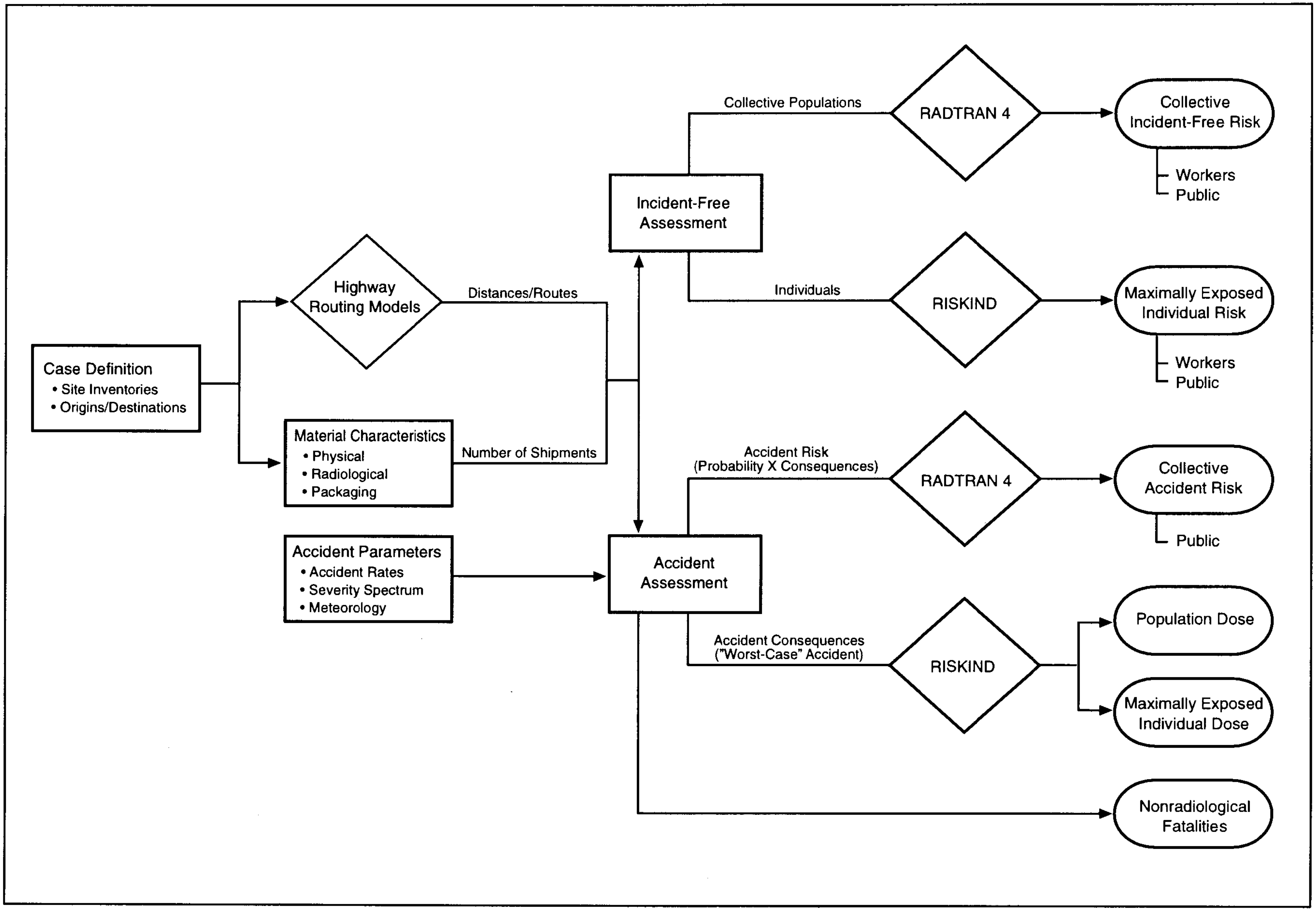

Figure L–1. Overland Transportation Risk Assessment high-probability accidents that have low consequences, and (2) an accident consequence assessment that considers only the consequences of the most severe transportation accidents postulated.

The RADTRAN 4 computer code (Neuhauser and Kanipe 1995) is used for incident-free and accident risk assessments to estimate the impacts on collective populations. RADTRAN 4 was developed by Sandia National Laboratories to calculate population risks associated with the transportation of radioactive materials by a variety of modes, including truck, rail, air, ship, and barge.

The RADTRAN 4 population risk calculations take into account both the consequences and probabilities of potential exposure events. The collective population risk is a measure of the total radiological risk posed to society as a whole by the alternative being considered. As such, the collective population risk is used as the primary means of comparing the various alternatives. The RISKIND computer code (Yuan et al. 1995) is used to estimate the incident-free doses to maximally exposed individuals and for estimating impacts for the accident consequence assessment. The RISKIND computer code was developed for DOE's Office of Civilian Radioactive Waste Management to analyze the exposure of individuals during incident-free transportation. In addition, the RISKIND code was designed to allow a detailed assessment of the consequences to individuals and population subgroups from severe transportation accidents under various environmental settings.

The RISKIND calculations were conducted to supplement the collective risk results calculated with RADTRAN 4. Whereas the collective risk results provide a measure of the overall risks of each alternative, the RISKIND calculations are meant to address areas of specific concern to individuals and population subgroups. Essentially, the RISKIND analyses are meant to address "What if" questions, such as "What if I live next to a site access road?" or "What if an accident happens near my town?"

If highly specialized analytic codes had been used to model SST/SGT behavior in an accident (*DOE-Developed Analysis of Dispersal Risk Occurring in Transportation* or ADROIT [Clauss et al. 1995:689–696]), the code would have provided a probabilistic risk analysis of special nuclear materials shipped in an SST/SGT. ADROIT is designed to provide a focused analysis of a release caused by partial detonation of explosive material. The approach and the code could be tailored for the materials shipped as part of the surplus plutonium disposition program. However, detailed thermal and mechanical models have not been created for most of the packages used in the SPD EIS.

L.5 ALTERNATIVES, PARAMETERS, AND ASSUMPTIONS

The transportation risk assessment is designed to ensure—through uniform and judicious selection of models, data, and assumptions—that relative comparisons of risk among the various alternatives are meaningful. The major input parameters and assumptions used in the transportation risk assessment are discussed below.

L.5.1 Transportation Alternatives

The proposed action would involve transporting plutonium and other nuclear materials between DOE and commercial sites. Except for the No Action Alternative, each alternative in the SPD EIS has extensive and unique requirements for the transportation of hazardous materials. In this section, the assumptions and logic used to model the intersite transportation requirements are described.

Alternatives 2 through 12 require transporting plutonium metal and pits from various DOE sites to the pit conversion facility at Hanford, INEEL, Pantex, or SRS. The pit conversion facility would disassemble pits and convert the plutonium metal into plutonium dioxide. During the pit disassembly process, HEU would be recovered and shipped from the pit conversion facility to the Y–12 facility at Oak Ridge. In addition, some pit parts would be recovered and shipped to LANL. The plutonium dioxide would be shipped to the MOX facility or the immobilization facility depending on the alternative. In many of the alternatives, the pit conversion facility is located on the same site as the MOX facility or immobilization facility, limiting the need for intersite transportation of the plutonium dioxide. In these alternatives, the plutonium dioxide would be transported between the facilities via a secure tunnel between the facilities.

In addition to reducing the number of trips required and the distance that would have to be traveled to transport surplus pits to the pit conversion facility, by placing the pit conversion facility at Pantex the dose associated with repackaging pits for intersite shipment could be reduced by nearly 40 percent. This is because pits can be transferred to the pit conversion facility at Pantex in their current storage containers (mainly the AL–R8 container) without having to be repackaged. If the pits are transported to another site, they have to be moved to a shipping container (e.g., FL-type, 9975).

Based on estimates presented in the *Final EIS for the Continued Operation of Pantex and Associated Storage of Nuclear Weapons Components (Pantex Sitewide EIS)* (DOE 1996c), about 50 workers would be needed to repackage approximately 13,000 pits from their current storage containers into containers that could also be used for shipping.[1] Work is currently under way to repackage pits from the AL–R8 container into the AL–R8 sealed insert (SI) container as discussed in the *Supplement Analysis for the Final Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapons Components—AL–R8 Sealed Insert Container* (DOE 1998). This effort could be completed over 10 years, and the estimated annual dose received from repackaging activities would be about 208 mrem per worker (Low 1999). By locating the pit conversion facility at Pantex, it is expected that the additional dose associated with repackaging the surplus pits into shipping containers could be avoided. This would effectively reduce the total expected dose for these activities by 50 percent. If the pit conversion facility were sited at Pantex, the pits would be slowly moved from storage locations in storage containers on specially designed vehicles to the pit conversion facility instead of having to be put into offsite shipping containers. Over the 10-year operating life of the pit conversion facility, this would reduce the total estimated dose to involved Pantex transportation and staging workers by 104 person-rem from 208 person-rem to 104 person-rem.[2] Under either scenario, the estimated number of excess cancer fatalities associated with repackaging activities would be 0.1 or less.

In August 1998, DOE prepared a supplement analysis (DOE 1998) for the *Pantex Sitewide EIS* that compares all environmental impact parameters to those analyzed in the *Pantex Sitewide EIS* and final determinations made in the Record of Decision that was signed on January 17, 1997, with respect to the use of the AL–R8 SI. Results of the analysis indicated that both the AT–400A container and the modified AL–R8 container, or AL–R8 SI, comply with the latest pit storage specifications to provide an improved storage environment for the pits and would be considered feasible solutions to long-term pit storage at Pantex. The containers were further analyzed with respect to the parameters established in the *Pantex Sitewide EIS* for public, personnel, and environmental impact potential. Based on conclusions drawn from this analysis, DOE concluded that the use of the AL–R8 SI containers does not constitute new circumstances or information or substantial change in the proposed action relevant to environmental concerns; therefore, no supplemental EIS, no new EIS, nor further NEPA documentation is required.

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[1] In the analysis presented in the *Pantex Sitewide EIS* (DOE 1996c), pits are assumed to be repackaged in AT–400A containers. The amount of effort involved in repackaging a pit in an AT–400A container is more intense than the effort needed to repackage a pit in an FL-type container or equivalent; therefore, the doses would be expected to be higher. Since the *Pantex Sitewide EIS* was completed, it has been decided that surplus pits would not be repackaged in AT–400A containers. As a result, the dose estimates associated with repackaging pits as presented in the *Pantex Sitewide EIS* are conservatively high for the SPD EIS. No effort has been made to reestimate the dose associated with repackaging pits. The doses presented in the SPD EIS are based on using the AT–400A container, and therefore represent upper bounds on the expected dose to involved workers.

[2] Extremity doses are estimated to be approximately nine times higher than the whole body dose, but would be expected to stay within DOE’s administrative limit of 2 rem/yr, or in the case at Pantex, 5 rem/yr (Low 1999).

Alternatives 2 through 12 involve immobilization of nonpit plutonium at Hanford (Alternative 2, 4, 8, 10, or 11) or SRS (Alternative 3, 5, 6, 7, 9, or 12). This material would be transported from its current location at various DOE sites to the chosen immobilization facility. If the immobilization facility uses a ceramic process, uranium oxide would be required. One of the United States Enrichment Corporation's gaseous diffusion plants would fill cylinders with depleted uranium hexafluoride, which would be transported to a commercial facility for conversion to uranium oxide. (For the purpose of this analysis, the gaseous diffusion plant in Portsmouth, Ohio, and the nuclear fuel fabrication facility in Wilmington, North Carolina, were chosen as representative sites for these activities.) The uranium oxide would be transported to the immobilization facility at Hanford or SRS. After the material is immobilized, it is assumed that the additional canisters of high level waste would be shipped to a potential geologic repository consistent with the assumptions made in the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (WM PEIS) (DOE 1997a). Figure L–2 shows the transportation requirements for the proposed immobilization disposition activities.

The production of MOX fuel (Alternatives 2 through 10) requires transporting plutonium dioxide from the pit conversion facility to the MOX facility at Hanford, INEEL, Pantex, or SRS. However, in every alternative except Alternatives 4 and 5, the pit conversion facility and MOX facility are collocated so there would not be any intersite transportation required for the plutonium dioxide as discussed above. In the case of Alternative 4, the pit conversion facility would be located at Pantex and the plutonium dioxide would be shipped to Hanford. Under Alternative 5, the pit conversion facility would also be at Pantex but the plutonium dioxide would be shipped to SRS. Uranium oxide needed to produce MOX fuel would be converted from uranium hexafluoride, originally from Portsmouth, at Wilmington, and then transported to the MOX facility. If MOX fuel rods are bundled with low-enriched uranium fuel rods, the uranium fuel rods may come from a separate fabrication facility. Transportation of the uranium fuel rods to the MOX facility is equivalent to transportation of uranium fuel to a commercial reactor site. This transportation activity is covered under the *Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes* (NRC 1977). The MOX fuel would be transported to a domestic, commercial reactor for power production. For the purposes of this analysis, all MOX fuel was assumed to be transported to North Anna, the commercial reactor farthest from the MOX facility. Because the proposed reactor sites are in the same general area of the country, this approach closely models the risk of implementing each alternative. Figure L–3 shows the transportation requirements for the proposed MOX disposition activities.

Alternatives 2 through 10 include the production of MOX fuel. If this alternative is chosen by DOE, lead assembly fabrication and irradiation may precede the actual production of MOX fuel. Plutonium dioxide at LANL would be shipped to one of five DOE facilities (Argonne National Laboratory–West [ANL–W], Hanford, LLNL, LANL, or SRS). Low-enriched uranium (LEU) oxide would be produced from LEU hexafluoride, originally from Portsmouth, at Wilmington, and then transported to the lead assembly fabrication facility. From the fabrication facility, the MOX fuel lead assemblies would be transported overland to the McGuire reactor. After irradiation in the reactor, the MOX spent fuel lead assemblies would be transported to a DOE site (either ANL–W or Oak Ridge National Laboratory) for postirradiation examination. Figure L–4 shows the transportation requirements for the proposed lead assembly activities.

Table L–1 shows the container type, vehicle type, and number of shipments required for each material form. This table can be used along with Figures L–2 through L–4 to determine which shipments and how many shipments are required for each alternative. The container type and vehicle type are based on currently available containers, and current practices, regulations, and DOE Orders. If a MOX production alternative is selected, DOE would have to design and construct a container to transport MOX fuel to the commercial, domestic reactor. The estimated number of shipments is based on the best available information and could change slightly as material is prepared for transportation.

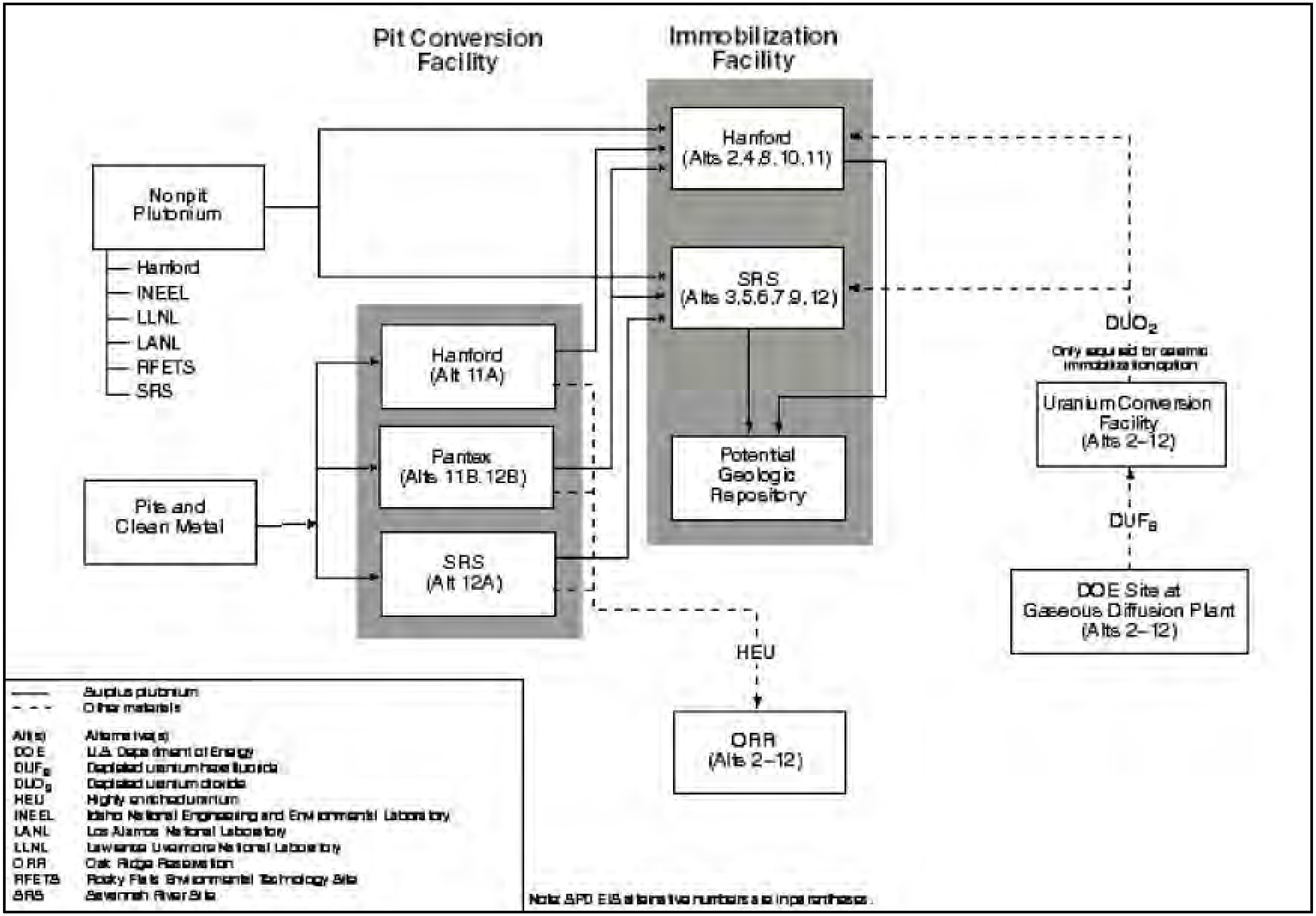
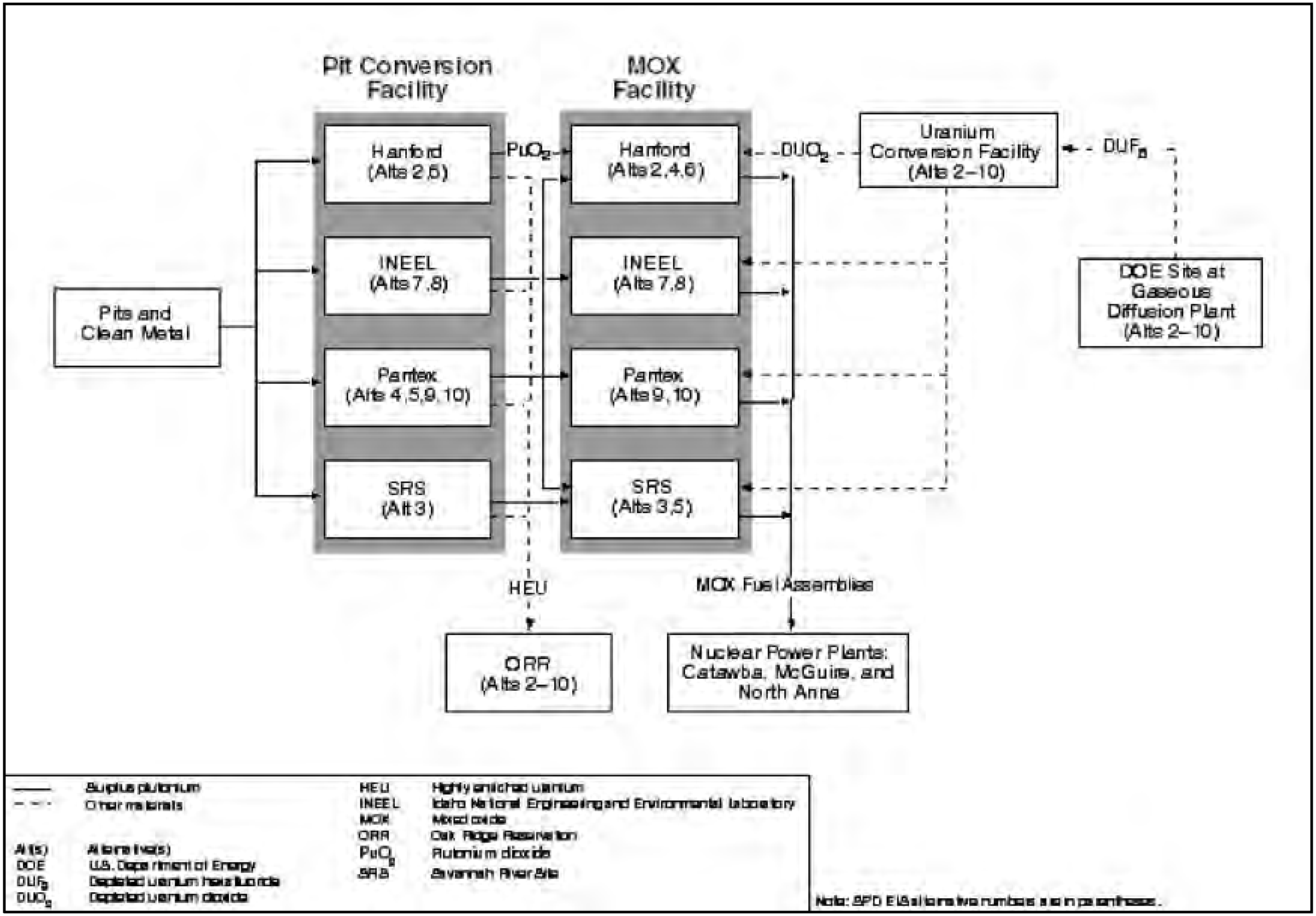


Figure L–2. Transportation Requirements for Plutonium Conversion and Immobilization



Note: SPD EIS alternative numbers are in parentheses.

Figure L–3. Transportation Requirements for MOX Fuel Fabrication

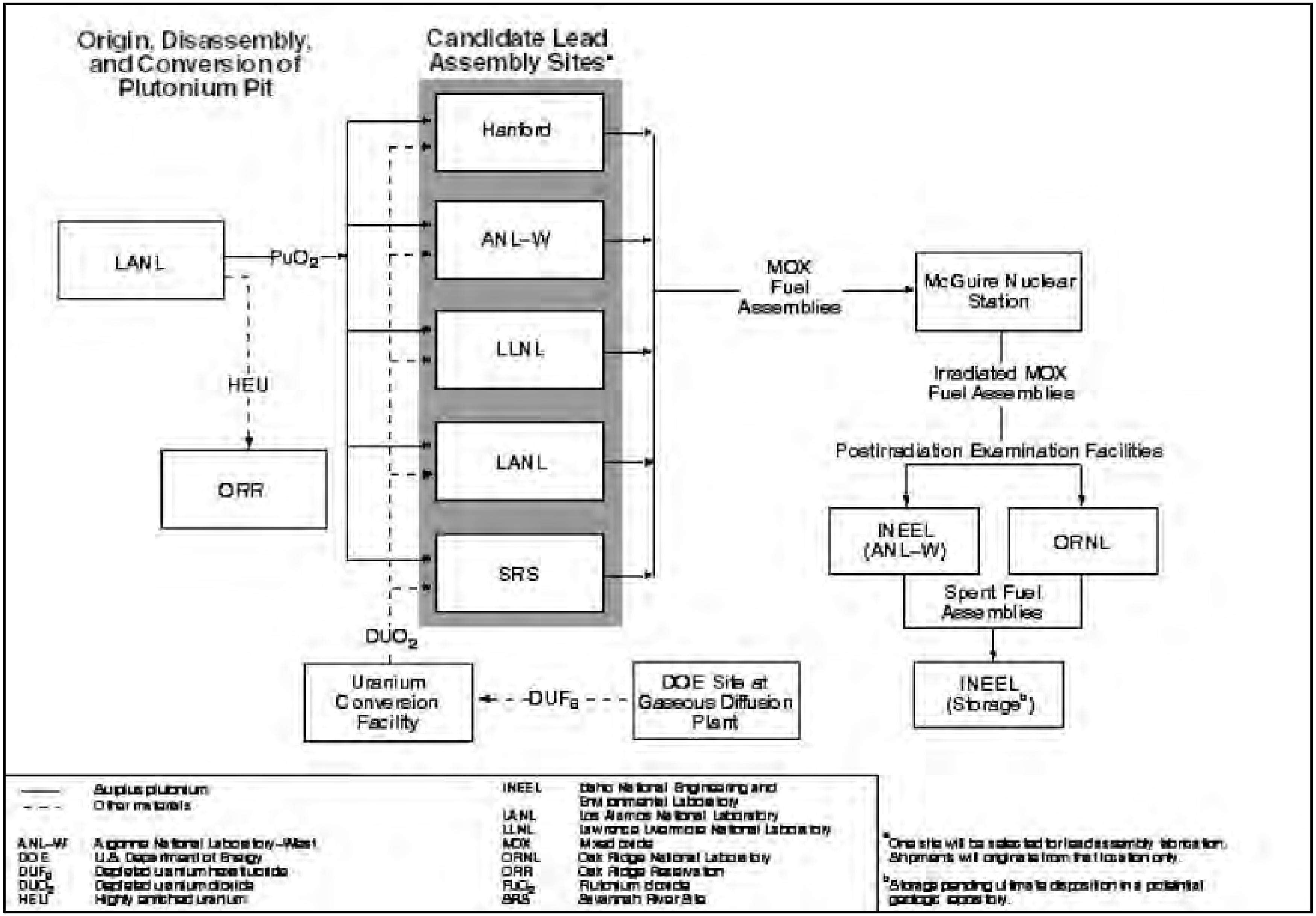


Figure L–4. Transportation Requirements for Lead Assembly Fabrication

Table L–1. Summary of Material Shipments

Origin	Destination	Material Form	Container	Vehicle	No. of Shipments
Surplus plutonium [a,b]					
Pantex	PDCF	Pits	To be designed	SST/SGT	530
Hanford	Immobilization	Oxide	9975	SST/SGT	104
		FFTF pins	M60	SST/SGT	13
		FFTF assemblies	RRSC	SST/SGT	14
ANL–W	Immobilization	ZPPR plates	9975	SST/SGT	116
		ZPPR pins	9975	SST/SGT	40
SRS	Immobilization	SRS material	9975	SST/SGT	48
LANL	Immobilization	Oxide	SAFEKEG	SST/SGT	7
		Metal	SAFEKEG	SST/SGT	4
LLNL	Immobilization	Various	9975	SST/SGT	8
RFETS	Immobilization	Oxide	9975	SST/SGT	104
Pit conversion facility [a,b]					
PDCF	Y–12	HEU	DT-22	SST/SGT	160
PDCF	LANL	Piece parts	UC-609	SST/SGT	20
PDCF	LANL	Piece parts	9968	SST/SGT	10
PDCF	Immobilization or MOX facility	Oxide	SAFEKEG	SST/SGT	254
Immobilization facility					
GDP	UO_2 facility	UF_6(c)	30B cylinder	Commercial	2/2(d)
UO_2 facility	Immobilization	UO_2(c)	55-gal drum	Commercial	2/5(d)
Immobilization	Potential geologic repository	Vitrified HLW[b]	TRUPACT	Commercial	145/395(d)
MOX facility [e]					
GDP	UO_2 facility	UF_6(c)	30B	Commercial	80
UO_2 facility	MOX facility	UO_2(c)	55-gal drum	Commercial	60
MOX facility	Reactors	MOX fuel bundles [a,b]	To be designed	SST/SGT	830
Lead assembly fabrication facility[f]					
LANL	Lead assembly	Pu oxide	SAFEKEG	SST/SGT	12
GDP	UO_2 facility	UF_6	30B cylinder	Commercial	1
UO_2 facility	MOX facility	UO_2	55-gal drum	Commercial	2
MOX facility	Reactors	MOX fuel bundles	MO-1	SST/SGT	4
Reactor	Examination site	Irradiated fuel	Type -B	Commercial	8

[a] From Didlake 1998.

[b] From UC 1998a–h, 1999a–d.

[c] From White 1997.

[d] 17-ton cases/50-ton cases.

[e] Some equipment for the MOX facility may be manufactured in Europe and shipped to the United States. No nuclear or radiologically contaminated materials would be transported. Any such shipments would be made by commercial vessel, and no impacts other than those occurring from routine commercial shipping would be expected.

[f] From O'Connor et al. 1998a–e.

Key: ANL–W, Argonne National Laboratory–W; FFTF, Fast Flux Test Facility; GDP, Gaseous Diffusion Plant; HEU, highly enriched uranium; HLW, high-level waste; LANL, Los Alamos National Laboratory; LLNL, Lawrence Livermore National Laboratory; PDCF, pit disassembly and conversion facility; Pu, plutonium; RFETS, Rocky Flats Environmental Technology Site; SST/SGT, safe, secure trailer/SafeGuards Transport; UF_6, uranium hexafluoride; UO_2, uranium dioxide; ZPPR, Zero Power Physics Reactor.

L.5.2 Representative Routes and Populations

Representative overland truck routes were selected for the origin and destination points identified in Figures L–2, L–3, and L–4 are shown in Table L–2. The routes (which were determined for risk assessment purposes) were selected consistent with current routing practices and all applicable routing regulations and guidelines. They do not necessarily represent the actual routes that would be used to transport plutonium and other hazardous materials in the future. Details about a planned shipment cannot be identified in advance, as explained in Appendix L.3.3.

Route characteristics that are important to the radiological risk assessment include the total shipment distance and the population distribution along the route. The specific route selected determines both the total potentially exposed population and the expected frequency of transportation-related accidents. Route characteristics are summarized in Table L–2. The population densities along each route are derived from 1990 U.S. Bureau of the Census data and projected forward to the year 2010 using State-specific projections. Rural, suburban, and urban areas are characterized according to the following breakdown: rural population densities range from 0 to 54 persons per square kilometer (0 to 139 person per square mile); the suburban range is from 55 to 1,284 persons per square kilometer (140 to 3,326 persons per square mile); and the urban includes all population densities greater than 1,284 persons per square kilometer (3,326 persons per square mile). The exposed population includes all persons living within 800 m (0.5 mi) of each side of the road.

L.5.3 Distance Traveled by Alternative

Table L–3 shows the number of shipments, the total mileage traveled by the trucks carrying nuclear materials, and the affected populations. The affected population is designed to show the number of people potentially exposed to nuclear material shipments. The measure is calculated by multiplying the number of shipments by the number of people living within 800 m (0.5 mi) of the route used to transport the material. The highest possible lead test assembly mileages and populations from Table L–3 are used in the alternative totals. The number of trips in Table L–3 comes from the SPD EIS data reports (UC 1998a–h, 1999a–d).

[Text deleted.]

L.5.4 Shipment External Dose Rates

The dose and corresponding risk to populations and maximally exposed individuals during incident-free transportation conditions are directly proportional to the assumed shipment external dose rate. The Federal regulations for maximum allowable dose rates for exclusive-use shipments were presented in Appendix L.3.1.

The actual shipment dose rate is a complex function of the composition and configuration of shielding and containment used in the cask, the geometry of the loaded shipments, and characteristics of the material shipped. DOE has years of experience handling the materials that would be required to be shipped under the alternatives assessed in the SPD EIS, and has regularly conducted radiation level measurements while handling these materials. The maximum predicted dose from individual packages, based on experience at DOE facilities, would yield a dose rate less than the Federal regulatory limit in every case. Spent nuclear fuel and nonpit plutonium were conservatively assumed to have dose rates equal to the regulatory limit of 10 mrem/hr at 2 m (6.6 ft) from the vehicle. This DOE experience was used in the preparation of the dose rates given in the data reports (UC 1998a–h, 1999a–d) and used in the analysis.

Table L–2. Potential Shipping Legs Evaluated in the SPD EIS

From	To	Distance (km)	Percentage in Zones			Population Density (person/km^2)			Affected Population
			Rural	Suburban	Urban	Rural	Suburban	Urban	
ANL–W	INEEL	34	100	0	0	2	0	0	84
ANL–W	Hanford	1,035	91.7	7.6	0.6	9	570	2,883	113,482
ANL–W	Pantex	2,395	90.1	8.3	1.6	6	561	2,963	380,038
ANL–W	SRS	3,756	82.8	15.4	1.8	9	453	2,787	767,529
Hanford	INEEL	967	91.6	7.9	0.6	8	559	2,898	107,214
Hanford	ORR	3,981	87.6	11.1	1.3	8	461	2,830	604,916
Hanford	Pantex	3,032	90.6	8.0	1.4	6	574	2,979	450,511
Hanford	Onsite	24	100	0	0	10	0	0	538
Hanford	Geologic repository[a]	1,907	87.8	10.3	1.9	4	485	2,098	397,534
Hanford	LANL	2,511	90.2	8.6	1.2	6	569	2,952	361,442
INEEL	SRS	3,719	82.7	15.4	1.8	9	450	2,788	757,940
INEEL	ORR	3,312	86.7	11.9	1.4	8	437	2,778	518,875
INEEL	LANL	1,841	89.6	9.1	1.4	6	553	2,962	286,387
LANL	Pantex	647	90.7	6.8	2.5	6	676	3,061	132,446
LANL	LLNL	1,218	88.8	7.8	3.4	5	634	3,634	346,679
LANL	INEEL	1,841	89.6	9.1	1.4	6	553	2,962	286,387
LANL	Hanford	2,511	90.2	8.6	1.2	6	569	2,952	361,442
LANL	SRS	2,787	80.8	16.9	2.4	12	455	2,786	684,441
LANL	ORR	2,390	85.8	12.3	1.9	10	435	2,764	439,696
LANL	ANL–W	1,873	89.1	9.5	1.4	4.5	386	2,085	296,222
LLNL	Hanford	1,429	76.0	20.5	3.5	12	487	2,868	478,115
LLNL	INEEL	1,566	85.7	10.3	4.0	6	713	3,546	552,834
LLNL	Pantex	2,327	89.8	6.7	3.5	5	674	3,525	643,591
LLNL	SRS	4,416	80.6	16.4	3.0	10	482	3,165	1,284,987
LLNL	NTS	1,143	85.8	8.6	5.6	5	716	3,771	506,575
Pantex	ORR	1,762	84.4	14.0	1.6	12	392	2,657	302,418
Pantex	SRS	2,169	78.1	19.6	2.3	14	426	2,706	543,092
Pantex	INEEL	2,363	90.2	8.2	1.6	6	561	2,988	373,420
Pantex	WIPP	713	93.1	6.0	0.8	4	697	2,631	75,392
Pantex	NTS	1,997	94.0	4.8	1.2	4	634	3,086	228,159
Pantex	LANL	647	90.7	6.8	2.5	6	676	3,061	132,446
Portsmouth, OH	Fuel fabrication[b]	1,014	63.5	34.6	1.7	20	380	2,446	301,445
RFETS	INEEL	1,178	91.4	7.4	1.2	6	505	3,329	156,394
RFETS	Pantex	1,255	87.2	10.0	2.9	5	634	3,143	319,338
RFETS	Hanford	1,848	91.6	7.4	1.0	6	547	3,228	232,380
RFETS	SRS	2,609	78.1	19.3	2.5	11	439	2,741	674,965
SRS	ORR	575	68.7	30.5	0.8	18	374	2,306	132,959
SRS	Hanford	4,389	84.2	14.2	1.6	9	467	2,823	835,727
SRS	Onsite	6	100	0	0	10	0	0	134
SRS	Geologic repository[a]	3,936	83.2	19.9	1.9	9	510	3,069	893,080
SRS	LANL	2,787	80.8	16.9	2.4	12	455	2,786	684,441
Fuel fabrication[b]	SRS	581	72.8	26.8	0.3	23	301	2,202	97,034
Fuel fabrication[b]	Pantex	2,577	76.2	22.4	1.4	14	392	2,690	651,769
Fuel fabrication[b]	Hanford	4,796	82.6	16.1	1.2	10	435	2,806	856,223

Table L–2. Potential Shipping Legs Evaluated in the SPD EIS (Continued)

From	To	Distance (km)	Percentage in Zones			Population Density (person/km^2)			Affected Population
			Rural	Suburban	Urban	Rural	Suburban	Urban	
Fuel fabrication[b]	ANL–W	4,165	81.0	17.7	1.3	10	418	2,769	787,474
Fuel fabrication[b]	LLNL	4,880	82.5	15.1	2.4	10	457	3,192	1,199,169
Fuel fabrication[b]	LANL	3,201	78.0	19.8	1.6	13	413	2,766	696,023
Generic 4,000 km		4,000	84.0	15.0	1.0	6	719	3,861	969,600
Generic 5,000 km		5,000	84.0	15.0	1.0	6	719	3,861	1,212,000
Hanford	Catawba	4,498	84.5	14.1	1.3	9	447	2,776	765,850
INEEL/ANL	Catawba	3,793	83.0	15.5	1.5	9	429	2,737	697,959
SRS	Catawba	251	69.0	29.8	1.2	17	418	2,373	66,154
LANL	Catawba	2,844	81.1	17.0	1.8	11	428	2,722	595,856
LLNL	Catawba	4,539	84.3	13.1	2.6	9	477	3,167	1,105,526
Pantex	Catawba	2,243	78.6	19.7	1.7	13	397	2,626	477,319
Catawba	ORR	497	58.3	39.8	2.0	20	405	2,546	177,922
Hanford	McGuire	4,458	84.8	13.9	1.2	9	428	2,802	716,024
INEEL/ANL–W	McGuire	3,753	83.4	15.3	1.3	9	409	2,767	636,712
SRS	McGuire	296	66.4	31.6	2.1	15	441	2,438	94,828
LANL	McGuire	2,821	81.5	16.9	1.7	11	401	2,753	559,307
LLNL	McGuire	4,500	84.6	12.9	2.5	9	458	3,207	1,055,765
Pantex	McGuire	2,203	79.3	19.3	1.4	13	370	2,661	419,295
McGuire	ORR	457	59.5	39.9	0.5	21	343	2,504	118,268
Hanford	N. Anna	4,575	86.1	12.4	1.4	9	449	2,717	744,228
INEEL/ANL–W	N. Anna	3,870	85.0	13.4	1.6	10	429	2,666	671,048
SRS	N. Anna	837	72.7	26.8	0.5	21	306	2,167	145,069
LANL	N. Anna	3,117	83.6	14.7	1.7	13	397	2,711	574,877
LLNL	N. Anna	4,797	84.7	12.7	2.7	9	492	2,886	1,134,405
Pantex	N. Anna	2,499	82.0	16.6	1.4	14	364	2,619	435,744
N. Anna	ORR	753	76.3	22.7	1.0	22	317	2,503	137,224

[a] Potential geologic repository assumed to be located at Yucca Mountain, Nevada, for the purposes of analysis.

[b] Assumed to be located at Wilmington, North Carolina, for the purposes of analysis.

Key: ANL–W, Argonne National Laboratory–W; LANL, Los Alamos National Laboratory; LLNL, Lawrence Livermore National Laboratory; NTS, Nevada Test Site; ORR, Oak Ridge Reservation; RFETS, Rocky Flats Environmental Technology Site; WIPP, Waste Isolation Pilot Plant.

Table L–3. Summary of SPD EIS Transportation Requirements

Alternative	Number of Trips	Cumulative Distance (km)	Affected Population (millions)
2	2,447	7.5 M	5.4
3	2,530	4.3 M	7.0
4	2,171	6.3 M	4.9
5	2,254	3.8 M	6.7
6	2,530	8.7 M	8.5
7	2,530	7.6 M	8.1
8	2,447	6.4 M	5.3
9	2,000	4.8 M	6.4
10	1,917	3.6 M	4.2
11A	2,153	3.7 M	4.7
11B	1,877	2.5 M	4.1
12A	2,236	4.4 M	6.8
12B	1,960	3.9 M	6.4
Lead assembly			
ANL–W	27	77 K	2.5
Hanford	27	89 K	2.7
LLNL	27	73 K	3.4
LANL	15	49 K	2.1
SRS	27	67 K	1.7

Key: ANL–W, Argonne National Laboratory–W; K, thousands; LANL, Los Alamos National Laboratory; LLNL, Lawrence Livermore National Laboratory; M, million.

L.5.5 Health Risk Conversion Factors

The health risk conversion factors used to estimate expected cancer fatalities were taken from the *1990 Recommendations of the International Commission on Radiological Protection* (ICRP 1991): 0.0005 and 0.0004 fatal cancer cases per person-rem for members of the public and workers, respectively. Cancer fatalities occur during the lifetimes of the exposed populations and, thus, are called LCFs.

L.5.6 Accident Involvement Rates

For the calculation of accident risks, vehicle accident and fatality rates are taken from data provided in other reports (Saricks and Kvitek 1994). Accident rates are generically defined as the number of accident involvements (or fatalities) in a given year per unit of travel in that same year. Therefore, the rate is a fractional value, with the accident-involvement count as the numerator of the fraction and vehicular activity (total travel distance) as its denominator. Accident rates are generally determined for a multiyear period. For assessment purposes, the total number of expected accidents or fatalities is calculated by multiplying the total shipment distance for a specific case by the appropriate accident or fatality rate.

For truck transportation, the rates presented are specifically for heavy combination trucks involved in interstate commerce (Saricks and Kvitek 1994). Heavy combination trucks are rigs composed of a separable tractor unit containing the engine and one to three freight trailers connected to each other. Heavy combination trucks are typically used for radioactive waste shipments. The truck accident rates are computed for each State based on statistics compiled by the DOT Office of Motor Carriers for 1986 to 1988. Saricks and Kvitek present accident involvement and fatality counts; estimated kilometers of travel by State; and the corresponding average accident involvement, fatality, and injury rates for the 3 years investigated. Fatalities are deaths (including crew members) attributable to the accident or that occurred at any time within 30 days thereafter. SST/SGT accident rates are based on operational experience (Claus and Shyr 1999) and influence factors (Phillips et al. 1994).

L.5.7 Container Accident Response Characteristics and Release Fractions

The transportation accident model assigns accident probabilities to a set of accident categories. Eight accident-severity categories defined in the NRC's *Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes*, NUREG-0170 (NRC 1977), were used. The least severe categories (Categories I and II) represent low magnitudes of crush force, accident-impact velocity, fire duration, and puncture-impact speed. The most severe category (Category VIII) represents a large crush force, high accident-impact velocity, long fire duration, and a high puncture-impact speed. The fraction of material released and material aerosolized, and the fraction of that material that is respirable (particles smaller than 10 microns), was assigned based on the accident categories and container types. Because all plutonium shipments will use the previously described Type B containers and the SST/SGT system, even severe accidents release, at the most, a portion of the material being transported. The risks associated with other materials are significantly lower.

L.6 RISK ANALYSIS RESULTS

L.6.1 Per-Shipment Risk Factors

Per-shipment risk factors have been calculated for the collective populations of exposed persons and the crew for all anticipated routes and shipment configurations. The radiological risks are presented in doses per shipment for each unique route, material, and container combination. Doses are calculated for the crew, off-link public (i.e., people living along the route), on-link public (i.e., pedestrians and drivers along the route), and public at rest and fueling stops (i.e., stopped cars, buses, and trucks, workers, and other bystanders). The accident risk factors are called "dose risk" because the values incorporate the spectrum of accident severity probabilities and associated consequences. Separate risk factors are provided for fatalities resulting from hydrocarbon emissions (known to contain carcinogens) and transportation accidents (fatalities resulting from impact).

L.6.2 Evaluation of Shipment Risks

Tables L–4 and L–5 show the human health risks and maximum human health risks, respectively, of transporting materials for the lead assembly alternatives. As shown, the risks include the risk of transporting uranium dioxide, uranium hexafluoride, plutonium dioxide, fuel assemblies, and spent fuel. Table L–6 shows the results of similar calculations that give the risks for each alternative. The risk estimates in Table L–6 include the maximum risk for the lead assembly transportation (Alternatives 2 through 10), plutonium pit shipments, pit material shipments (HEU and nonplutonium bearing pit parts), uranium hexafluoride, uranium dioxide, fuel assemblies, and nonpit plutonium. The risks are calculated by multiplying the per-shipment factors by the number of shipments and, in the case of the radiological doses, by the health risk conversion factors.

Table L–4. Human Health Risks of Transport to Lead Assembly Facilities

	DUO_2 and LEU Fuel Assemblies From FFF					PuO_2 From LANL				
	Routine Transport Impacts					Routine Transport Impacts				
	Radiological			Accident Risks		Radiological			Accident Risks	
Site	**Crew**	**Public**	**Nonrad**[a]	**Rad**	**Nonrad**	**Crew**	**Public**	**Nonrad**[a]	**Rad**	**Nonrad**
LANL	5.6E-6	4.5E-5	2.0E-5	3.8E-4	2.5E-4	–	–	–	–	–
ANL–W	7.3E-6	5.8E-5	2.2E-5	1.6E-4	3.2E-4	2.1E-6	2.2E-6	8.2E-5	2.3E-4	1.6E-4
SRS	9.8E-7	7.9E-6	1.3E-6	1.2E-5	4.3E-5	3.2E-6	4.2E-6	2.1E-4	5.3E-4	2.3E-4
Hanford	8.4E-6	6.7E-5	2.3E-5	1.7E-4	3.7E-4	2.8E-6	2.9E-6	9.4E-5	2.8E-4	2.1E-4
LLNL	8.5E-6	6.8E-5	4.7E-5	3.4E-4	3.8E-4	1.4E-6	1.4E-6	1.3E-4	2.9E-4	1.0E-4

[a] Toxic emissions.

Key: ANL–W, Argonne National Laboratory–West; DUO_2, depleted uranium dioxide; FFF, Uranium Fuel Fabrication Facility; LANL, Los Alamos National Laboratory; LEU, low-enriched uranium; LLNL, Lawrence Livermore National Laboratory; Rad, radiological; Nonrad, nonradiological; PuO_2, plutonium dioxide; UO_2, uranium dioxide.

Note: All risks are expressed in latent cancer fatalities during the implementation of the proposed action, except for the Nonrad Accident Risks column, which is the number of fatalities.

Table L–5. Maximum Human Health Risks of Transport to Lead Assembly Facilities

	Routine Transport Impacts				
	Radiological			Accident Risks	
Shipment	**Crew**	**Public**	**Nonradiological**[a]	**Radiological**	**Nonradiological**
Depleted UO_2 and LEU fuel assemblies from FFF and PuO_2 from LANL	1.1E-5	7.0E-5	2.1E-4	6.3E-4	5.8E-4
Depleted UF_6 from gaseous diffusion plant to FFF	2.5E-8	2.0E-7	3.4E-6	5.2E-5	4.0E-5
Lead assemblies to reactor site	3.7E-7	2.2E-7	1.2E-4	2.1E-6	1.3E-4
Spent fuel to postirradiation examination site	5.5E-4	4.8E-3	7.8E-5	2.3E-3	1.2E-3

[a] Toxic emissions.

Key: FFF, Uranium Fuel Fabrication Facility; LANL, Los Alamos National Laboratory; LEU, low-enriched uranium; PuO_2, plutonium dioxide; UF_6, uranium hexafluoride; UO_2, uranium dioxide.

Note: All risks are expressed in latent cancer fatalities during the implementation of the proposed action, except for the Nonradiological Accident Risks column, which is the number of fatalities.

L.6.3 Maximally Exposed Individuals

The risks to maximally exposed individuals under incident-free transportation conditions were estimated for hypothetical exposure scenarios. The estimated dose to inspectors and the public is presented in Table L–7 on a per-event basis (person-rem per event). Note that the potential exists for individual exposures if multiple exposure events occur. For instance, the dose to a person stuck in traffic next to a shipment for 30 minutes is calculated to be 11 mrem. (This conservatively assumes the person in a car is 1.2 m [4 ft] from the edge of the truck.) If the exposure duration was longer, the dose would rise proportionally. In addition, a person working at a truck service station could receive a significant dose if trucks were to use the same stops repeatedly. The dose to a person fueling a truck could be as much as 1 mrem. Administrative controls could be instituted to control the location and duration of truck stops if multiple exposures were to occur routinely. However, it is DOE's normal practice to have SST/SGT guard force members (trained, monitored radiation workers) perform fueling and routine on-road maintenance checks (i.e., check oil or windshield wiper fluid).

Table L–6. Total Risks for All SPD EIS Alternatives

				Routine Transport Impacts			Accident Risks	
				Radiological		Nonradiological		Radiological
Alternative	**Pit Conversion**	**MOX**	**Immobilization**	**Crew**	**Public**	**Emission**	**Traffic**	**Accident**
2	Hanford	Hanford	Hanford	0.012	0.020	0.025	0.074	0.004
3	SRS	SRS	SRS	0.024	0.034	0.019	0.053	0.004
4	Pantex	Hanford	Hanford	0.012	0.020	0.021	0.065	0.004
5	Pantex	SRS	SRS	0.024	0.033	0.016	0.050	0.004
6	Hanford	Hanford	SRS	0.024	0.035	0.033	0.091	0.004
7	INEEL	INEEL	SRS	0.024	0.035	0.032	0.083	0.004
8	INEEL	INEEL	Hanford	0.012	0.020	0.024	0.065	0.003
9	Pantex	Pantex	SRS	0.024	0.034	0.019	0.052	0.004
10	Pantex	Pantex	Hanford	0.012	0.019	0.012	0.043	0.003
11A	Hanford	NA	Hanford	0.027	0.036	0.011	0.054	0.0003
11B	Pantex	NA	Hanford	0.027	0.036	0.007	0.045	0.0007
12A	SRS	NA	SRS	0.057	0.074	0.021	0.081	0.0006
12B	Pantex	NA	SRS	0.057	0.073	0.018	0.078	0.0012

Key: NA, not applicable.

Note: All risks are expressed in latent cancer fatalities during the implementation of the proposed action, except for the Nonradiological Accident Risks column, which is the number of fatalities.

Table L–7. Estimated Dose to Maximally Exposed Individuals During Incident-Free Transportation Conditions[a,b]

Receptor	Dose to Maximally Exposed Individual
Workers	
Crew member	0.1 rem/yr[c]
Inspector	0.0029 rem/event
Public	
Resident	4.0×10^{-7} rem/event
Person in traffic construction	0.011 rem/event
Person at service station	0.001 rem/event

[a] The exposure scenario assumptions are described in Appendix L.6.3.

[b] Doses are calculated assuming that the shipment external dose rate is equal to the maximum expected dose 10 mrem/hr at 2 m (6.6 ft) from the package.

[c] Dose to truck drivers could exceed the legal limit of 100 mrem/yr in the absence of administrative controls.

The cumulative dose to a resident was calculated assuming all shipments passed his or her home. The cumulative doses assume that the resident is present for every shipment and is unshielded at a distance of 30 m (98 ft) from the route. Therefore, the cumulative dose is only a function of the number of shipments passing a particular point and is independent of the actual route being considered. The maximum dose to this resident, would be about 1 mrem. The annual individual dose can be estimated by assuming that shipments would occur uniformly over a 15-year time period.

The accident consequence assessment is intended to provide an estimate of the maximum potential impacts posed by the most severe potential transportation accidents involving a shipment. The accident consequence results are presented in Table L–8 for the maximum severity accidents involving plutonium dioxide shipments, and Table L–9 for maximum severity accidents involving plutonium pits. Table L–8 applies to alternatives in which the pit conversion facility is located at Pantex, and large amounts of plutonium dioxides are shipped to a MOX or conversion facility. Table L–9 applies to alternatives in which plutonium pits and metals are shipped to a pit conversion facility at a site other than Pantex. In either table, the accident frequency in rural locations is about 1×10^{-7}per year (once in 10 million years). The frequency of accidents in urban and suburban zones was evaluated. Accidents are much less likely to occur in urban and suburban zones because the total distance traveled is much lower than in rural zones. The impacts represent the most severe accidents hypothesized.

Table L–8. Estimated Dose to the Population and to Maximally Exposed Individuals During the Most Severe Accident Conditions (Plutonium Dioxide)[a, b]

	Neutral Conditions[c]				**Stable Conditions[f]**			
	Population[d]		**Maximally Exposed Individual[e]**		**Population[d]**		**Maximally Exposed Individual[e]**	
Mode and Accident Location	**Dose (person-rem)**	**Consequences (Cancer Fatalities)**	**Dose (rem)**	**Consequences (Probability of Cancer Fatality)**	**Dose (person-rem)**	**Consequences (Cancer Fatalities)**	**Dose (rem)**	**Consequences (Probability of Cancer Fatality)**
Truck								
Urban	228,760	114	684	0.68	40,420	20.2	23.2	0.023
Suburban	49,880	25	684	0.68	8,815	4.4	23.2	0.023
Rural	624	0.31	684	0.68	581	0.29	23.2	0.023

[a] The most severe accidents correspond to the NUREG-0170 accident severity Category VIII (NRC 1977).

[b] Buoyant plume rise resulting from fire for a severe accident was included in the exposure model.

[c] Neutral weather conditions result in moderate dispersion and dilution of the release plume. Neutral conditions were taken to be Pasquill stability Class D with a wind speed of 4 m/sec (9 mph). Neutral conditions occur approximately 50 percent of the time in the United States.

[d] Populations extend at a uniform density to a radius of 80 km (50 mi) from the accident site. Population exposure pathways include acute inhalation, acute cloudshine, groundshine, resuspended inhalation, resuspended cloudshine, and ingestion of food, including initially contaminated food (RISKIND assumes that all food is grown in rural areas) (Yuan et al. 1995). It is assumed that decontamination or mitigative actions are taken.

[e] The maximally exposed individual is assumed to be at the location of maximum exposure. The locations of maximum exposure would be 100 m (330 ft) and 500 m (1,650 ft) from the accident site under neutral and stable atmospheric conditions, respectively. Individual exposure pathways include acute inhalation, acute cloudshine, and groundshine during passage of the plume. No ingested dose is considered. Note that the maximally exposed individual receives more dose than the population in a rural location. This analytic phenomena is caused by probabilistic calculations. It is very unlikely that an individual will be nearby in a rural population zone.

[f] Stable weather conditions result in minimal dispersion and dilution of the release plume and are thus unfavorable. Stable conditions were taken to be Pasquill stability Class F with a wind speed of 1 m/sec (2.2 mph). Stable conditions occur approximately one-third of the time in the United States.

The hypothetical accidents described in Tables L–8 and L–9 involve either a long-term fire or tremendous impact or crushing forces. In the case of crushing forces, a fire would have to be burning in order to spread the plutonium as modeled. These accidents are assumed to cause a ground-level release of 10 percent of the radioactive material in the truck. These accidents are more likely on rural interstates where speeds are higher and where the vehicles spend most of their travel time. NUREG-0170 (NRC 1977) describes the analytic approach in more detail.

The population doses are for a uniform population density within an 80-km (50-mi) radius (Neuhauser and Kanipe 1995). The location of the maximally exposed individual is determined based on atmospheric conditions at the time of the accident and the buoyant characteristics of the released plume. The locations of maximum exposure would be 100 m (330 ft) and 500 m (1,650 ft) from the accident site for neutral (average) and stable conditions, respectively. The dose to the maximally exposed individual is independent of the location of the accident. No acute or early fatalities would be expected from radiological causes.

Table L–9. Estimated Dose to the Population and to Maximally Exposed Individuals During the Most Severe Accident Conditions (Plutonium Pits)[a, b]

	Neutral Conditions [c]				Stable Conditions[f]			
	Population[d]		Maximally Exposed Individual[e]		Population[d]		Maximally Exposed Individual[e]	
Mode and Accident Location	Dose (person-rem)	Consequences (Cancer Fatalities)	Dose (rem)	Consequences (Probability of Cancer Fatality)	Dose (person-rem)	Consequences (Cancer Fatalities)	Dose (rem)	Consequences (Probability of Cancer Fatality)
Truck								
Urban	31,920	16	96	0.096	5,640	2.8	3.3	0.0016
Suburban	6,960	3.5	96	0.096	1,230	0.62	3.3	0.0016
Rural	87	0.044	96	0.096	81	0.041	3.3	0.0016

[a] The most severe accidents correspond to the NUREG-0170 accident severity Category VIII (NRC 1977).

[b] Buoyant plume rise resulting from fire for a severe accident was included in the exposure model.

[c] Neutral weather conditions result in moderate dispersion and dilution of the release plume. Neutral conditions were taken to be Pasquill stability Class D with a wind speed of 4 m/sec (9 mph). Neutral conditions occur approximately 50 percent of the time in the United States.

[d] Populations extend at a uniform density to a radius of 80 km (50 mi) from the accident site. Population exposure pathways include acute inhalation, acute cloudshine, groundshine, resuspended inhalation, resuspended cloudshine, and ingestion of food, including initially contaminated food (RISKIND assumes that all food is grown in rural areas) (Yuan et al. 1995). It is assumed that decontamination or mitigative actions are taken.

[e] The maximally exposed individual is assumed to be at the location of maximum exposure. The locations of maximum exposure would be 100 m (330 ft) and 500 m (1,650 ft) from the accident site under neutral and stable atmospheric conditions, respectively. Individual exposure pathways include acute inhalation, acute cloudshine, and groundshine during passage of the plume. No ingested dose is considered. Note that the maximally exposed individual receives more dose than the population in a rural location. This analytic phenomena is caused by probabilistic calculations. It is very unlikely that an individual will be nearby in a rural population zone.

[f] Stable weather conditions result in minimal dispersion and dilution of the release plume and are thus unfavorable. Stable conditions were taken to be Pasquill stability Class F with a wind speed of 1 m/sec (2.2 mph). Stable conditions occur approximately one-third of the time in the United States.

L.6.4 Waste Transportation

Under all of the alternatives being considered in the SPD EIS, some transportation would be required to support routine shipments of wastes from the proposed surplus plutonium disposition facilities to treatment, storage, or disposal facilities located on the sites. All DOE sites have plans and procedures for handling and transporting waste. This transportation would be handled in the same manner as other site waste shipments and would not represent a large increase in the amount of wastes generated at these sites. The shipments would not represent any additional risks beyond the ordinary waste shipments at these sites, as analyzed in the WM PEIS (DOE 1997a).

However, in four specific cases, waste would be generated that is not covered in the WM PEIS (DOE 1997a): (1) transuranic (TRU) waste generated at Pantex from the pit conversion facility; (2) low-level waste (LLW) generated at Pantex from the pit conversion facility; (3) LLW generated at Pantex from the MOX facility, and (4) LLW generated at LLNL during lead assembly fabrication.

TRU waste generated at Pantex was not covered by the WM PEIS Record of Decision (ROD) because there was no TRU waste at Pantex at the time the ROD was issued, and none was anticipated to be generated by ongoing site operations. Location of the pit conversion and MOX facilities at Pantex would result in the generation of TRU waste as described in Section 4.17.2.2 of the SPD EIS. Shipment of TRU waste to WIPP was analyzed using the methodology and parameters found in Appendix E of the Waste Isolation Pilot Plant *Disposal Phase Final Supplemental Environmental Impact Statement* (DOE 1997b). In order to support the transportation of TRU waste from Pantex to WIPP, 76 additional shipments were analyzed in the SPD EIS.

A fairly large increase in the amount of LLW (i.e., 25 percent of the site's current storage capacity) would be expected if the pit conversion facility were located at Pantex. Currently, this type of waste is shipped to the Nevada Test Site (NTS) for disposal. In order to support the transportation of pit conversion facility LLW from Pantex to NTS, 21 additional shipments were analyzed in the SPD EIS. The impacts were calculated from LLW transportation impacts presented in the WM PEIS (DOE 1997a).

An additional increase in the amount of LLW (i.e., 14 percent, for a total of 39 percent of the site's current storage capacity) would be expected if the pit conversion and MOX facilities are located at Pantex. Currently, this type of waste is shipped to NTS for disposal. In order to support the transportation of MOX LLW from Pantex to NTS, 38 additional shipments have been analyzed in the SPD EIS. The impacts were calculated from LLW transportation impacts presented in the WM PEIS (DOE 1997a).

Further, an increase in the LLW at LLNL would be expected if the lead assembly were done at LLNL. Currently, this type of waste is shipped to NTS for disposal. In order to support transportation of lead assembly LLW from LLNL to NTS, 44 additional shipments were analyzed in the SPD EIS. The impacts were calculated from LLW transportation impacts presented in the WM PEIS (DOE 1997a). Table L–10 shows the impacts of transporting LLW and TRU waste. The radiological risks to the public are larger for TRU than for LLW because of the larger amount of radioactive material in TRU. The dose to the crew are about the same, because the truck carrying TRU would require some shielding or spacing to ensure that the dose rate to the truck crew is less than 2 mrem/hr.

Table L–10. Impacts of Transporting LLW and Transuranic Waste

					Routine Transport Impacts			**Accidental Risks**	
					Radiological		**Nonradiological**		**Radiological**
Waste Type	**Origin**	**Destination**	**Trips**	**Kilometers Traveled**	**Crew**	**Public**	**Emission**	**Traffic**	
LLW	Pantex, pit conversion facility	NTS	38	76,000	0.0011	0.0015	0.00018	0.0029	5.8×10^{-7}
LLW	Pantex, MOX	NTS	21	42,000	0.0006	0.0008	0.00010	0.0016	3.2×10^{-7}
LLW	LLNL	NTS	44	50,000	0.0007	0.0010	0.00056	0.0020	3.8×10^{-7}
TRU	Pantex, pit conversion facility	WIPP	76	54,000	0.0008	0.0025	0.00013	0.0015	1.1×10^{-6}

Key: LLNL, Lawrence Livermore National Laboratory; LLW, low-level waste; NTS, Nevada Test Site; TRU, transuranic; WIPP, Waste Isolation Pilot Plant.

Note: All risks are expressed in latent cancer fatalities during the implementation of the proposed actions except for the Nonradiological Accidental Traffic column, which is the number of fatalities.

L.6.5 Consequences of Sabotage or Terrorist Attack During Transportation

This section provides an evaluation of impacts that could potentially result from a malicious act on a shipment of hazardous or radioactive material during transportation. In no instance, even in severe cases such as those discussed below, could a nuclear explosion or permanent contamination of the environment leading to condemnation of land occur. Because of the Transportation Safeguards System described in Appendix L.3.2, DOE considers sabotage or terrorist attack on an SST/SGT to be unlikely enough such that no further risk analysis is required.

DOE analyzed the nonproliferation aspects (DOE 1997c) of the transportation associated with the alternatives in the SPD EIS. In this study, DOE realized that all plutonium disposition alternatives under consideration would involve processing and transport of plutonium, which will involve more risk of theft in the short term than if the material had remained in heavily guarded storage, in return for the long-term benefit of converting the material to more proliferation-resistant forms. DOE intends to use the same SST/SGTs for these shipments that are used for shipment of intact nuclear weapons, with similar security forces and other measures. The level of assurance against possible attack during transportation can be increased to essentially any desired level by applying more resources such as money, security forces, or technology. DOE concluded that transport of plutonium is the point in the disposition process when the material is most vulnerable to overt, armed attacks designed to steal plutonium. With sufficient resources devoted to security, high levels of protection against such overt attacks can be provided. International, and particularly overseas, shipments would involve greater transportation concerns than domestic shipments (DOE 1997c).

The *Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel* (DOE 1996d) analyzed the spectrum of attacks on spent nuclear fuel casks. They fall into three categories or scenarios: (1) exploding a bomb near a shipping cask, (2) attacking a cask with a shaped charge or an armor-piercing weapon (i.e., an antitank weapon), and (3) hijacking (stealing) a shipping cask. None of the scenarios considered would lead to a criticality accident. DOE determined that, due to the security measures that would be in place for any spent nuclear fuel shipments, such attacks would be unlikely to occur. At a minimum, the extent or effects of any such attacks would be mitigated by the security measures. Additionally, the SPD EIS considered a comparatively few shipments (if the lead assembly program is implemented) of spent nuclear fuel. Other materials, including uranium hexaflouride, uranium dioxide, TRU waste, and LLW, are commonly shipped and do not represent particularly attractive targets for sabotage or terrorist attacks.

L.7 CUMULATIVE IMPACTS OF TRANSPORTATION

L.7.1 Radiological Impacts

The cumulative impacts of the transportation of radioactive material consist of impacts from (a) historical shipments of radioactive waste and spent nuclear fuel, (b) reasonably foreseeable actions that include transportation of radioactive material, (c) general radioactive materials transportation that is not related to a particular action, and (d) the alternatives evaluated in the SPD EIS. The assessment of cumulative transportation impacts concentrates on the cumulative impacts of offsite transportation because offsite transportation yields potential radiation doses to a greater portion of the general population than does onsite transportation. The collective dose to the general population and workers was the measure used to quantify cumulative transportation impacts. This measure of impact was chosen because it may be directly related to LCFs using a cancer risk coefficient and because of the difficulty in identifying a maximally exposed individual for shipments throughout the United States spanning the period 1943 through 2048 (106 years). The year 1943 corresponds to the start of operations at Hanford and the Oak Ridge Reservation.

Collective doses from historical shipments of spent nuclear fuel to NTS were summarized in *Summary of Doses and Health Effects* (Jones and Maheras 1994). Data for these shipments were available for 1971 through 1993 and were linearly extrapolated back to 1951, the start of operations at NTS, because data before 1971 were not available. The results of this analysis are summarized in Table L–11. Collective doses from historical shipments of low-level waste, mixed low-level waste, and TRU waste were also estimated (DOE 1996e). Over the time period 1974 through 1994, there were about 8,400 of these shipments. These

Table L–11. Cumulative Transportation-Related Radiological Collective Doses and Latent Cancer Fatalities (1943 to 2048) (person-rem)

	Collective Dose	
Category	**Occupational Dose**	**General Population Dose**
Historical shipments (DOE 1995a)	250	130
Radioactive waste to Nevada Test Site (DOE 1996e)	82	100
Reasonably foreseeable actions		
Nevada Test Site expanded use (DOE 1996e)	–	150[a]
Spent nuclear fuel management (DOE 1995a, 1996d)	360	810
Waste Management PEIS (DOE 1997a)[b]	16,000	20,000
Waste Isolation Pilot Plant (DOE 1997b)	790	5,900
Molybdenum-99 production (DOE 1996f)	240	520
Tritium supply and recycling (DOE 1995b)	–	–
Surplus highly enriched uranium disposition (DOE 1996g)	400	520
Storage and Disposition PEIS (DOE 1996a)	–	2,400[a]
Stockpile Stewardship (DOE 1996h)	–	38[a]
Pantex (DOE 1996c)	250[c]	490[c]
West Valley (DOE 1996i)	1,400	12,000
S3G and D1G prototype reactor plant disposal (DOE 1997d)	2.9–6.8	2.2–5.4
S1C prototype reactor plant disposal (DOE 1996j)	6.7	1.9
Container system for naval spent nuclear fuel (USN 1996a)	11	15
Cruiser and submarine reactor plant disposal (USN 1996b)	5.8	5.8
Submarine reactor compartment disposal (USN 1984)	–	0.053
Return of cesium 137 capsules (DOE 1994)	0.42	5.7
Uranium billets (DOE 1992)	0.50	0.014
Nitric acid (DOE 1995c)	0.43	3.1
General transportation		
1943 to 1982 (NRC 1977)	220,000	170,000
1983 to 2048 (Weiner, LaPlante, and Hageman 1991a:661–666; 1991b:655–660)	110,000	120,000
Shipments for alternatives evaluated in the SPD EIS	10	50
Summary		
Historical	330	230
Reasonably foreseeable actions	19,000	43,000
General transportation (1943 to 2048)	330,000	290,000
Shipments for alternatives evaluated in the SPD EIS	10	50
Total collective dose (rounded to nearest thousand)	349,000	333,000
Total latent cancer fatalities	140	170

[a] Includes public and occupational collective doses.
[b] Includes mixed low-level waste and low-level waste; transuranic waste included in DOE 1997b.
[c] Includes all highly enriched uranium shipped to Y–12.

shipments were estimated to result in a collective occupational dose of 82 person-rem and a collective dose for the general population of 100 person-rem.

Collective doses from other historical shipments of radioactive material were evaluated in the *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE 1995a). These include historical shipments associated with Hanford, INEEL, Oak Ridge, SRS, and Naval spent nuclear fuel and test specimens.

There are considerable uncertainties in these historical estimates of collective dose. For example, the population densities and transportation routes used in the dose assessments were based on census data for 1990 and the U.S. highway and rail system as it existed in the 1990s. Using census data for 1990 tends to overestimate historical collective doses because the U.S. population has continuously increased over the time covered in these assessments. Basing collective dose estimates on the U.S. highway and rail system as it existed in the 1990s may slightly underestimate doses for shipments that occurred in the 1940s, 1950s, and 1960s, because a larger portion of the transport routes would have been on non-interstate highways where the population may have been closer to the road. Data were not available that correlated transportation routes and population densities for the 1940s, 1950s, 1960s, and 1970s; therefore, it was necessary to use more recent data to make dose estimates. By the 1970s, the structure of the interstate highway system was largely fixed and most shipments would have been made on interstates.

Shipment data were linearly extrapolated for years when data were unavailable, which also results in uncertainty. However, this technique was validated by linearly extrapolating the data in the *Historical Overview of Domestic Spent Fuel Shipments–Update* (SAIC 1991) for 1973 through 1989 to estimate the number of shipments that took place during the time period 1964 through 1972 (also contained in SAIC 1991). The data in the historical overview could not be used directly because only shipment counts are presented for 1964 through 1982, and no origins or destinations were listed for years before 1983. Based on the data in the historical overview, linearly extrapolating the data for 1973 through 1989 overestimates the shipments for 1964 through 1972 by 20 percent when compared to the actual shipment counts for 1964 through 1972.

Transportation impacts may also result from reasonably foreseeable projects, such as the transportation impacts contained in other DOE National Environmental Policy Act analyses. The results of these analyses are summarized in Table L–11. For some of these analyses, a preferred alternative was not identified nor a ROD issued. In those cases, the alternative that was estimated to result in the largest transportation impact was included in Table L–11.

There are also reasonably foreseeable projects that involve limited transportation of radioactive material: (a) shipment of submarine reactor compartments from the Puget Sound Naval Shipyard to Hanford for burial, (b) return of cesium 137 isotope capsules to Hanford, (c) shipment of uranium billets from Hanford to the United Kingdom, and (d) shipment of low-specific-activity nitric acid from Hanford to the United Kingdom. While this is not an exhaustive list of projects that may involve limited transportation of radioactive material, it does illustrate that the transportation impacts associated with these types of projects are extremely low when compared to major projects or general transportation.

There are also general transportation activities that take place that are unrelated to the alternatives evaluated in the SPD EIS or to reasonably foreseeable actions. Examples of these activities are shipments of radiopharmaceuticals to nuclear medicine laboratories and shipments of commercial low-level radioactive waste to commercial disposal facilities. The NRC evaluated these types of shipments based on a survey of radioactive materials transportation published in NUREG-0170 (NRC 1977). Categories of radioactive material evaluated in NUREG-0170 included: (a) limited quantity shipments, (b) medical, (c) industrial, (d) fuel cycle, and (e) waste.

The NRC estimated that the annual collective worker dose for these shipments was 5,600 person-rem. The annual collective general population dose for these shipments was estimated to be 4,200 person-rem. Because comprehensive transportation doses were not available, these collective dose estimates were used to estimate transportation collective doses for 1943 through 1982 (40 years). These dose estimates included spent nuclear fuel and radioactive waste shipments made by truck and rail.

Based on the transportation dose assessments in NUREG-0170, the cumulative transportation collective doses for 1943 through 1982 were estimated to be 220,000 person-rem for workers and 170,000 person-rem for the general population.

In 1983, another survey of radioactive materials transportation in the United States was conducted (Javitz et al. 1985). This survey included NRC and Agreement State licensees. Both spent nuclear fuel and radioactive waste shipments were included in the survey. Weiner, LaPlante, and Hageman (1991a:661–666, 1991b:665–660) used the survey by Javitz et al. (1985) to estimate collective doses from general transportation. The transportation dose assessments in Weiner, LaPlante, and Hageman (1991a:661–666, 1991b:665–660) were used to estimate transportation doses for 1983 through 2048 (66 years). Weiner, LaPlante, and Hageman (1991a:661–666) evaluated eight categories of radioactive material shipments by truck: (a) industrial, (b) radiography, (c) medical, (d) fuel cycle, (e) research and development, (f) unknown, (g) waste, and (h) other. Based on a median external exposure rate, an annual collective worker dose of 1,400 person-rem and an annual collective general population dose of 1,400 person-rem were estimated. Over the 66-year time period from 1983 through 2048, both the collective worker and general population doses were estimated to be 92,000 person-rem.

Weiner, LaPlante, and Hageman (1991b:655–660) also evaluated six categories of radioactive material shipments by plane: (a) industrial, (b) radiography, (c) medical, (d) research and development, (e) unknown, and (f) waste. Based on a median external exposure rate, an annual collective worker dose of 290 person-rem and an annual collective general population dose of 450 person-rem were estimated. Over the 66-year time period from 1983 through 2048, the collective worker dose was estimated to be 19,000 person-rem and the general population collective dose was estimated to be 30,000 person-rem.

Like the historical transportation dose assessments, the estimates of collective doses from general transportation also exhibit considerable uncertainty. For example, data for 1975 were applied to general transportation activities from 1943 through 1982. This approach probably overestimates doses because the amount of radioactive material that was transported in the 1950s and 1960s was less than the amount shipped in the 1970s. For example, in 1968, the shipping rate for radioactive material packages was estimated to be 300,000 packages per year (Patterson 1968:199–209); in 1975, this rate was estimated to be 2,000,000 packages per year (NRC 1977). However, because comprehensive data that would enable a more realistic transportation dose assessment are not available, the dose estimates developed by NRC were used.

Total collective worker doses from all types of shipments (historical, reasonably foreseeable actions, and general transportation) were estimated to be approximately 350,000 person-rem (140 LCFs), for the period of time 1943 through 2048 (106 years). Total general population collective doses were also estimated to be 330,000 person-rem (170 LCFs). The majority of the collective dose for workers and the general population was because of general transportation of radioactive material. The total number of LCFs over the time period 1943 through 2048 was estimated to be 310. Over this same period of time (106 years), about 54,060,000 people would die from cancer, based on 510,000 LCFs per year (DOC 1993). It should be noted that the estimated number of transportation-related LCFs would be indistinguishable from other LCFs, and the transportation-related LCFs would be 0.0000057 percent of the total number of expected LCFs during this timeframe.

L.7.2 Accident Impacts

For transportation accidents involving radioactive material, the dominant risk is from accidents that are unrelated to the cargo (i.e., traffic or vehicular accidents). Fatalities involving the shipment of radioactive materials were surveyed for 1971 through 1993 using the Radioactive Material Incident Report database. For 1971 through 1993, 21 vehicular accidents involving 36 fatalities occurred. These fatalities resulted from vehicular accidents and were not associated with the radioactive nature of the cargo; no radiological fatalities because of transportation accidents have ever occurred in the United States. During the same period of time, over 1,100,000 persons were killed in vehicular accidents in the United States (National Safety Council 1994). About 100 additional vehicular accident fatalities were estimated to result from the transportation of radioactive material (i.e., the transportation associated with reasonably foreseeable actions and general radioactive materials transportation). During the 39-year time period from 2010 through 2048, approximately 1,600,000 people would be expected to be killed in vehicular accidents in the United States. The vehicular accident fatalities associated with radioactive materials transportation would be expected to be 0.006 percent of the total number of vehicular accident fatalities.

L.8 UNCERTAINTY AND CONSERVATISM IN ESTIMATED IMPACTS

The sequence of analyses performed to generate the estimates of radiological risk for the transportation includes: (1) determination of the inventory and characteristics, (2) estimation of shipment requirements, (3) determination of route characteristics, (4) calculation of radiation doses to exposed individuals (including estimation of environmental transport and uptake of radionuclides), and (5) estimation of health effects. Uncertainties are associated with each of these steps. Uncertainties exist in the way that the physical systems being analyzed are represented by the computational models, in the data required to exercise the models (due to measurement errors, sampling errors, natural variability, or unknowns simply caused by the future nature of the actions being analyzed), and in the calculations themselves (e.g., approximate algorithms used by the computers).

In principle, the uncertainty associated with each input or computational source can be estimated and the resultant uncertainty in each set of calculations can be predicted. Thus, the uncertainties from one set of calculations to the next can be propagated and the uncertainty in the final or absolute result can be estimated; however, conducting such a full-scale quantitative uncertainty analysis is often impractical and sometimes impossible, especially for actions to be initiated at an unspecified time in the future. Instead, the risk analysis is designed to ensure, through uniform and judicious selection of scenarios, models, and input parameters, that relative comparisons of risk among the various alternatives are meaningful. In the transportation risk assessment, this design is accomplished by uniformly applying common input parameters and assumptions to each alternative. Therefore, although considerable uncertainty is inherent in the absolute magnitude of the transportation risk for each alternative, much less uncertainty is associated with the relative differences among the alternatives in a given measure of risk.

In the following sections, areas of uncertainty are discussed for the assessment steps enumerated above. Special emphasis is placed on identifying whether the uncertainties affect relative or absolute measures of risk. The degree of conservatism of the assumption is addressed. Where practical, the parameters that most significantly affect the risk assessment results are identified.

L.8.1 Uncertainties in Material Inventory and Characterization

The inventories and the physical and radiological characteristics are important input parameters to the transportation risk assessment. The potential amount of transportation for any alternative is determined primarily by the projected nuclear material inventory and assumptions concerning shipment capacities. The physical and radiological characteristics are important in determining the amount of material released during accidents and the subsequent doses to exposed individuals through multiple environmental exposure pathways.

Uncertainties in the inventory and characterization will be reflected to some degree in the transportation risk results. If the inventory is overestimated (or underestimated), the resulting transportation risk estimates also will be overestimated (or underestimated) by roughly the same factor. However, the same inventory estimates are used to analyze the transportation impacts of each of the SPD EIS alternatives. Therefore, for comparative purposes, the observed differences in transportation risks among alternatives are believed to represent unbiased, reasonably accurate estimates from current information in terms of relative risk comparisons.

No detailed characterization of surplus nonpit plutonium was included in the evaluation of each shipment of this material. Such information typically would not be compiled until actual shipments were being planned. Only global, conservative assumptions were used in the impact analysis. For the purpose of analysis, DOE assumed a maximum of 4.5 kg (9.9 lb) of plutonium per package, and 40 packages per SST/SGT. Actual SST/SGT shipments could handle more material. This leads to a conservative estimate of radiological accident risks for shipment of surplus nonpit plutonium for each alternative. However, since such shipments have been shown to have lower radiological accident risks than shipments of either plutonium dioxides from pits or lead assembly spent fuel, the overall effect would be very small.

L.8.2 Uncertainties in Containers, Shipment Capacities, and Number of Shipments

The amount of transportation required for each alternative is based, in part, on assumptions concerning the packaging characteristics and shipment capacities for commercial trucks and safe, secure transports. Changes in loading, tiedown, or packaging practices could affect estimates. Representative shipment capacities were defined for assessment purposes based on probable future shipment capacities. In reality, the actual shipment capacities may differ from the predicted capacities, so the projected number of shipments, and consequently the total transportation risk, would change. However, although the predicted transportation risks would increase or decrease accordingly, the relative differences in risks among alternatives would remain about the same. The maximum amount of material allowed in Type B containers is set by conservative safety analyses.

L.8.3 Uncertainties in Route Determination

Representative routes were determined between all origin and destination sites considered in the SPD EIS. The routes were determined consistent with current guidelines, regulations, and practices, but may not be the actual routes that would be used in the future. In reality, the actual routes could differ from the representative ones in terms of distances and total population along the routes. Moreover, since radioactive materials could be transported over an extended period of time starting at some time in the future, the highway infrastructures and the demographics along routes could change. These effects were not accounted for in the transportation assessment; however, it is not anticipated that these changes would significantly affect relative comparisons of risk among the alternatives considered in the SPD EIS. The dates and times that specific transportation routes would be used are classified.

L.8.4 Uncertainties in the Calculation of Radiation Doses

The models used to calculate radiation doses from transportation activities introduce a further uncertainty in the risk assessment process. It is generally difficult to estimate the accuracy or absolute uncertainty of the risk assessment results. The accuracy of the calculated results is closely related to the limitations of the computational models and the uncertainties in each of the input parameters that the model requires. The single greatest limitation facing users of RADTRAN, or any computer code of this type, is the scarcity of data for certain input parameters.

Uncertainties associated with the computational models are minimized by using state-of-the-art computer codes that have undergone extensive review. Because there are numerous uncertainties that are recognized but difficult to quantify, assumptions are made at each step of the risk assessment process that are intended to produce conservative results (i.e., overestimate the calculated dose and radiological risk). Because parameters and assumptions are applied to all alternatives, this model bias is not expected to affect the meaningfulness of relative comparisons of risk; however, the results may not represent risks in an absolute sense.

The single largest contributor to the collective population doses calculated with RADTRAN was found to be the dose to members of the public at truck stops. Currently, RADTRAN uses a simple point-source approximation for truck-stop exposures and assumes that the total stop time for a shipment is proportional to the shipment distance. The parameters used in the stop model were based on a survey of a very limited number of radioactive material shipments that examined a variety of shipment types in different areas of the country. It was assumed that stops occur as a function of distance, with a stop rate of 0.011 hr/km (0.018 hr/mi). For non-SST/SGT shipments, it was further assumed that an average of 50 people at each stop are exposed at a distance of 20 m (66 ft). In RADTRAN, the population dose is directly proportional to the external shipment dose rate and the number of people exposed, and inversely proportional to the square of the distance. For this assessment, it was assumed that many shipments (nonpit plutonium and spent nuclear fuel) would have external dose rates at the regulatory limit of 10 mrem/hr at 2 m (6.6 ft). In practice, the external dose rates would vary from shipment to shipment. The stop rate assumed results in an hour of stop time per 100 km (62 mi) of travel.

Based on the qualitative discussion with shippers, the parameter values used in the assessment appear to be conservative. However, data do not exist to quantitatively assess the degree of control, location, frequency, and duration of truck stops. However, based on the regulatory requirements of 10 CFR 73 for continuous escort of the material and the requirement for two drivers, it is clear that the trucks would be on the move much of the time until arrival at the destination. Therefore, the calculated impacts are extremely conservative. By using these conservative parameters, the calculations in the SPD EIS are consistent with the RADTRAN published values.

Shielding exposed populations is not considered. For all incident-free exposure scenarios, no credit has been taken for shielding exposed individuals. In reality, shielding would be afforded by trucks and cars sharing the transport routes, rural topography, and the houses and buildings in which people reside. Incident-free exposure to external radiation could be reduced significantly depending on the type of shielding present. For residential houses, shielding factors (i.e., the ratio of shielded to unshielded exposure rates) were estimated to range from 0.02 to 0.7, with a recommended value of 0.33. If shielding were to be considered for the maximally exposed resident living near a transport route, the calculated doses and risks would be reduced by approximately 70 percent. Similar levels of shielding may be provided to individuals exposed in vehicles.

Postaccident mitigative actions were not considered for dispersal accidents. For severe accidents involving the release and dispersal of radioactive materials in the environment, no postaccident mitigative actions, such as interdiction of crops or evacuation of the accident vicinity, were considered in this risk assessment. Postaccident mitigative measures to reduce groundshine doses (evacuation and/or decontamination) are assumed to occur 24 hours after the accident in RADTRAN analyses. Additionally, RADTRAN assumes that highly contaminated crops are not ingested (Neuhauser and Knipe 1995). Since RISKIND is modeling the worst credible accident, these measures were not considered. In reality, mitigative actions would take place following an accident in accordance with U.S. Environmental Protection Agency radiation protection guides for nuclear incidents (EPA 1992). The effects of mitigative actions on population accident doses are highly dependent on the severity, location, and timing of the accident. For this risk assessment, ingestion doses were only calculated for accidents occurring in rural areas (the calculated ingestion doses; however, it assumed, all food grown on contaminated ground is consumed and is not limited to the rural population). Interdiction of foodstuffs would act to reduce, but not eliminate, this contribution.

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Table M–1. Racial and Ethnic Composition of Minority Populations Residing Within 80 km of Candidate DOE Sites in 1990

Candidate Site	Total Pop.	Minority Pop.	Percent Minority Pop.	Asian or Pacific Islander Pop.	Percent Asian or Pacific Islander Pop.	Black Pop.	Percent Black Pop.	Hispanic Pop.	Percent Hispanic Pop.	Native American Pop.	Percent Native American Pop.	Other Race	Percent Other Race Pop.	White Pop.	Percent White Pop.
Hanford 400 Area	277,515	70,493	25.4	3,989	1.4	2,788	1.0	59,736	21.5	3,981	1.4	372	0.1	206,651	74.5
Hanford 200 East	346,031	90,526	26.2	4,852	1.4	4,144	1.2	74,490	21.5	7,040	2.0	556	0.2	254,949	73.7
INEEL	119,138	11,757	9.9	1,166	1.0	385	0.3	7,154	6.0	3,052	2.6	135	0.1	107,246	90.0
Pantex	266,004	50,778	19.1	3,450	1.3	11,130	4.2	33,977	12.8	2,220	0.8	363	0.1	214,864	80.7
[Text deleted.]															
SRS APSF, if built	614,095	232,781	37.9	5,888	1.0	219,136	35.7	6,456	1.1	1,300	0.2	175	0.0	381,139	62.1
SRS DWPF	626,317	241,168	38.5	5,951	1.0	227,378	36.3	6,521	1.0	1,319	0.2	175	0.0	384,974	61.5

Key: APSF, Actinide Packaging and Storage Facility; DWPF, Defense Waste Processing Facility.

Table M–2. Projected Racial and Ethnic Composition of Minority Populations Residing Within 80 km of Candidate DOE Sites in 1997

Candidate Site	Total Pop.	Minority Pop.	Percent Minority Pop.	Asian or Pacific Islander Pop.	Percent Asian or Pacific Islander Pop.	Black Pop.	Percent Black Pop.	Hispanic Pop.	Percent Hispanic Pop.	Native American Pop.	Percent Native American Pop.	Other Race	Percent Other Race Pop.	White Pop.	Percent White Pop.
Hanford 400 Area	324,640	98,586	30.4	5,640	1.7	3,153	1.0	85,642	26.4	4,151	1.3	418	0.1	225,636	69.5
Hanford 200 East	396,420	126,166	31.8	6,885	1.7	4,666	1.2	106,551	26.9	8,064	2.0	631	0.2	269,623	68.0
INEEL	145,117	16,785	11.6	1,627	1.1	590	0.4	10,793	7.4	3,775	2.6	166	0.1	128,166	88.3
Pantex	292,004	62,845	21.5	5,107	1.7	12,801	4.4	42,490	14.6	2,447	0.8	414	0.1	228,745	78.3
[Text deleted.]															
SRS APSF, if built	694,891	274,985	39.6	9,276	1.3	254,807	36.7	9,456	1.4	1,447	0.2	201	0.0	419,704	60.4
SRS DWPF	688,352	275,654	40.0	9,332	1.4	255,459	37.1	9,422	1.4	1,441	0.2	201	0.0	412,497	59.9

Key: APSF, Actinide Packaging and Storage Facility; DWPF, Defense Waste Processing Facility.

Table M–3. Projected Racial and Ethnic Composition of Minority Populations Residing Within 80 km of Candidate DOE Sites in 2010

Candidate Site	Total Pop.	Minority Pop.	Percent Minority Pop.	Asian or Pacific Islander Pop.	Percent Asian or Pacific Islander Pop.	Black Pop.	Percent Black Pop.	Hispanic Pop.	Percent Hispanic Pop.	Native American Pop.	Percent Native American Pop.	Other Race	Percent Other Race Pop.	White Pop.	Percent White Pop.
Hanford 400 Area	426,473	163,767	38.4	9,287	2.2	3,907	0.9	144,750	33.9	5,824	1.4	508	0.1	262,198	61.5
Hanford 200 East	532,179	207,732	39.0	11,341	2.1	5,763	1.1	180,345	33.9	10,283	1.9	761	0.1	323,686	60.8
INEEL	185,748	27,887	15.0	2,426	1.3	960	0.5	18,887	10.2	5,615	3.0	210	0.1	157,651	84.9
Pantex	332,001	84,418	25.4	7,626	2.3	15,916	4.8	58,101	17.5	2,775	0.8	490	0.1	247,093	74.4
[Text deleted.]															
SRS APSF, if built	802,140	336,549	42.0	13,974	1.7	306,706	38.2	14,271	1.8	1,598	0.2	235	0.0	465,356	58.0
SRS DWPF	815,380	345,527	42.4	14,093	1.7	315,444	38.7	14,374	1.8	1,617	0.2	235	0.0	469,617	57.6

Key: APSF, Actinide Packaging and Storage Facility; DWPF, Defense Waste Processing Facility.

Table M–4. Uncertainties in Estimates of Total and Minority Populations for the Year 2010

Candidate Site	No. of Partially Included Block Groups	No. of Fully Included Block Groups	T/P	Upper Bound for Total Population	Estimate of Total Population	Lower Bound for Total Population	Upper Bound for Minority Population	Estimate of Minority Population	Lower Bound for Minority Population
Hanford									
400 Area	8(OR) 39(WA)	31(OR) 233(WA)	5.6	422,872	415,828	397,570	161,697	159,713	153,854
200 East	13(OR) 42(WA)	6(OR) 365(WA)	6.7	519,364	509,136	482,861	205,420	202,832	196,212
INEEL	39	91	2.3	215,134	183,565	155,726	32,443	27,650	23,498
Pantex	22	483	22.0	338,218	330,300	321,477	85,566	83,963	82,332
SRS									
[Text deleted.]									
APSF, if built	27(GA) 55(SC)	245(GA) 277(SC)	6.4	865,698	807,583	753,569	365,148	339,708	318,908
DWPF	31(GA) 57(SC)	232(GA) 291(SC)	5.9	815,864	800,530	758,866	347,365	340,704	324,062

Key: APSF, Actinide Packaging and Reprocessing Facility; DWPF, Defense Waste Processing Facility; GA, Georgia; OR, Oregon; SC, South Carolina; WA, Washington.

block groups that are partly within the circle of 80-km (50-mi) radius centered at the various facilities. Column 3 shows the number of block groups that lie completely within the circle. Potentially affected areas surrounding Hanford and SRS include two States. Columns 2 and 3 show the number of partial or total inclusions for the affected States. Column 4 of the table, denoted as "T/P," shows the number of totally included block groups divided by the number of partially included block groups. In order to minimize the uncertainties in the population estimate, it is desirable that this ratio be as large as possible. Column 5 shows upper bounds for the estimates of the total population listed in column 6. As discussed above, upper bounds were obtained by including the total population of all block groups that lie at least partially within the affected area. Lower bounds for the estimate of total population shown in column 7 were obtained by including only the populations of totally included block groups. Analogous statements apply to columns 8 through 10.

As would be expected from the value of T/P shown in column 4, uncertainties in the total population estimate for Pantex were the smallest among the four sites (+2.4 percent and −2.7 percent), as were the uncertainties in the estimate of the minority population at risk near Pantex (+1.9 percent and −1.9 percent). Uncertainties in the population estimates for INEEL were the largest among the four sites (+17.2 percent and −15.2 percent for total population; +17.3 percent and −15.0 percent for minority population). None of the uncertainties shown in Table M–4 are large enough to noticeably affect the conclusions regarding radiological health effects or environmental justice.

M.5.2 Geographical Dispersion of Minority and Low-Income Populations

Figures M–2 through M–9 show the geographical distributions of minority and low-income populations at risk in the vicinity of the candidate DOE sites. Distributions shown in these figures are based on baseline population data for 1990. Even-numbered figures show the geographical distribution of minority populations in potentially affected areas within a distance of 80 km (50 mi) of candidate facilities. Block groups are shaded to indicate the percentage of the total population comprised of minorities. According to the decennial census of 1990, minorities comprised 24.2 percent of the total population of the contiguous United States. Block groups unshaded in the even-numbered figures are those for which the percentage of minority residents is less than the national percentage minority population. Areas shaded in gray show block groups for which the percentage of minority residents exceeds the national minority percentage by less than a factor of two. Diagonally hatched block groups shown in the even-numbered figures are those for which the percentage of minority residents exceeds the national minority percentage by a factor of two or more.

Odd-numbered figures show the geographical distribution of low-income populations potentially at risk from implementation of the proposed action or alternatives. According to the decennial census of 1990, 13.4 percent of the population of the contiguous United States reported incomes less than the poverty threshold. Block groups unshaded in Figures M–1, M–5, M–7, and M–9 are those for which the percentage of low-income residents is less than the national percentage of persons reporting an income less than the poverty threshold. Areas shaded in gray show block groups for which the percentage of low-income residents exceeds the national low-income percentage by less than a factor of two. Diagonally hatched block groups shown in the odd-numbered figures are those for which the percentage of low-income residents exceeds the national low-income percentage by a factor of two or more.

M.5.3 Environmental Effects on Minority and Low-Income Populations Residing Near Candidate DOE Sites

The analysis of environmental effects on populations residing within 80 km (50 mi) of proposed facilities is presented in Chapter 4 of the SPD EIS. This analysis shows that no radiological fatalities are likely to result from implementation of the proposed action or alternatives. Radiological risks to the public are small regardless of the racial and ethnic composition of the population, and regardless of the economic status of

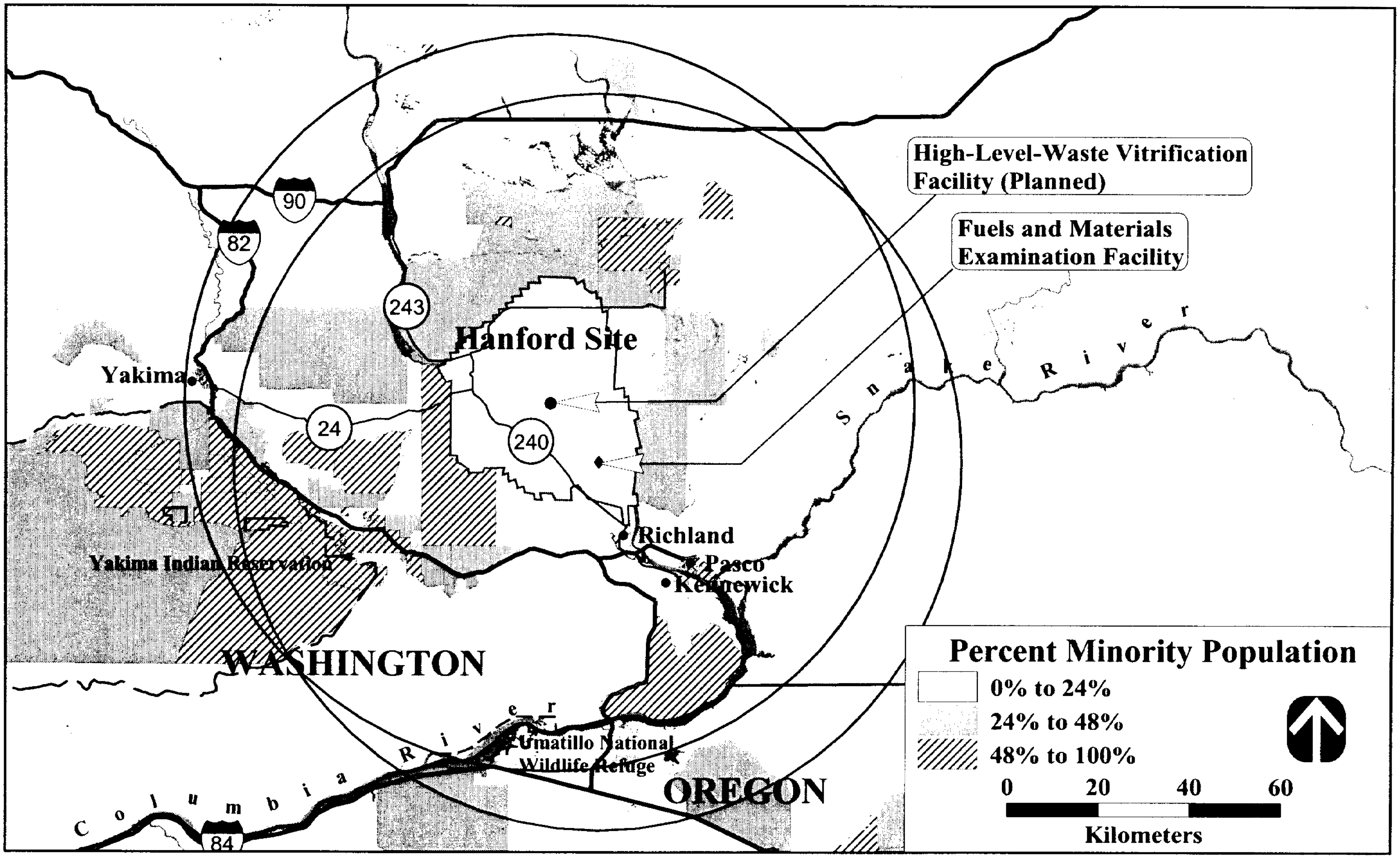


Figure M–2. Geographical Distribution of the Minority Population Residing Within 80 km (50 mi) of Proposed Facilities at Hanford

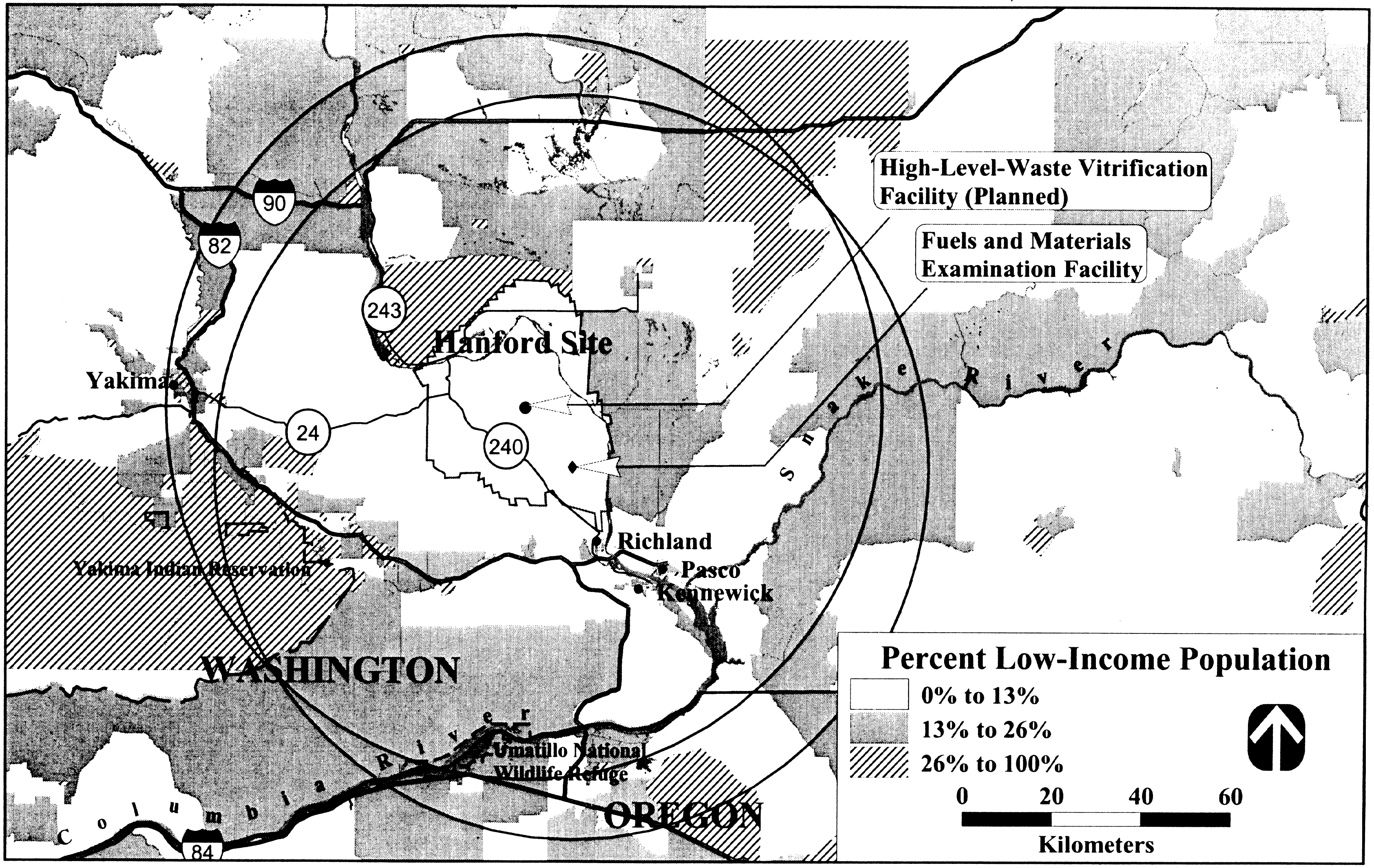


Figure M–3. Geographical Distribution of the Low-Income Population Residing Within 80 km (50 mi) of Proposed Facilities at Hanford

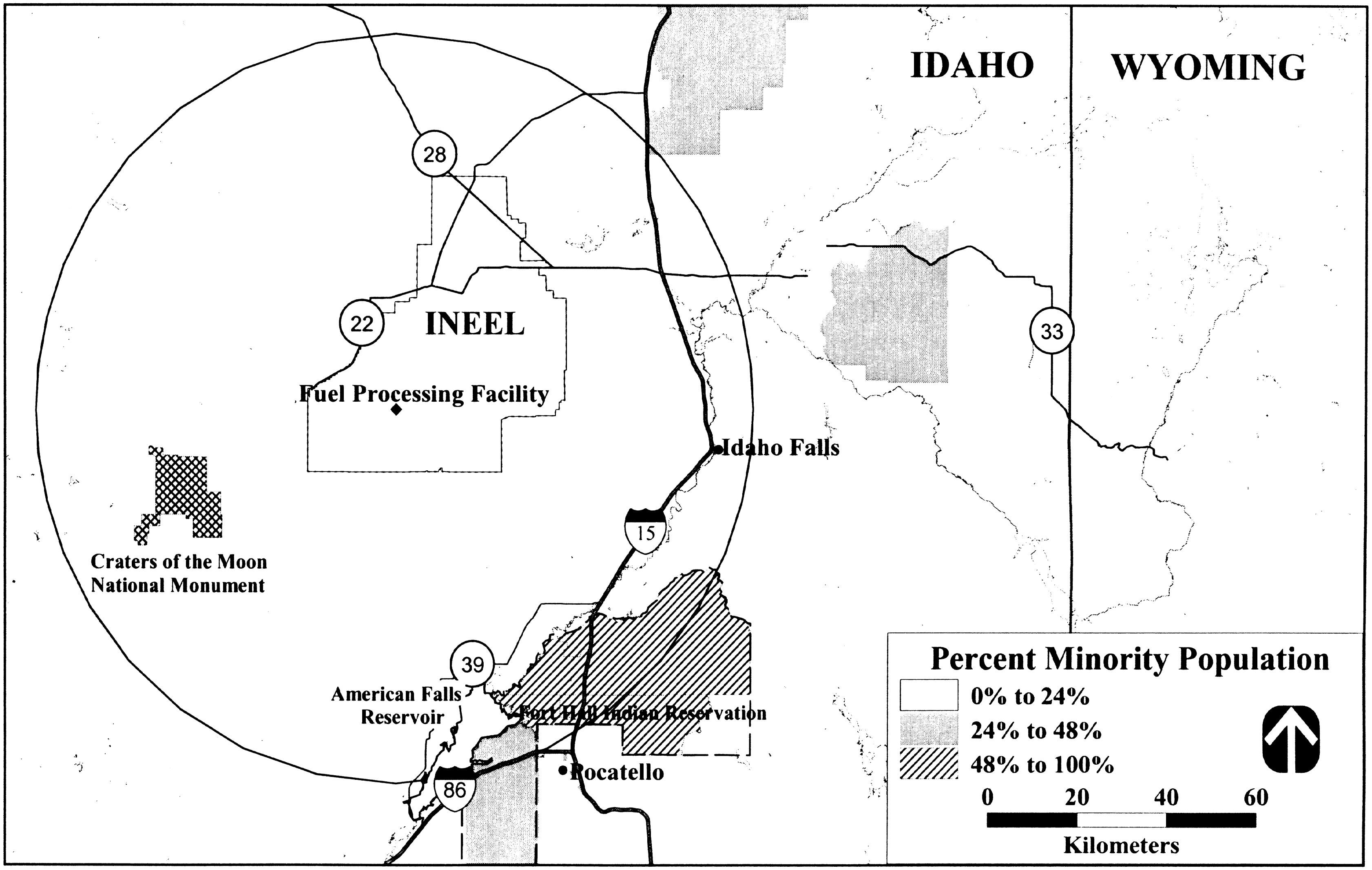


Figure M–4. Geographical Distribution of the Minority Population Residing Within 80 km (50 mi) of Fuel Processing Facility at INEEL

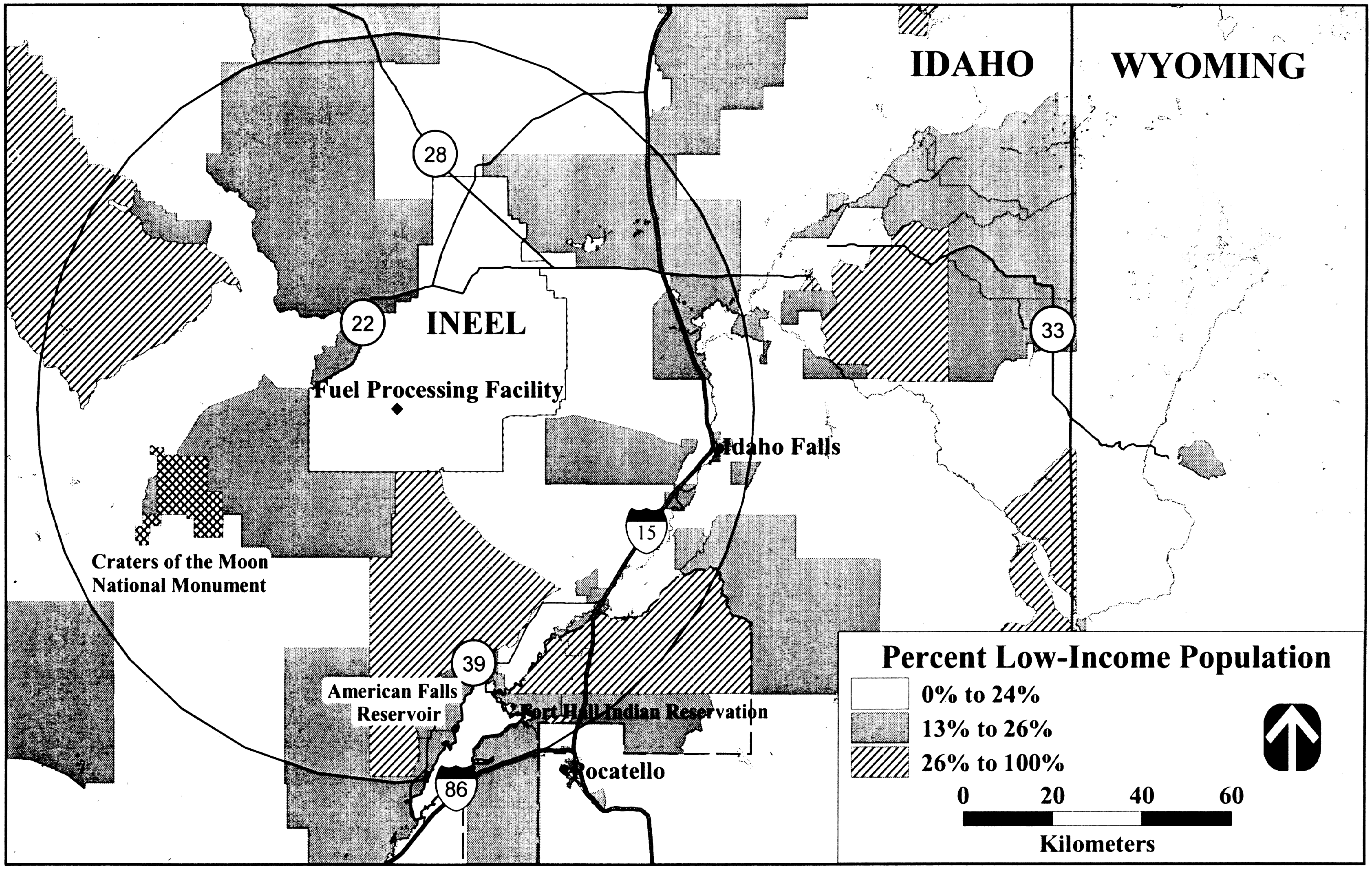


Figure M–5. Geographical Distribution of the Low-Income Population Residing Within 80 km (50 mi) of Fuel Processing Facility at INEEL

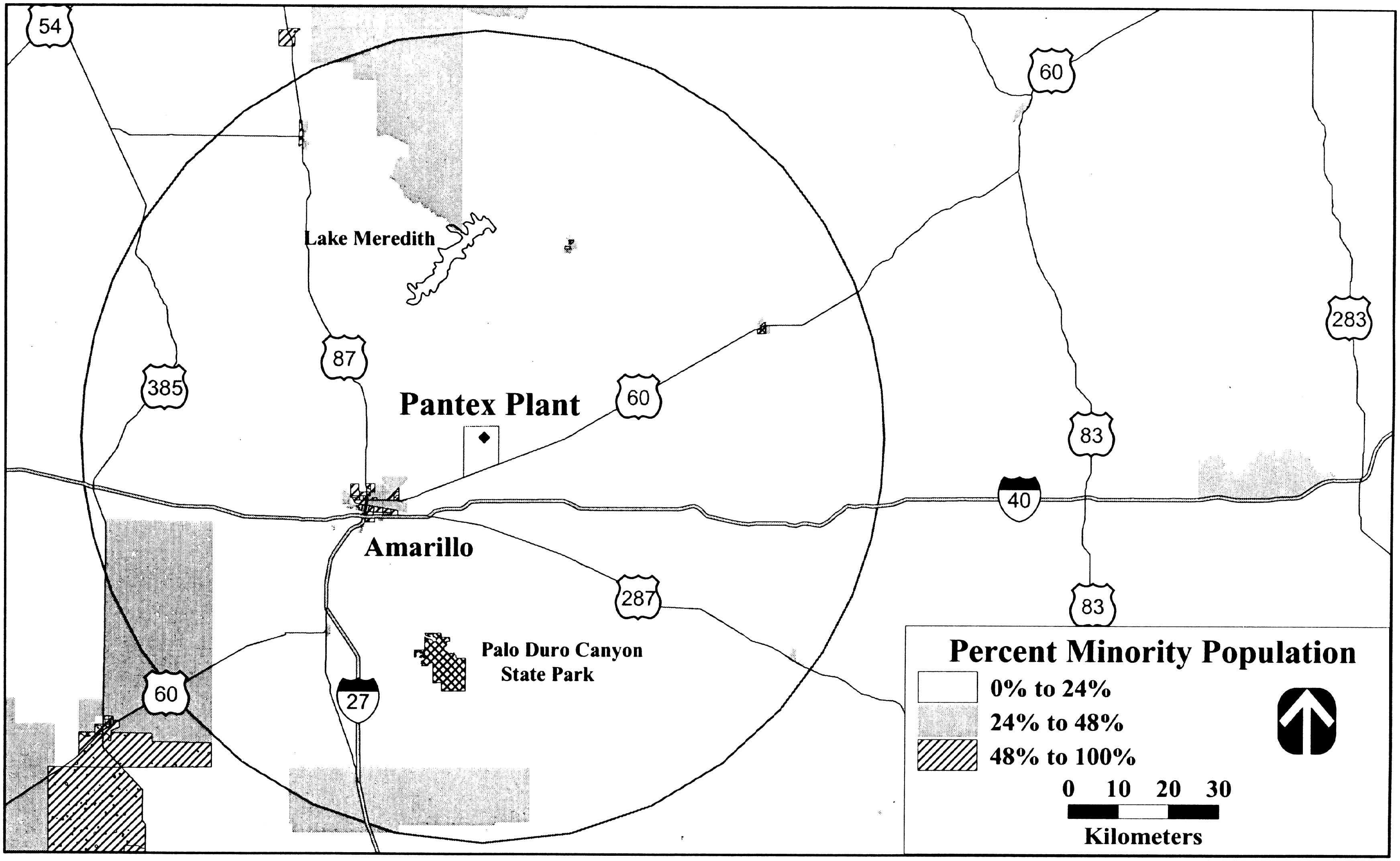


Figure M–6. Geographical Distribution of the Minority Population Residing Within 80 km (50 mi) of Potentially Affected Area at Pantex

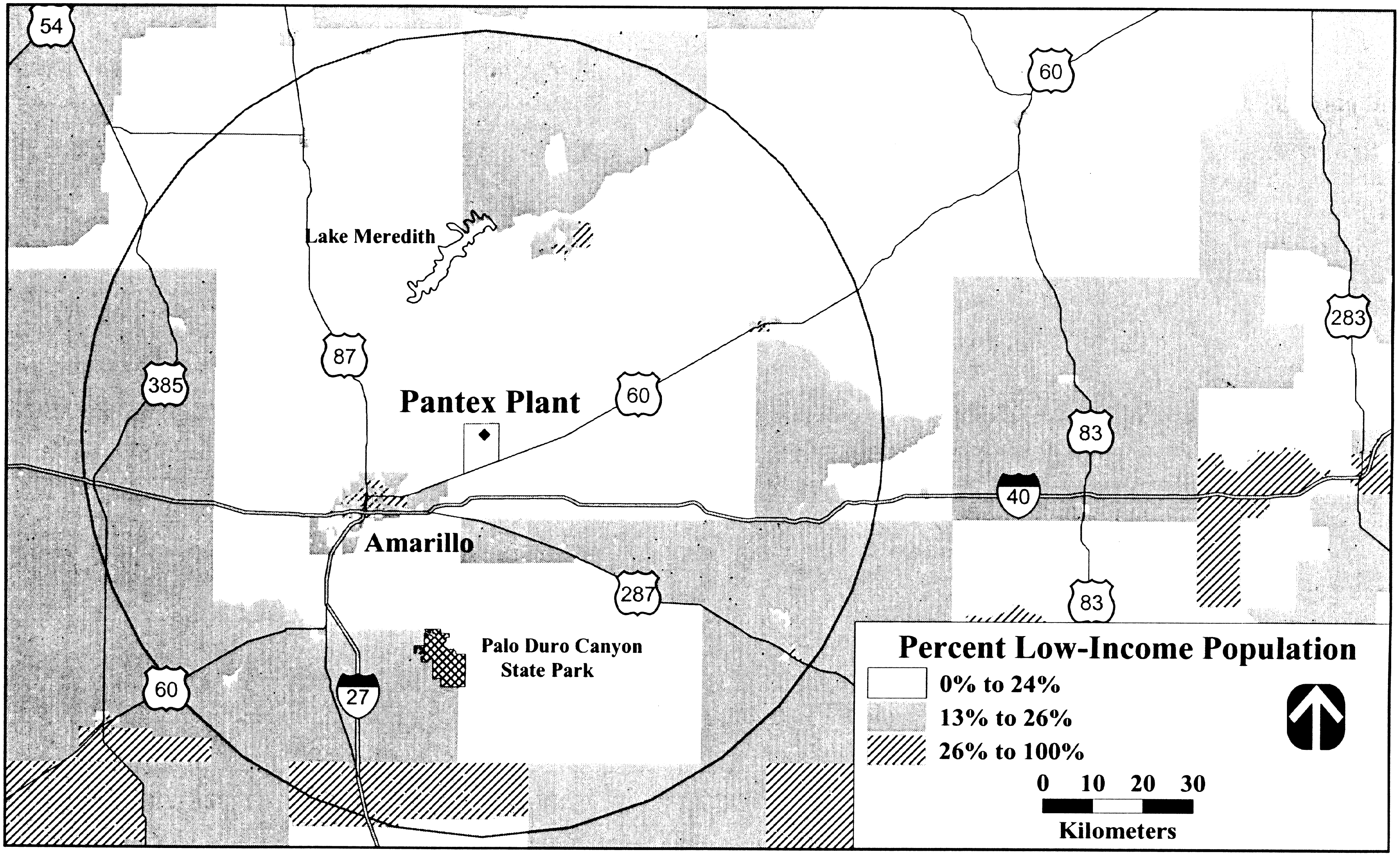


Figure M–7. Geographical Distribution of the Low-Income Population Residing Within 80 km (50 mi) of Potentially Affected Area at Pantex

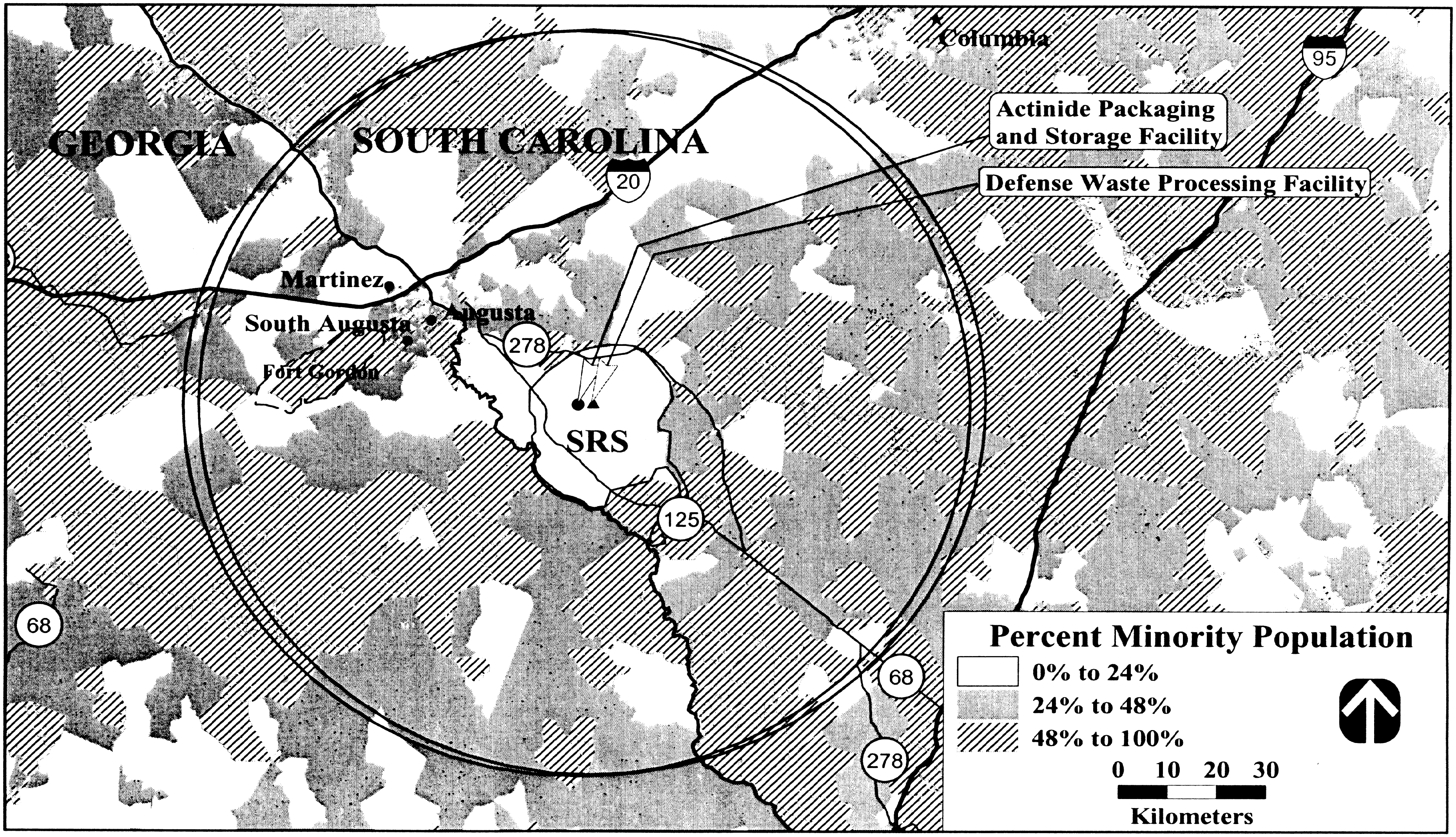


Figure M–8. Geographical Distribution of the Minority Population Residing Within 80 km (50 mi) of Proposed Facilities at SRS

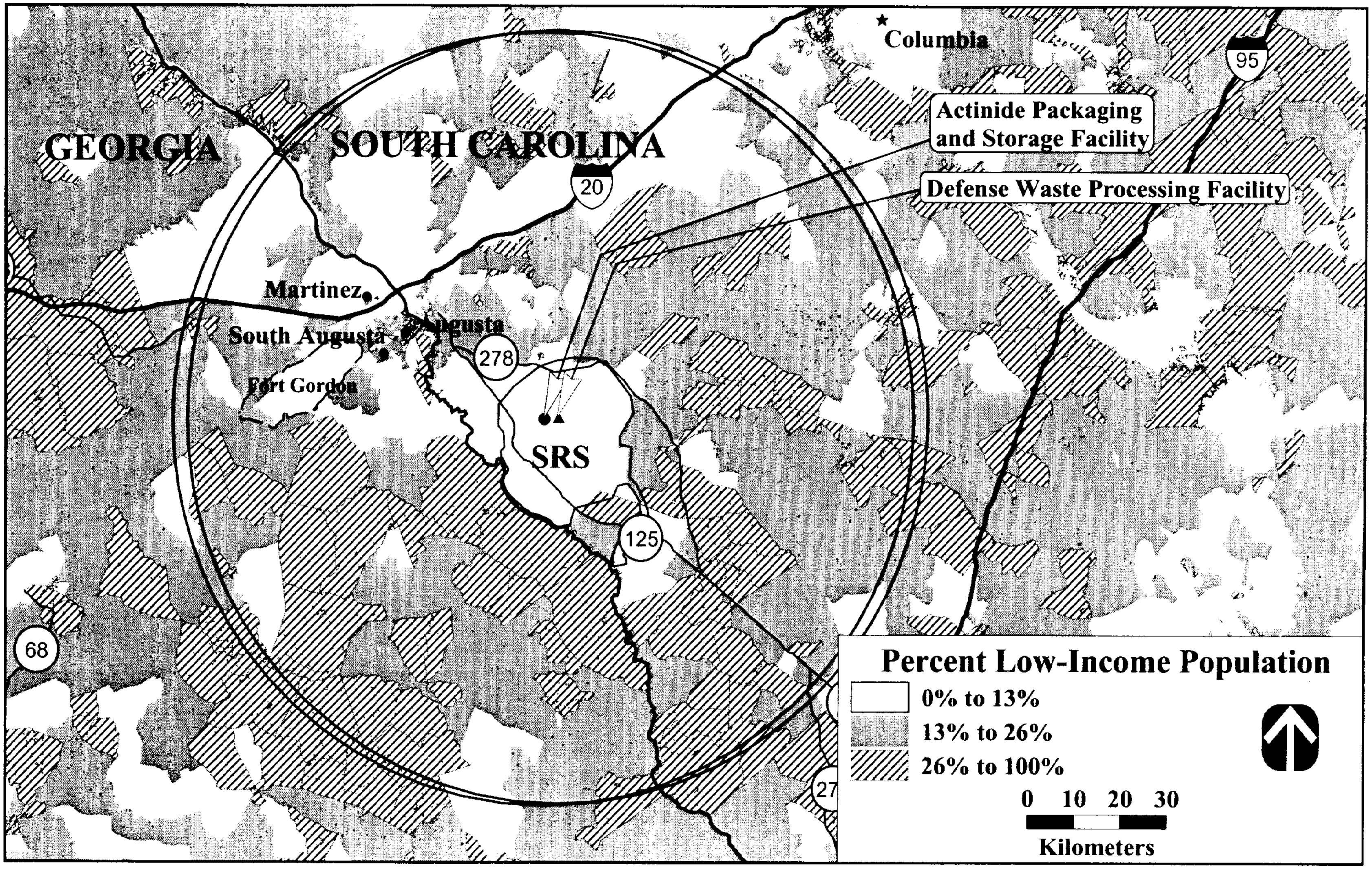


Figure M–9. Geographical Distribution of the Low-Income Population Residing Within 80 km (50 mi) of Proposed Facilities at SRS individuals comprising the population. Nonradiological risks to the general population are also small regardless of the racial and ethnic composition or economic status of the population. Thus, disproportionately high and adverse impacts on minority and low-income populations residing near the various facilities are not likely to result from implementation of the proposed action or alternatives.

M.6 RESULTS FOR TRANSPORTATION ROUTES

Table M–5 shows minority populations residing along 1.6-km (1-mi) corridors centered on routes that are representative of those that could be used for the transportation of nuclear materials under the proposed action or alternatives. Table M–6 shows similar data for low-income populations. Population data for Tables M–5 and M–6 were extracted from Tables P–12 and P–121 of the STF–3A files (DOC 1992). Distances from a given origin to a given destination are similar but not identical to corresponding distances shown in Appendix L. This is because distances listed in Appendix L were calculated with the HIGHWAY computer code, while distances shown in Tables M–5 and M–6 were obtained from a Geographical Information System analysis using TigerLine data and STF3A files prepared by the Census Bureau. Both techniques use block group spatial resolution, and the differences are generally less than 5 percent.

Total and minority populations residing in the highway corridors are listed in Columns 4 and 5, respectively, of Table M–5. Column 6 shows minority populations residing within highway corridors as a percentage of the total population. Although total and minority populations residing within the corridors generally tend to increase with increasing distance, the relationship is clearly route dependent.

As discussed in Appendix L of the SPD EIS, implementation of the proposed action or alternatives would not result in significant radiological or nonradiological risks to populations residing along highway transportation routes. Although the percentage minority or low-income populations residing along highway routes can vary by as much as a factor of four, results of the analysis presented in Chapter 4 are independent of the racial and ethnic composition of populations within the corridors, as well as the economic status of populations at risk within the corridors. Implementation of the proposed action or alternatives is not likely to result in disproportionately high and adverse effects on minority or low-income populations residing within representative transportation corridors.

Table M–5. Minority Populations Residing Along Transportation Routes for Surplus Plutonium

Origin	Destination	Distance (km)	Total Population Along Route	Minority Population Along Route	Percentage Minority Population Along Route
ANL–W	Hanford	1,035	82,418	9,356	11.4
ANL–W	Pantex	2,395	281,386	82,566	29.3
ANL–W	SRS	3,756	580,985	122,415	21.1
Fuel fabrication	Hanford	4,760	601,233	95,417	15.9
Fuel fabrication	INEEL	4,092	556,388	88,331	15.9
Fuel fabrication	LANL	3,201	506,962	126,460	24.9
Fuel fabrication	Pantex	2,563	430,359	87,635	20.4
Fuel fabrication	SRS	578	75,050	30,702	40.9
Hanford	Geological repository	1,888	248,006	31,424	12.7
Hanford	INEEL	949	74,624	8,927	12.0
Hanford	LANL	2,515	276,768	71,860	26.0
Hanford	ORR	3,993	434,235	62,000	14.3
Hanford	Pantex	3,040	342,903	92,151	26.9
INEEL	ORR	3,316	389,496	59,174	15.2
INEEL	SRS	3,702	574,433	123,656	21.5
LANL	ANL–W	1,868	230,510	60,265	26.1
LANL	INEEL	1,840	227,759	65,563	28.8
LANL	LLNL	1,218	454,603	224,303	49.3
LANL	Pantex	647	85,252	35,326	41.4
LANL	SRS	2,779	521,907	163,376	31.3
LLNL	Fuel fabrication	4,838	771,701	257,880	33.4
LLNL	Geological repository	1,140	414,432	192,001	46.3
LLNL	Hanford	1,428	380,755	50,764	13.3
LLNL	INEEL	1,559	373,040	72,575	19.5
LLNL	Pantex	2,302	476,701	226,661	47.5
LLNL	SRS	4,395	856,464	403,622	47.1
Pantex	Geological repository	1,986	186,981	66,118	35.4
Pantex	INEEL	2,365	293,805	85,783	29.2
Pantex	ORR	1,753	245,038	59,671	24.4
Pantex	SRS	2,165	441,441	126,441	28.6
Pantex	WIPP	538	121,377	37,477	30.9
Portsmouth, OH	Fuel fabrication	977	239,221	40,636	17.0
RFETS	Hanford	1,848	141,585	23,178	16.4
RFETS	INEEL	1,170	104,960	17,791	17.0
RFETS	Pantex	1,252	252,177	81,450	32.3
RFETS	SRS	2,954	540,944	123,248	22.8
SRS	Hanford	4,377	615,204	126,016	20.5
SRS	ORR	568	109,074	15,614	14.3

Key: ANL–W, Argonne National Laboratory–West; LANL, Los Alamos National Laboratory; LLNL, Lawrence Livermore National Laboratory; ORR, Oak Ridge Reservation; RFETS, Rocky Flats Environmental Technology Site; WIPP, Waste Isolation Pilot Plant.

Table M–6. Low-Income Populations Residing Along Transportation Routes for Surplus Plutonium

Origin	Destination	Distance (km)	Total Population Along Route	Low-Income Population Along Route	Percentage Low-Income Population Along Route
ANL–W	Hanford	1,035	82,418	10,016	12.2
ANL–W	Pantex	2,395	281,386	44,102	15.7
ANL–W	SRS	3,756	580,985	60,473	10.4
Fuel fabrication	Hanford	4,760	601,233	61,518	10.2
Fuel fabrication	INEEL	4,092	556,388	55,229	9.9
Fuel fabrication	LANL	3,201	506,962	73,801	14.6
Fuel fabrication	Pantex	2,563	430,359	64,909	15.1
Fuel fabrication	SRS	578	75,050	10,673	14.2
Hanford	Geological repository	1,888	248,006	28,699	11.6
Hanford	INEEL	949	74,624	9,468	12.7
Hanford	LANL	2,515	276,768	42,384	15.3
Hanford	ORR	3,993	434,235	42,696	9.8
Hanford	Pantex	3,040	342,903	53,293	15.5
INEEL	ORR	3,316	389,496	39,171	10.1
INEEL	SRS	3,702	574,433	61,713	10.7
LANL	ANL–W	1,868	230,510	35,476	15.4
LANL	INEEL	1,840	227,759	35,984	15.8
LANL	LLNL	1,218	454,603	59,814	13.2
LANL	Pantex	647	85,252	12,635	14.8
LANL	SRS	2,779	521,907	80,398	15.4
LLNL	Fuel fabrication	4,838	771,701	103,519	13.4
LLNL	Geological repository	1,140	414,732	48,663	11.7
LLNL	Hanford	1,428	380,755	38,761	10.2
LLNL	INEEL	1,559	373,040	34,078	9.1
LLNL	Pantex	2,302	476,701	62,602	13.1
LLNL	SRS	4,395	856,464	136,322	15.9
Pantex	Geological repository	1,986	186,981	30,207	16.2
Pantex	INEEL	2,365	293,805	46,898	16.0
Pantex	ORR	1,753	245,038	44,137	18.0
Pantex	SRS	2,165	441,441	68,339	15.5
Pantex	WIPP	538	121,377	26,269	21.6
Portsmouth, OH	Fuel fabrication	977	239,221	33,268	13.9
RFETS	Hanford	1,848	141,585	15,985	11.3
RFETS	INEEL	1,170	104,960	10,424	9.9
RFETS	Pantex	1,252	252,177	41,478	16.4
RFETS	SRS	2,954	540,944	58,752	10.9
SRS	Hanford	4,377	615,204	65,311	10.6
SRS	ORR	568	109,074	13,061	12.0

Key: ANL–W, Argonne National Laboratory–West; LANL, Los Alamos National Laboratory; LLNL, Lawrence Livermore National Laboratory; ORR, Oak Ridge Reservation; RFETS, Rocky Flats Environmental Technology Site; WIPP, Waste Isolation Pilot Plant.

M.7 RESULTS FOR THE REACTOR SITES

M.7.1 Minority and Low-Income Population Estimates

Table M–7 shows total populations, minority populations, and percentage minority populations that resided within 80 km (50 mi) of the various sites at the time of the 1990 census. The 80-km (50-mi) distance defines the radius of potential radiological effects for calculations of radiation dose to the general population. Table M–8 shows similar data for projected populations in 2015. As discussed in Appendix M.4, minority populations residing in potentially affected areas in 1990 were adopted as a baseline. Populations in 2015 were then projected from the baseline data under the assumption that percentage changes in the majority and minority populations residing in the affected areas will be identical to those projected for State populations. The Census Bureau estimates that the national minority percentage will increase from approximately 24 percent in 1990 to nearly 34 percent by 2015 (Census 1996). [Text deleted.] In Tables M–7 and M–8, the sum of percentages of the different populations may total slightly more or less than 100 percent due to roundoff.

Table M–9 illustrates the uncertainties in the population estimates for the year 2015 due to the partial inclusion of block groups within the boundaries of potentially affected areas. Column 2 of the table lists the number of block groups that are partly within the circle of 80-km (50-mi) radius centered at the various facilities. Column 3 shows the number of block groups that lie completely within the circle. Potentially affected areas surrounding all three of the proposed reactor sites include two States. Columns 2 and 3 show the number of partial or total inclusions for the affected States. Column 4 of the table, denoted as "T/P," shows the number of totally included block groups divided by the number of partially included block groups. In order to minimize the uncertainties in the population estimate, it is desirable that this ratio be as large as possible. Column 5 shows upper bounds for the estimates of the total population listed in column 6. As discussed above, upper bounds were obtained by including the total population of all block groups that lie at least partially within the affected area. Lower bounds for the estimate of total population shown in column 7 were obtained by including only the populations of totally included block groups. Analogous statements apply to columns 8 through 10.

As would be expected from the value of T/P shown in column 4, uncertainties in the total population estimate for McGuire were the smallest among the three proposed reactor sites (+3.7 percent and −2.4 percent), as were the uncertainties in the estimate of the minority population at risk near Catawba (+5.7 percent and −3.3 percent). Uncertainties in the population estimates for North Anna were the largest among the three sites (+6.5 percent and −4.5 percent for total population; +5.9 percent and −4.2 percent for minority population). None of the uncertainties shown in Table M–9 are large enough to noticeably affect the conclusions regarding radiological health effects or environmental justice.

An estimate of the percentage of low-income persons living within 80 km (50 mi) of the proposed reactor sites in 2015 was obtained using a linear projection of low-income data from the 1980 census and the 1990 census. In 1990, the percentage of low-income persons (i.e., those with reported incomes below the poverty threshold) residing in the contiguous United States was 13.1 percent. The percentage of low-income persons living within 80 km (50 mi) of the proposed reactor sites was lower than the national average in every case. Around Catawba, the percentage of low-income persons living within 80 km (50 mi), in 1990, was 10.5 percent. At McGuire, the percentage was 9.8 percent, and around North Anna, the percentage was 6.9 percent.

The estimated number of low-income persons living within 80 km (50 mi) of Catawba in 2015 is 157,477 or 7.0 percent of the projected population. The estimated number of low-income persons living within 80 km (50 mi) of McGuire in 2015 is 171,182 or 6.6 percent of the projected population. The estimated number of

Table M–7. Racial and Ethnic Composition of Minority Populations Residing Within 80 km of Proposed Reactor Sites in 1990

Reactor Site	Total Pop.	Minority Pop.	Percent Minority Pop.	Asian or Pacific Islander Pop.	Percent Asian or Pacific Islander Pop.	Black Pop.	Percent Black Pop	Hispanic Pop.	Percent Hispanic Pop.	Native American Pop.	Percent Native American Pop.	Other Race	Percent Other Race Pop.	White Pop.	Percent White Pop.
Catawba	1,519,392	315,089	20.7	10,942	0.7	288,382	19.0	10,666	0.7	5,098	0.3	442	0.0	1,203,861	79.2
McGuire	1,738,966	305,717	17.6	12,007	0.7	275,789	15.9	12,094	0.7	5,828	0.3	479	0.0	1,432,770	82.4
North Anna	1,286,156	281,652	21.9	18,783	1.5	241,619	18.8	17,550	1.4	3,686	0.3	947	0.1	1,003,557	78.0

Table M–8. Projected Racial and Ethnic Composition of Minority Populations Residing Within 80 km of Proposed Reactor Sites in 2015

Reactor Site	Total Pop.	Minority Pop.	Percent Minority Pop.	Asian or Pacific Islander Pop.	Percent Asian or Pacific Islander Pop.	Black Pop.	Percent Black Pop	Hispanic Pop.	Percent Hispanic Pop.	Native American Pop.	Percent Native American Pop.	Other Race	Percent Other Race Pop.	White Pop.	Percent White Pop.
Catawba	2,265,495	597,376	26.4	37,756	1.7	507,810	22.4	40,504	1.8	10,700	0.5	606	0.0	1,668,119	73.6
McGuire	2,575,369	620,701	24.1	43,333	1.7	517,577	20.1	46,486	1.8	12,635	0.5	670	0.0	1,954,668	75.9
North Anna	2,042,200	731,773	35.8	106,086	5.2	508,719	24.9	111,992	5.5	4,976	0.2	1,165	0.1	1,309,262	64.1

Table M–9. Uncertainties in Estimates of Total and Minority Populations for the Year 2015

Reactor Site	No. of Partially Included Block Groups	No. of Fully Included Block Groups	T/P	Upper Bound for Total Population	Estimate of Total Population	Lower Bound for Total Population	Upper Bound for Minority Population	Estimate of Minority Population	Lower Bound for Minority Population
Catawba	54 (NC) 52 (SC)	851 (NC) 314 (SC)	11.0	2,395,224	2,265,495	2,191,319	627,435	597,376	579,620
McGuire	64 (NC) 24 (SC)	1,190 (NC) 129 (SC)	15.0	2,672,795	2,575,369	2,513,292	636,842	620,701	611,521
North Anna	84 (VA) 10 (MD)	710 (VA) 5 (MD)	7.6	2,175,504	2,042,200	1,949,928	775,277	731,773	700,983

low-income persons living within 80 km (50 mi) of North Anna in 2015 is 110,531 or 5.4 percent of the projected population. [Text deleted.] Figures M–10 through M–15 show geographical distributions of minority and low-income populations residing with 80 km (50 mi) of the proposed reactor sites.

M.7.2 Environmental Effects on Minority and Low-Income Populations Residing Near Proposed Reactor Sites

The analysis of environmental effects on populations residing within 80 km (50 mi) of the proposed reactor sites is presented in Chapter 4 of the SPD EIS. This analysis shows that no radiological fatalities are likely to result from implementation of the proposed action or alternatives. Radiological risks to the public are small regardless of the racial and ethnic composition of the population, and regardless of the economic status of individuals comprising the population. Nonradiological risks to the general population are also small regardless of the racial and ethnic composition or economic status of the population. Thus, disproportionately high and adverse impacts on minority and low-income populations residing near the various facilities are not likely to result from implementation of the proposed action or alternatives.

M.8 REFERENCES

Campbell, P., 1996, *Population Projections: 1995–2025*, U.S. Department of Commerce, Bureau of the Census, Washington, DC, October.

CEQ (Council on Environmental Quality), 1997, *Environmental Justice, Guidance Under the National Environmental Policy Act*, Executive Office of the President, Washington, DC, December 10.

DOC (U.S. Department of Commerce), 1992, *Census of Population and Housing, 1990: Summary Tape File 3 on CD-ROM*, Bureau of the Census, Washington, DC, May.

DOC (U.S. Department of Commerce), 1996, *Resident Population of the United States: Middle Series Projections, 2015–2030, by Sex, Race, and Hispanic Origin, with Median Age*, Bureau of the Census, Washington, DC, March.

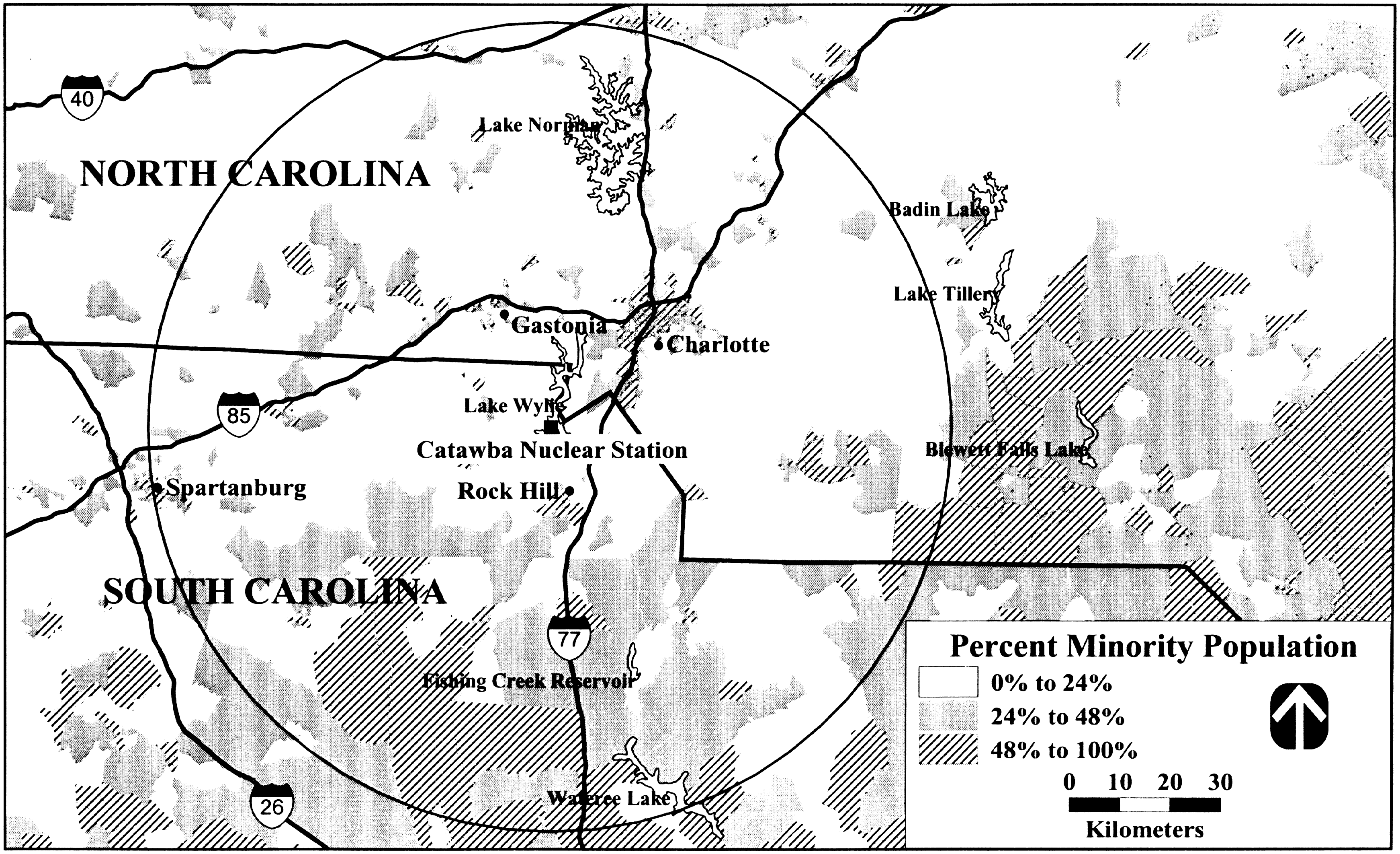


Figure M–10. Geographical Distribution of the Minority Population Residing Within 80 km (50 mi) of Catawba Nuclear Station

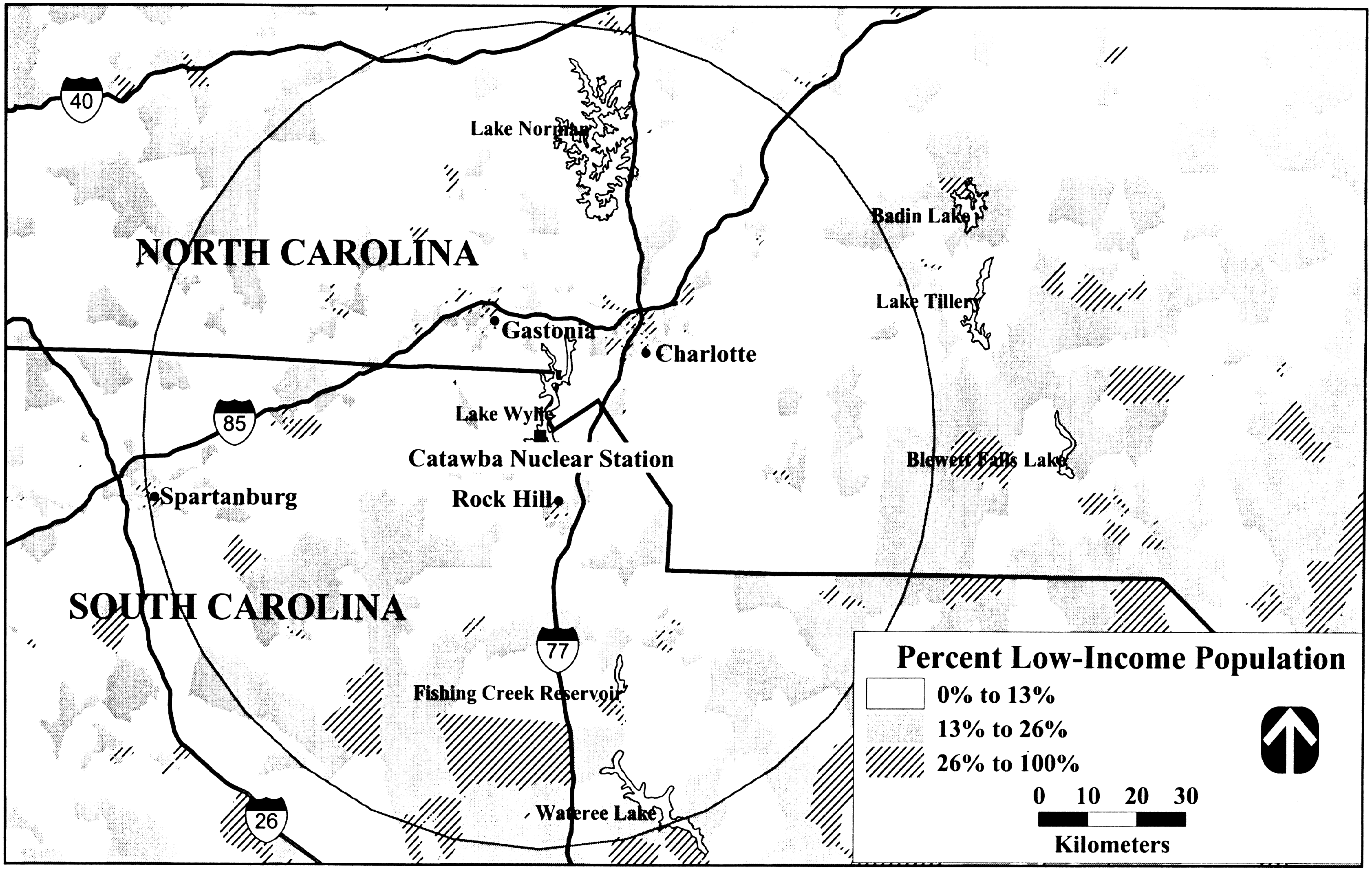


Figure M–11. Geographical Distribution of the Low-Income Population Residing Within 80 km (50 mi) of Catawba Nuclear Station

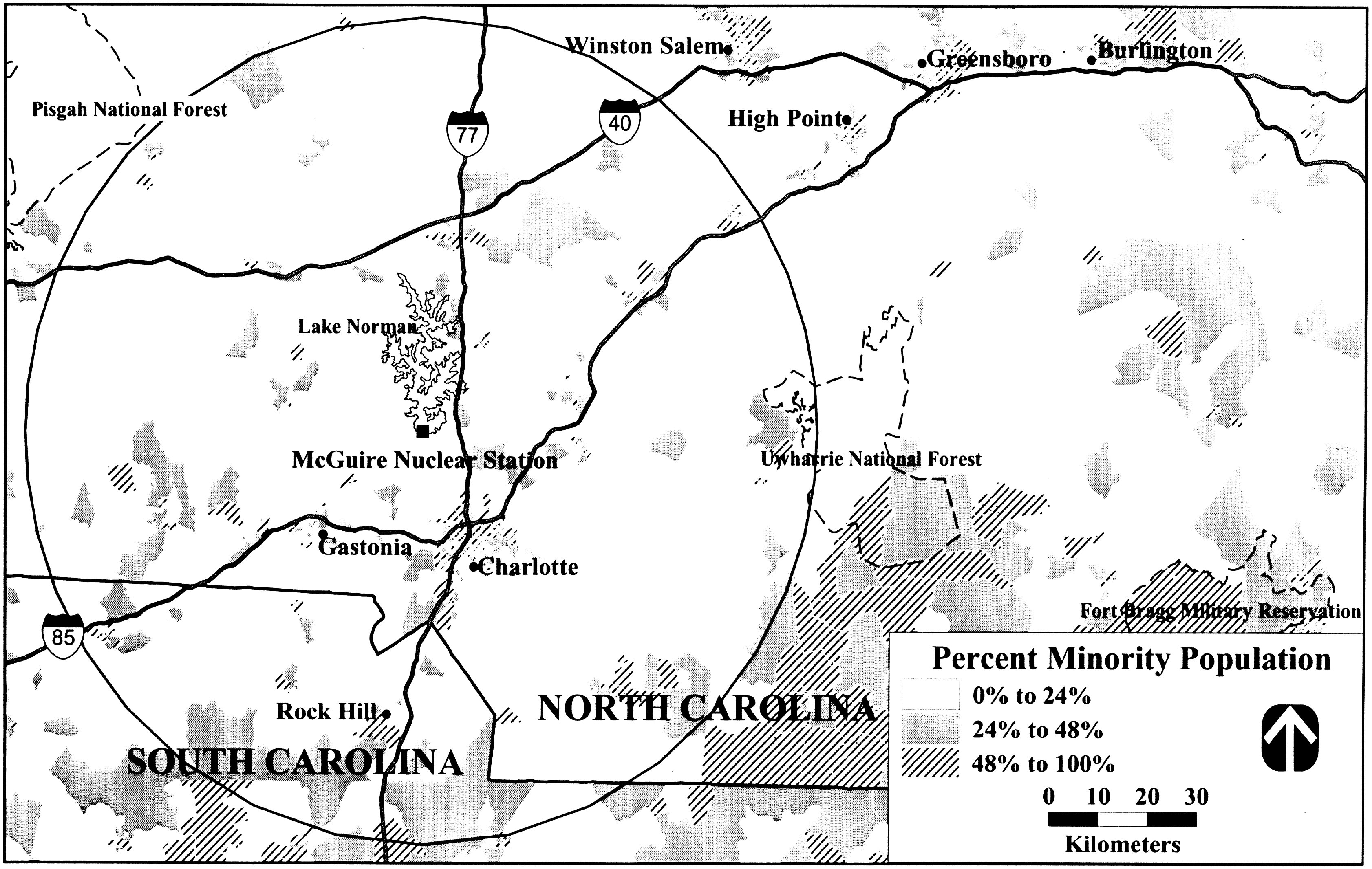


Figure M–12. Geographical Distribution of the Minority Population Residing Within 80 km (50 mi) of McGuire Nuclear Station

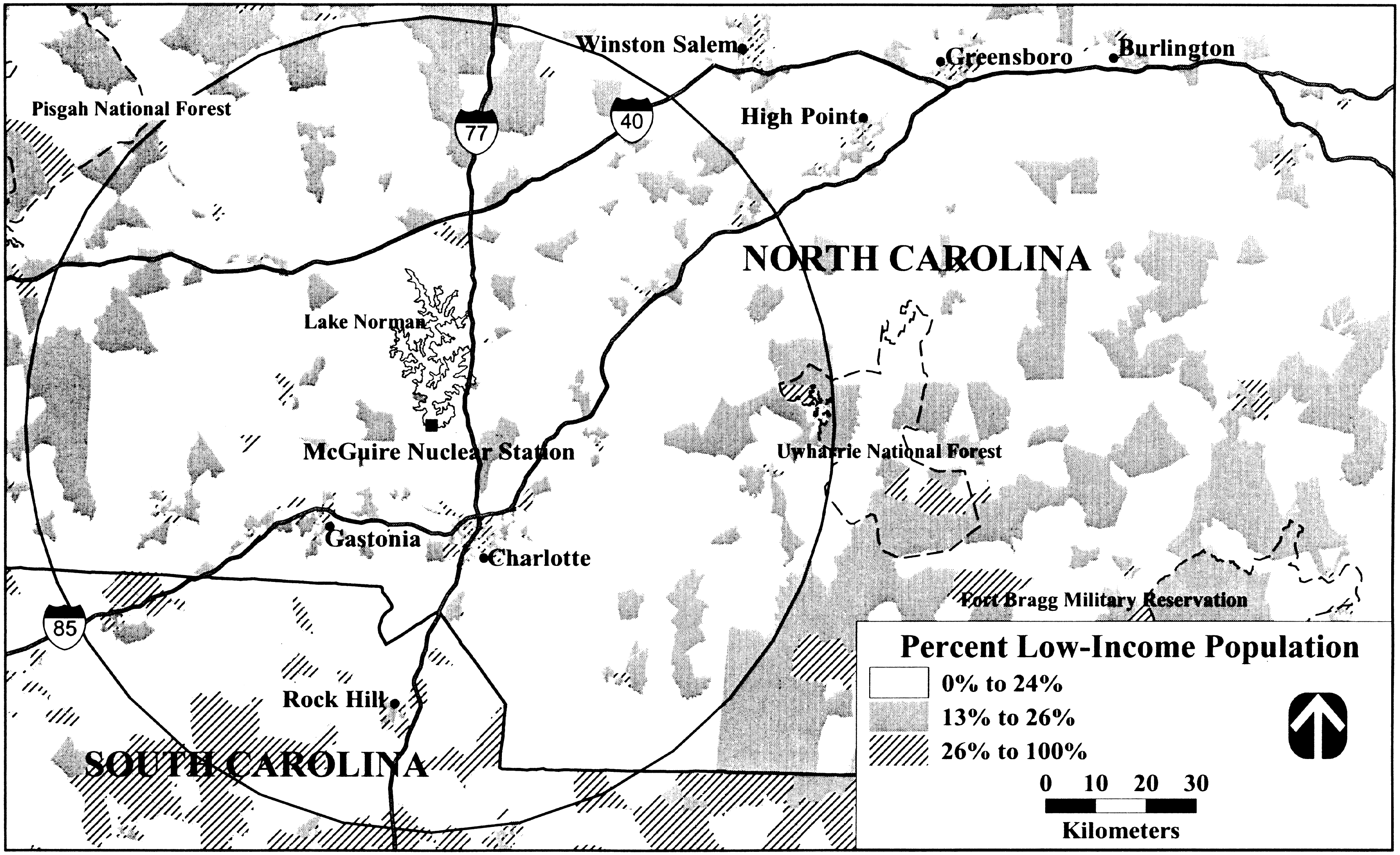


Figure M–13. Geographical Distribution of the Low-Income Population Residing Within 80 km (50 mi) of McGuire Nuclear Station

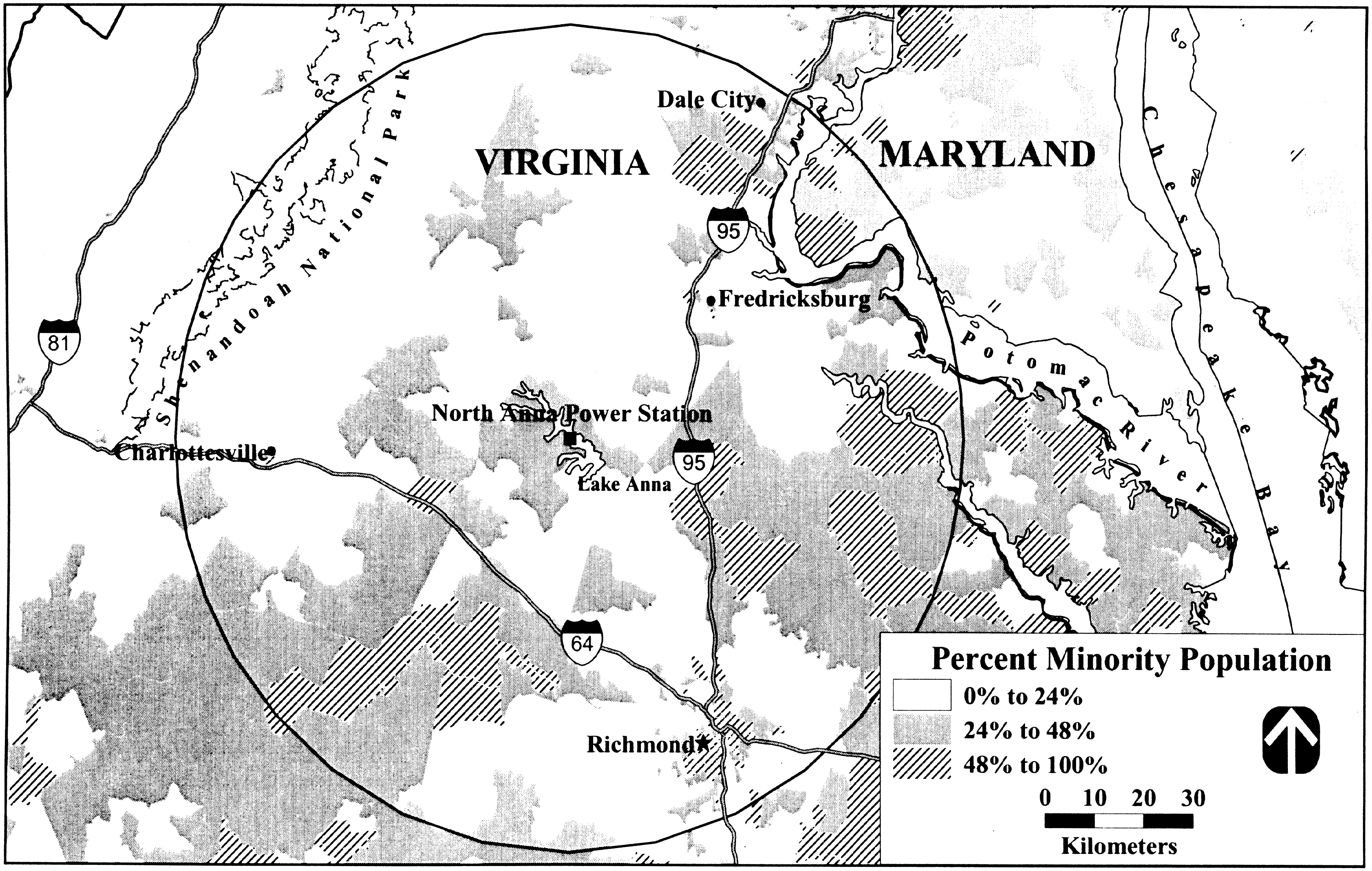


Figure M–14. Geographical Distribution of the Minority Population Residing Within 80 km (50 mi) of North Anna Power Station

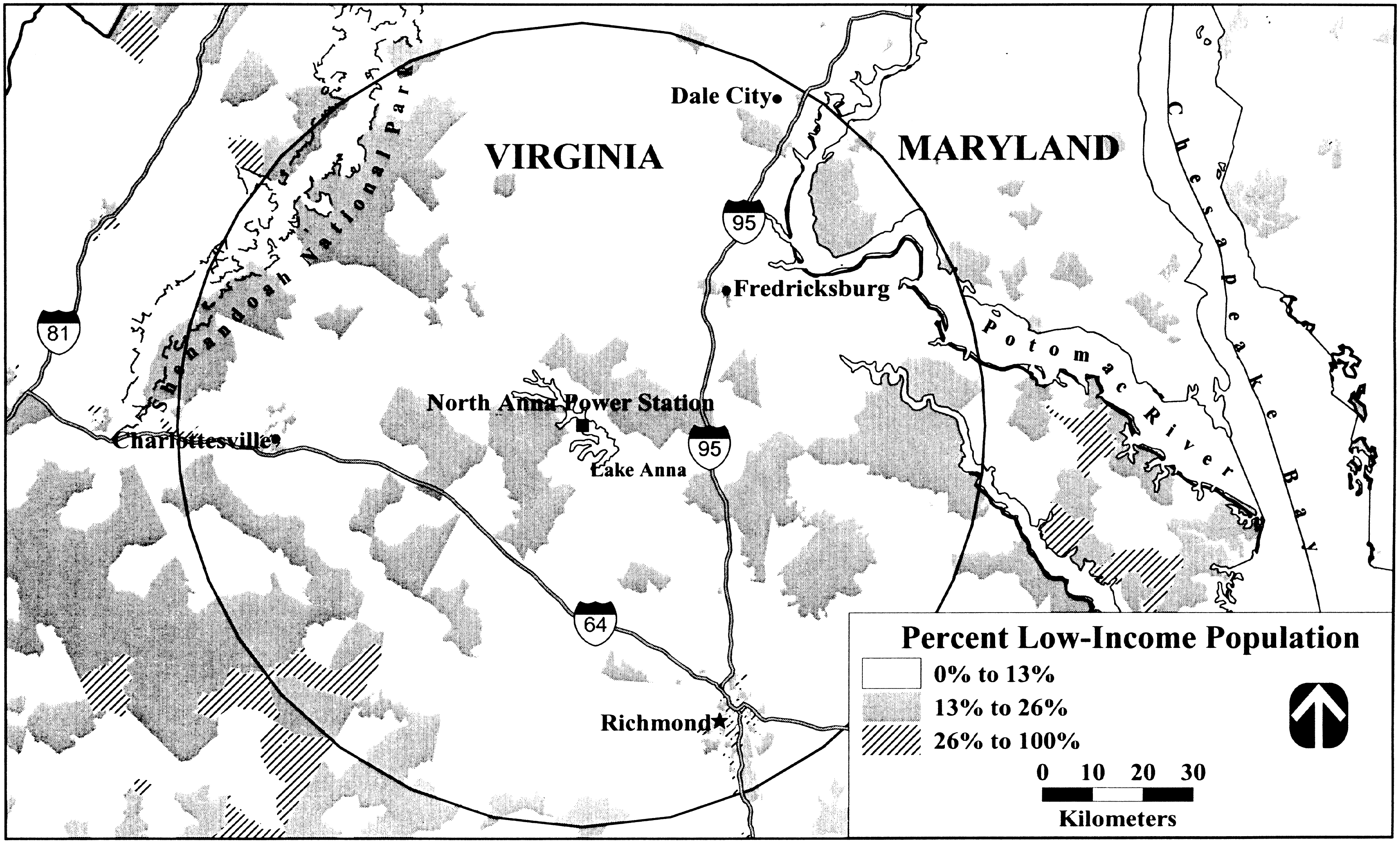


Figure M–15. Geographical Distribution of the Low-Income Population Residing Within 80 km (50 mi) of North Anna Power Station

Appendix O
Consultations

Certain statutes and regulations require the U.S. Department of Energy (DOE) to consider consultations with Federal, State, and local agencies and federally recognized Native American groups regarding the potential for alternatives for surplus plutonium disposition to disturb sensitive resources. These consultations are related to biotic, cultural, and Native American resources. DOE has initiated applicable consultations with Federal and State agencies and federally recognized Native American groups. Appendix O contains copies of the consultation letters sent by DOE to agencies and Native American groups, and any written responses provided by those agencies or groups. Attachments to responses are not included in Appendix O but are, nevertheless, part of the public record.

Department of Energy
Washington, DC 20585

October 30, 1998

David Hansen
State Historic Preservation Officer
Office of Archaeology & Historical Preservation
420 Golf Club Road SE, Suite 201
Lacey, Washington 98503

Subject: *Consultation for Surplus Plutonium Disposition Environmental Impact Analysis Process, Under Executive Memorandum Concerning Government-to-Government Relations*

Dear Mr. Hansen:

The purpose of this letter is to notify you that the United States Department of Energy (DOE) is in the process of conducting an Environmental Impact Analysis concerning the disposition of surplus plutonium.

With this letter we are soliciting specific concerns the Office of Archaeology and Historical Preservation may have about the proposal. This consultation is in accordance with the National Environmental Policy Act and Section 106 of the National Historic Preservation Act.

The *Surplus Plutonium Disposition Environmental Impact Statement* (SPD EIS) is tiered from the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic EIS* (DOE/EIS-0229), issued in December 1996, and the associated Record of Decision (62 FR 3014), issued on January 14, 1997. DOE is producing the SPD EIS in compliance with the National Environmental Policy Act (NEPA) and Council on Environmental Quality regulations implementing NEPA, DOE's NEPA Implementing Regulations (10 CFR 1021), and other applicable federal and state environmental legislation.

The purpose and need for the proposed action is to reduce the threat of nuclear weapons proliferation worldwide by disposing of surplus plutonium in the United States in an environmentally safe and timely manner. The SPD Draft EIS, a copy of which is attached for your review, examines the potential environmental impacts for 24 alternatives for the proposed siting, construction, and operation of three types of facilities: pit disassembly and conversion; mixed oxide (MOX) fuel fabrication; and plutonium conversion and immobilization.

If an alternative is selected that includes siting of surplus plutonium disposition facilities at the Hanford site (e.g., Alternative 2), a maximum of about 15 hectares

(37 acres) of land in the 400 Area would be impacted. No prehistoric or historic archaeological resources have been identified within the proposed construction areas, and no architectural resources in the 200 East of 400 Area. Preconstruction surveys (as required) and construction monitoring for previously unknown resources would be conducted within the framework of the *Hanford Cultural Resources Management Plan* (Battelle 1989; revised draft edition 1998).

If you have any specific concerns about the SPD EIS proposal, we would like to hear from you. Please contact me with your concerns or questions at:

Marcus Jones
SPD EIS Document Manager
U.S. Department of Energy
Office of Fissile Materials Disposition
P.O. Box 23786
Washington, DC 20026-3786
(202) 586-0149.

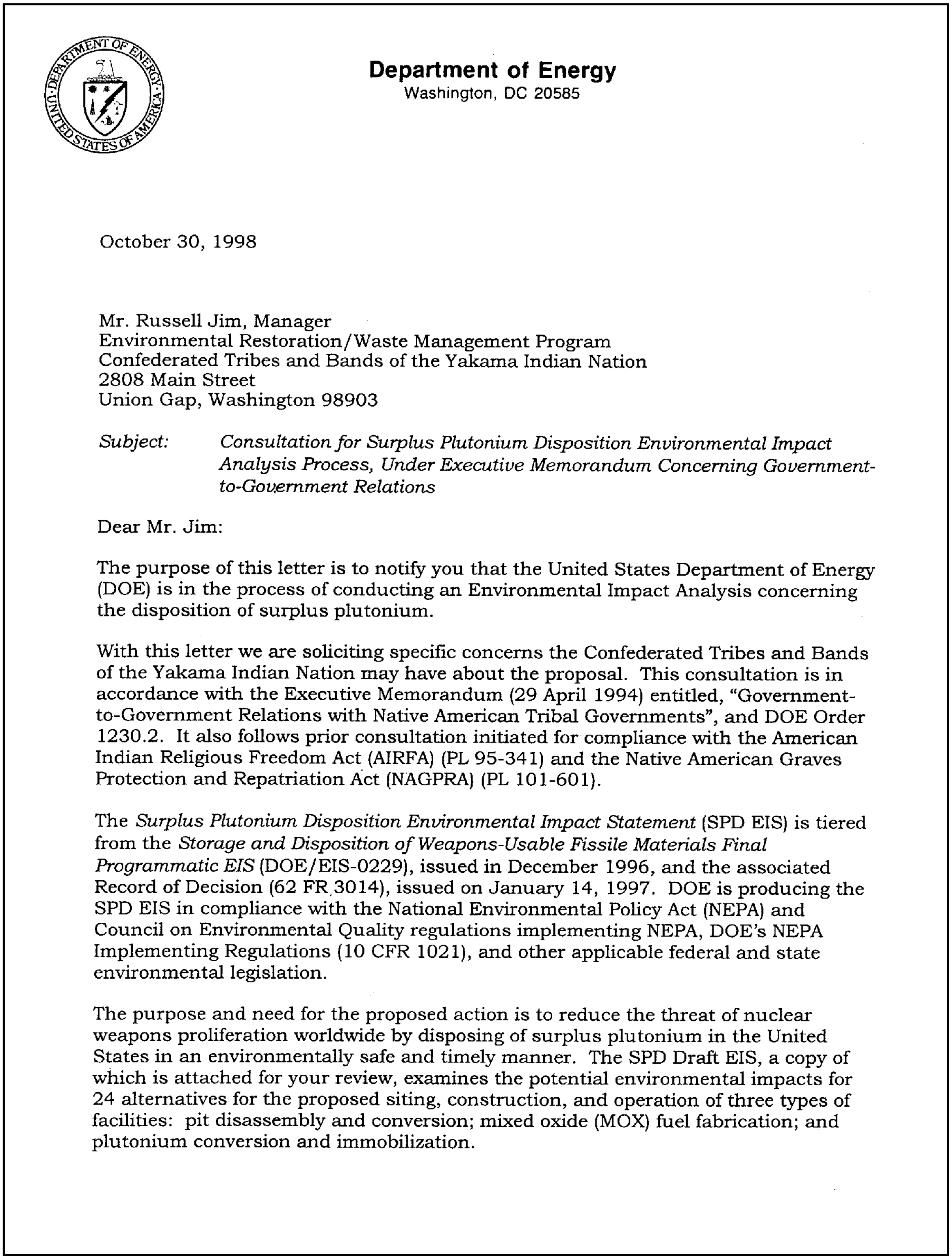
You may also contact Dee Lloyd, Hanford Cultural Resources Program Manager, at (509) 372-2299.

Sincerely,

Marcus Jones
SPD EIS Document Manager

cc: Dee Lloyd, Cultural Resource Manager, Hanford
Lois Thompson, Federal Preservation Officer, DOE HQ

SPD EIS enclosure



Department of Energy
Washington, DC 20585

October 30, 1998

Mr. Russell Jim, Manager
Environmental Restoration/Waste Management Program
Confederated Tribes and Bands of the Yakama Indian Nation
2808 Main Street
Union Gap, Washington 98903

Subject: *Consultation for Surplus Plutonium Disposition Environmental Impact Analysis Process, Under Executive Memorandum Concerning Government-to-Government Relations*

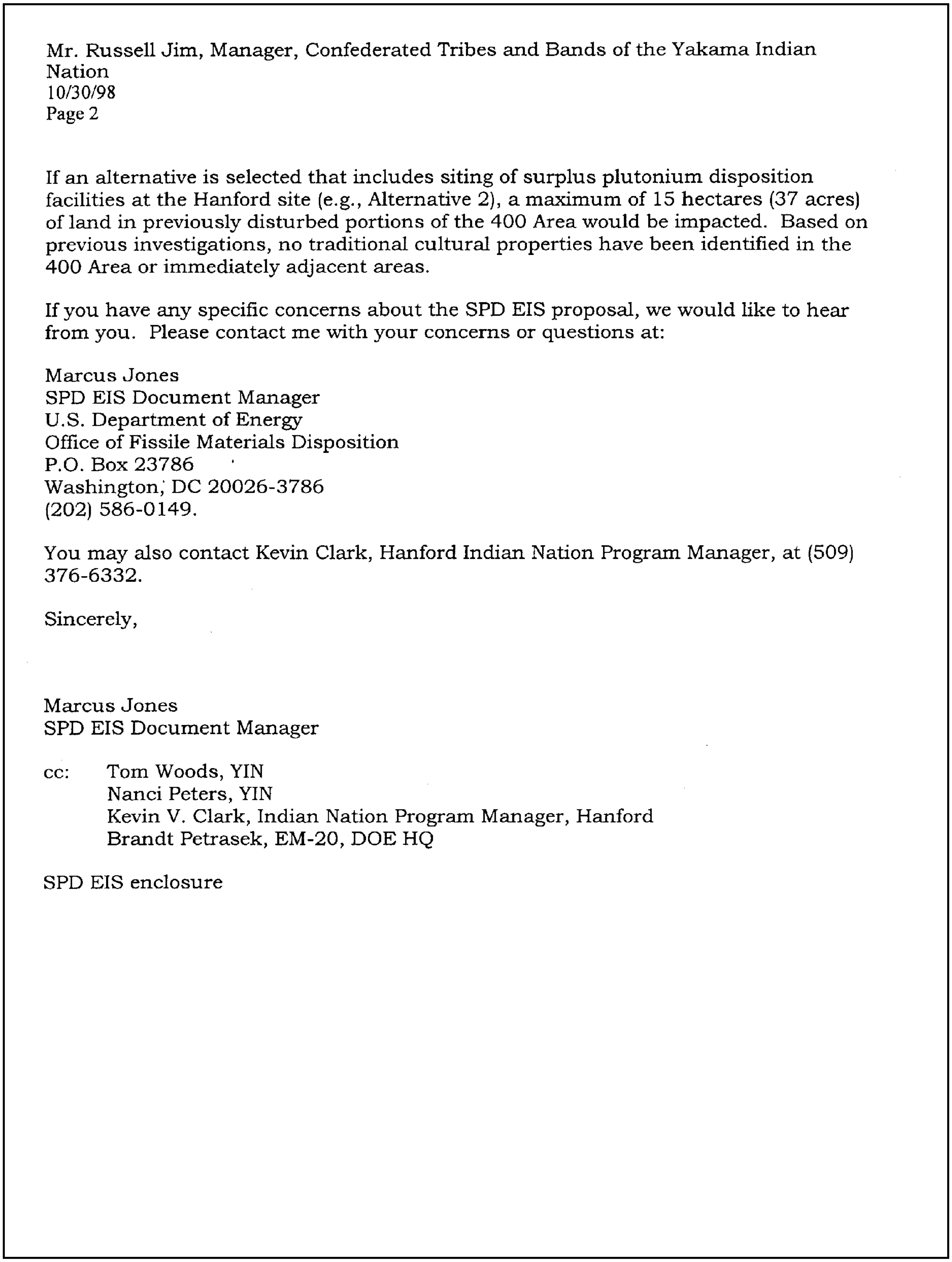
Dear Mr. Jim:

The purpose of this letter is to notify you that the United States Department of Energy (DOE) is in the process of conducting an Environmental Impact Analysis concerning the disposition of surplus plutonium.

With this letter we are soliciting specific concerns the Confederated Tribes and Bands of the Yakama Indian Nation may have about the proposal. This consultation is in accordance with the Executive Memorandum (29 April 1994) entitled, "Government-to-Government Relations with Native American Tribal Governments", and DOE Order 1230.2. It also follows prior consultation initiated for compliance with the American Indian Religious Freedom Act (AIRFA) (PL 95-341) and the Native American Graves Protection and Repatriation Act (NAGPRA) (PL 101-601).

The *Surplus Plutonium Disposition Environmental Impact Statement* (SPD EIS) is tiered from the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic EIS* (DOE/EIS-0229), issued in December 1996, and the associated Record of Decision (62 FR 3014), issued on January 14, 1997. DOE is producing the SPD EIS in compliance with the National Environmental Policy Act (NEPA) and Council on Environmental Quality regulations implementing NEPA, DOE's NEPA Implementing Regulations (10 CFR 1021), and other applicable federal and state environmental legislation.

The purpose and need for the proposed action is to reduce the threat of nuclear weapons proliferation worldwide by disposing of surplus plutonium in the United States in an environmentally safe and timely manner. The SPD Draft EIS, a copy of which is attached for your review, examines the potential environmental impacts for 24 alternatives for the proposed siting, construction, and operation of three types of facilities: pit disassembly and conversion; mixed oxide (MOX) fuel fabrication; and plutonium conversion and immobilization.



Mr. Russell Jim, Manager, Confederated Tribes and Bands of the Yakama Indian Nation
10/30/98
Page 2

If an alternative is selected that includes siting of surplus plutonium disposition facilities at the Hanford site (e.g., Alternative 2), a maximum of 15 hectares (37 acres) of land in previously disturbed portions of the 400 Area would be impacted. Based on previous investigations, no traditional cultural properties have been identified in the 400 Area or immediately adjacent areas.

If you have any specific concerns about the SPD EIS proposal, we would like to hear from you. Please contact me with your concerns or questions at:

Marcus Jones
SPD EIS Document Manager
U.S. Department of Energy
Office of Fissile Materials Disposition
P.O. Box 23786
Washington, DC 20026-3786
(202) 586-0149.

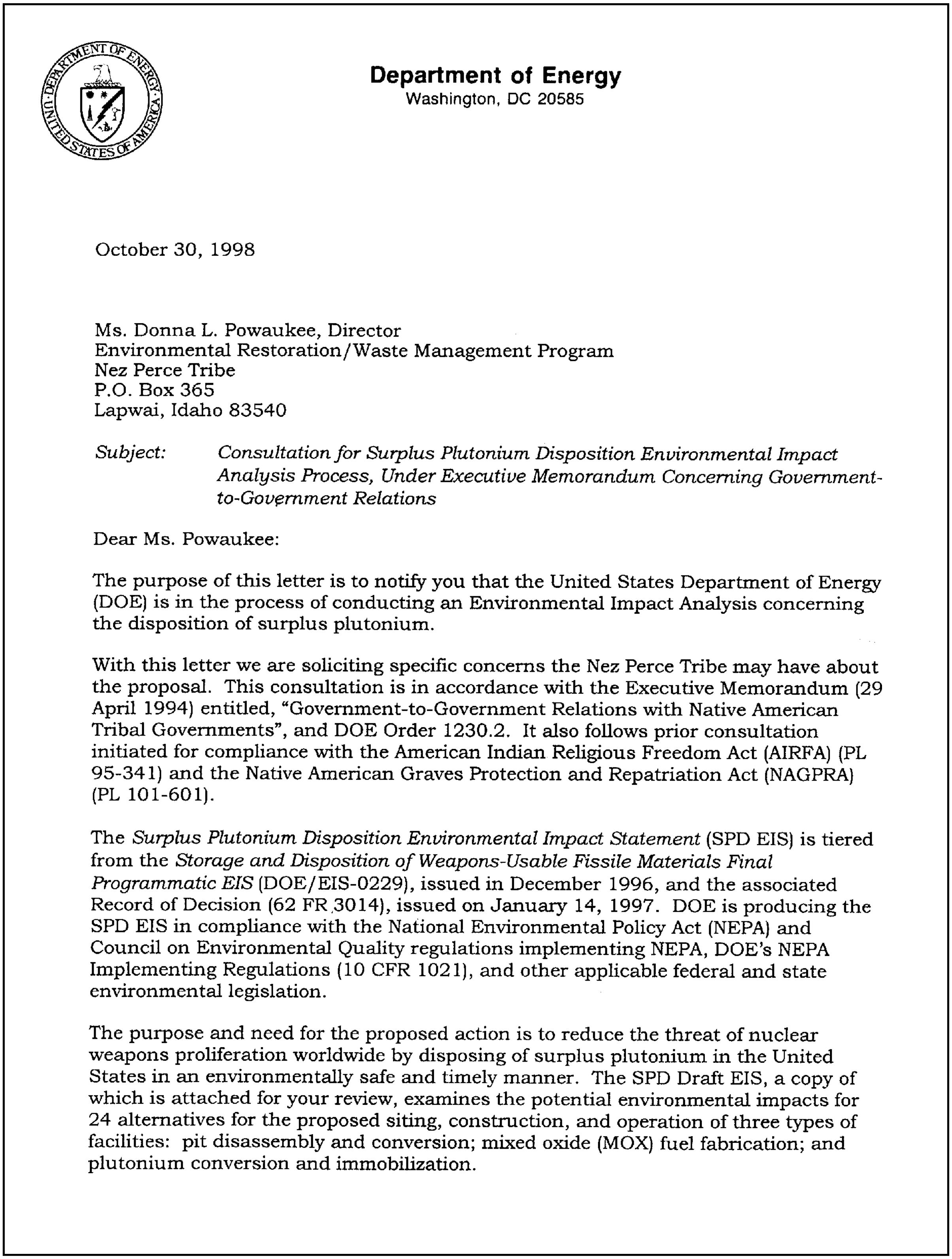
You may also contact Kevin Clark, Hanford Indian Nation Program Manager, at (509) 376-6332.

Sincerely,

Marcus Jones
SPD EIS Document Manager

cc: Tom Woods, YIN
Nanci Peters, YIN
Kevin V. Clark, Indian Nation Program Manager, Hanford
Brandt Petrasek, EM-20, DOE HQ

SPD EIS enclosure



Department of Energy
Washington, DC 20585

October 30, 1998

Ms. Donna L. Powaukee, Director
Environmental Restoration/Waste Management Program
Nez Perce Tribe
P.O. Box 365
Lapwai, Idaho 83540

Subject: *Consultation for Surplus Plutonium Disposition Environmental Impact Analysis Process, Under Executive Memorandum Concerning Government-to-Government Relations*

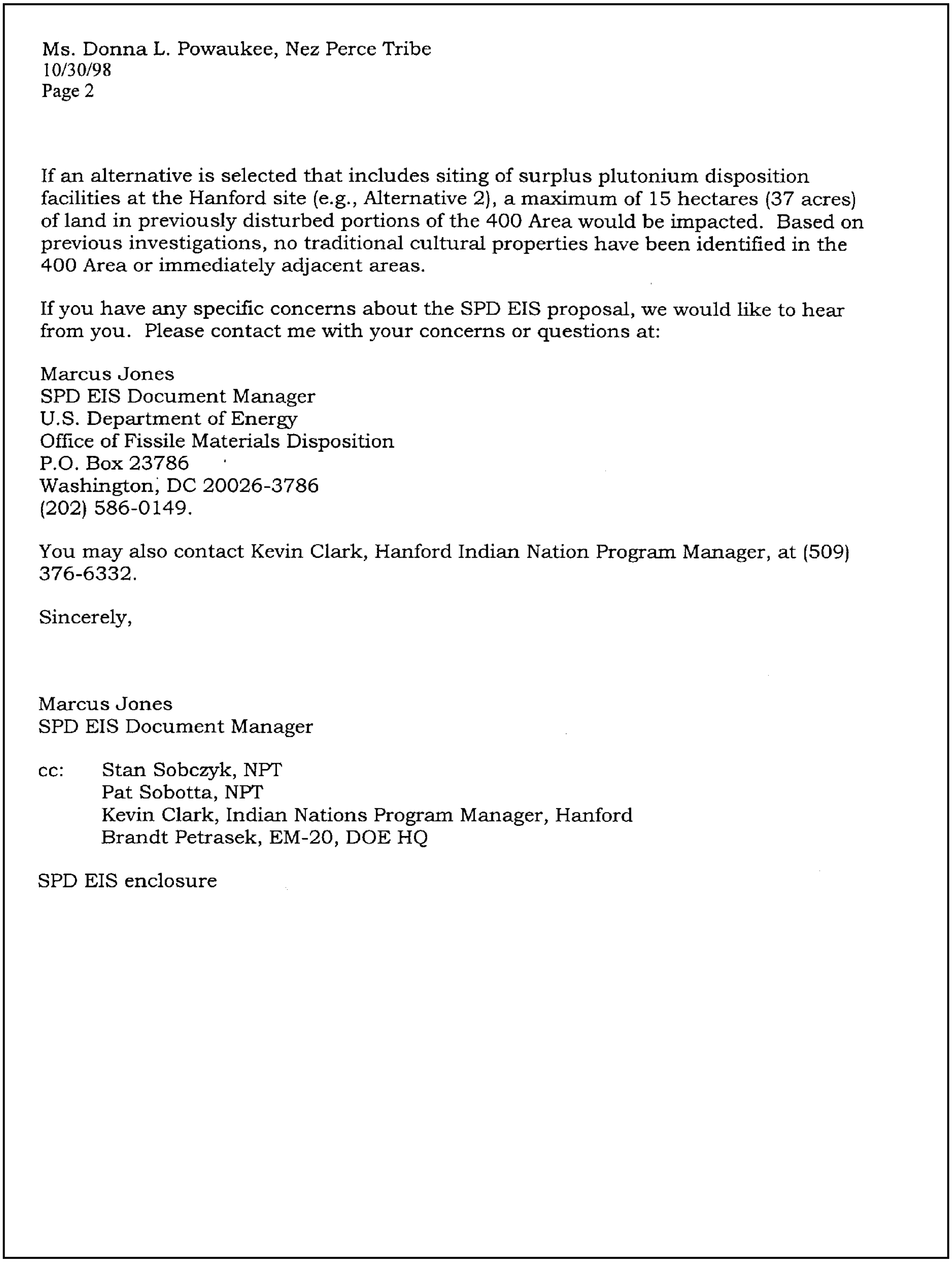
Dear Ms. Powaukee:

The purpose of this letter is to notify you that the United States Department of Energy (DOE) is in the process of conducting an Environmental Impact Analysis concerning the disposition of surplus plutonium.

With this letter we are soliciting specific concerns the Nez Perce Tribe may have about the proposal. This consultation is in accordance with the Executive Memorandum (29 April 1994) entitled, "Government-to-Government Relations with Native American Tribal Governments", and DOE Order 1230.2. It also follows prior consultation initiated for compliance with the American Indian Religious Freedom Act (AIRFA) (PL 95-341) and the Native American Graves Protection and Repatriation Act (NAGPRA) (PL 101-601).

The *Surplus Plutonium Disposition Environmental Impact Statement* (SPD EIS) is tiered from the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic EIS* (DOE/EIS-0229), issued in December 1996, and the associated Record of Decision (62 FR 3014), issued on January 14, 1997. DOE is producing the SPD EIS in compliance with the National Environmental Policy Act (NEPA) and Council on Environmental Quality regulations implementing NEPA, DOE's NEPA Implementing Regulations (10 CFR 1021), and other applicable federal and state environmental legislation.

The purpose and need for the proposed action is to reduce the threat of nuclear weapons proliferation worldwide by disposing of surplus plutonium in the United States in an environmentally safe and timely manner. The SPD Draft EIS, a copy of which is attached for your review, examines the potential environmental impacts for 24 alternatives for the proposed siting, construction, and operation of three types of facilities: pit disassembly and conversion; mixed oxide (MOX) fuel fabrication; and plutonium conversion and immobilization.



Ms. Donna L. Powaukee, Nez Perce Tribe
10/30/98
Page 2

If an alternative is selected that includes siting of surplus plutonium disposition facilities at the Hanford site (e.g., Alternative 2), a maximum of 15 hectares (37 acres) of land in previously disturbed portions of the 400 Area would be impacted. Based on previous investigations, no traditional cultural properties have been identified in the 400 Area or immediately adjacent areas.

If you have any specific concerns about the SPD EIS proposal, we would like to hear from you. Please contact me with your concerns or questions at:

Marcus Jones
SPD EIS Document Manager
U.S. Department of Energy
Office of Fissile Materials Disposition
P.O. Box 23786
Washington, DC 20026-3786
(202) 586-0149.

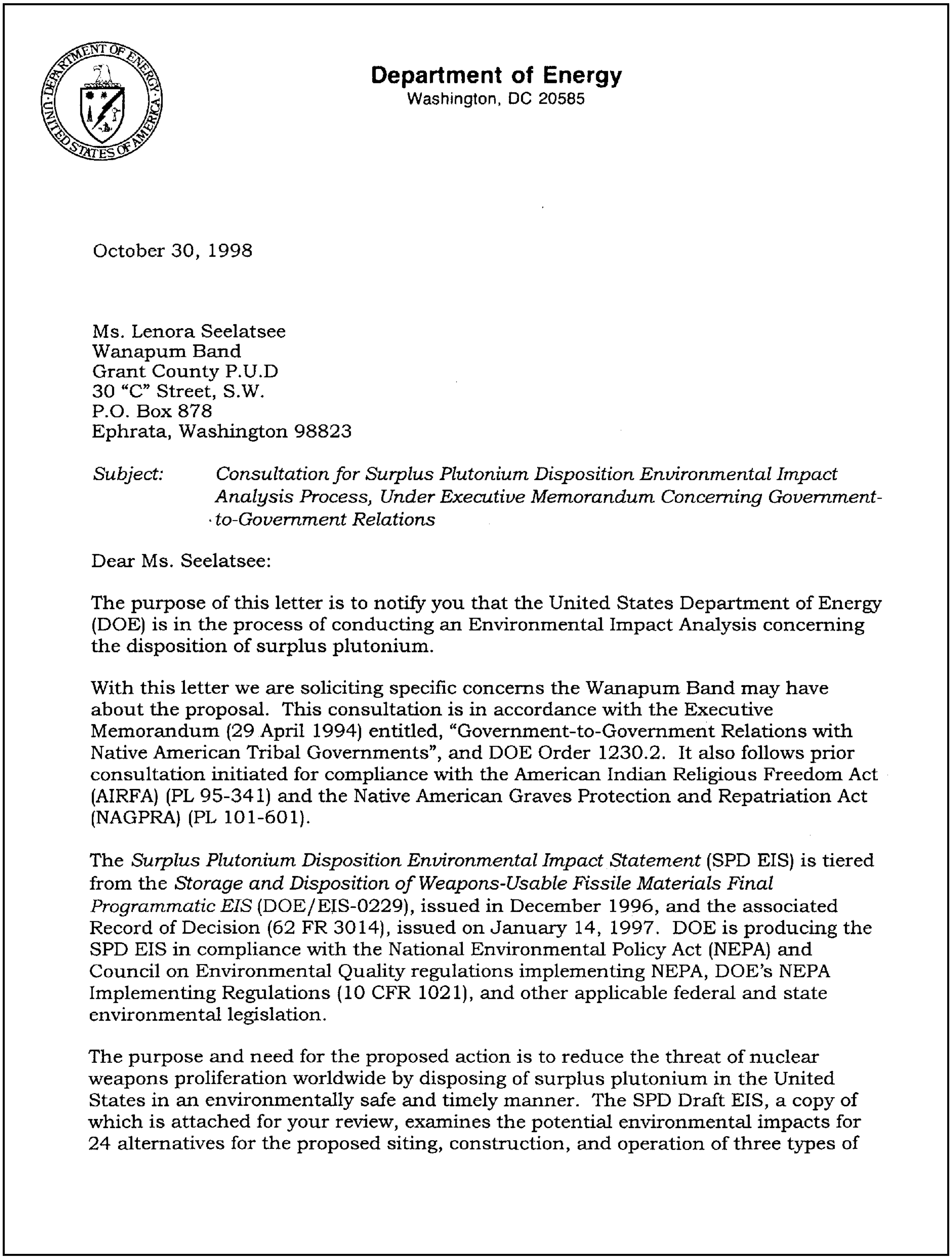
You may also contact Kevin Clark, Hanford Indian Nation Program Manager, at (509) 376-6332.

Sincerely,

Marcus Jones
SPD EIS Document Manager

cc: Stan Sobczyk, NPT
Pat Sobotta, NPT
Kevin Clark, Indian Nations Program Manager, Hanford
Brandt Petrasek, EM-20, DOE HQ

SPD EIS enclosure



Department of Energy
Washington, DC 20585

October 30, 1998

Ms. Lenora Seelatsee
Wanapum Band
Grant County P.U.D
30 "C" Street, S.W.
P.O. Box 878
Ephrata, Washington 98823

Subject: *Consultation for Surplus Plutonium Disposition Environmental Impact Analysis Process, Under Executive Memorandum Concerning Government-to-Government Relations*

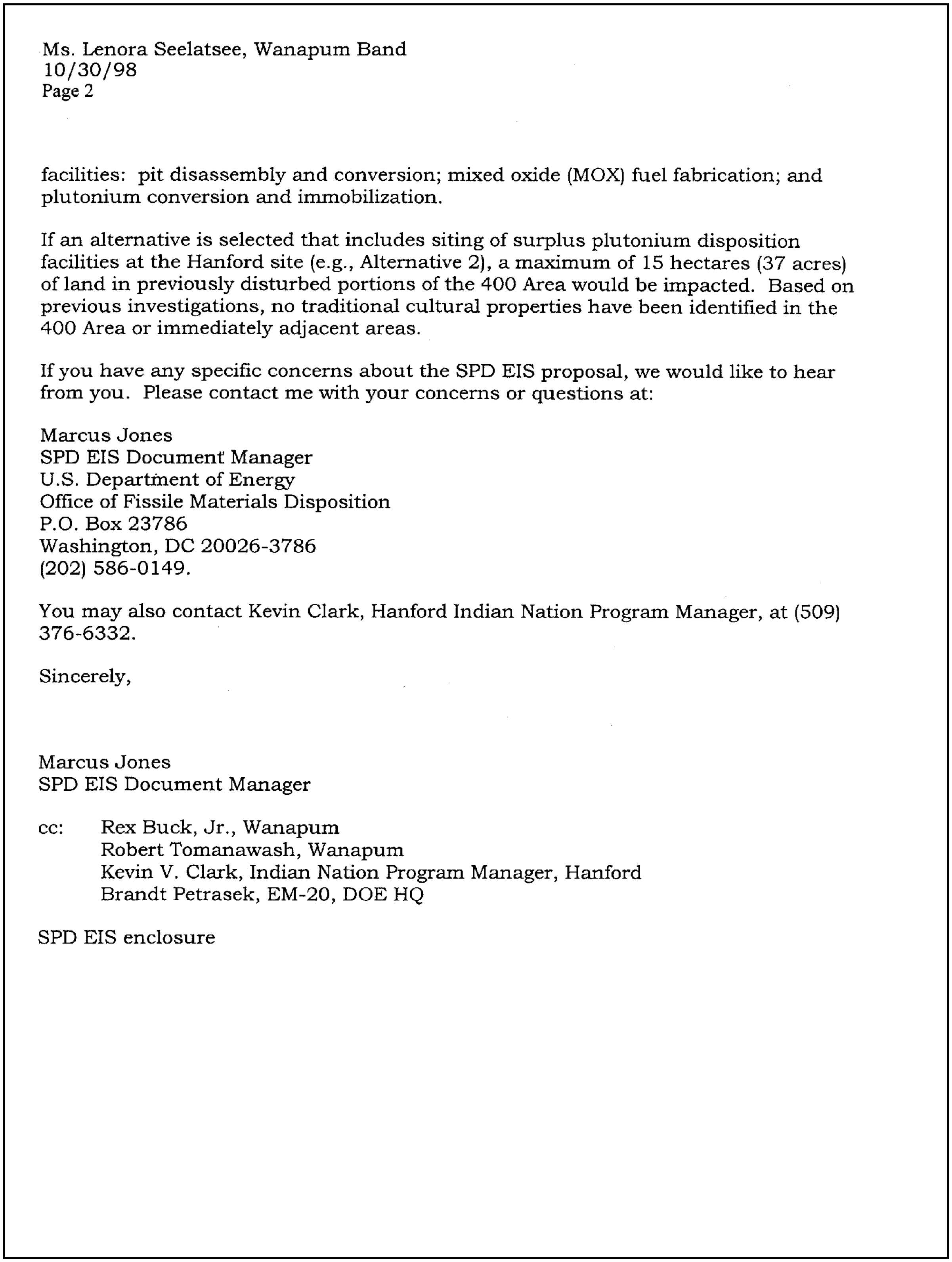
Dear Ms. Seelatsee:

The purpose of this letter is to notify you that the United States Department of Energy (DOE) is in the process of conducting an Environmental Impact Analysis concerning the disposition of surplus plutonium.

With this letter we are soliciting specific concerns the Wanapum Band may have about the proposal. This consultation is in accordance with the Executive Memorandum (29 April 1994) entitled, "Government-to-Government Relations with Native American Tribal Governments", and DOE Order 1230.2. It also follows prior consultation initiated for compliance with the American Indian Religious Freedom Act (AIRFA) (PL 95-341) and the Native American Graves Protection and Repatriation Act (NAGPRA) (PL 101-601).

The *Surplus Plutonium Disposition Environmental Impact Statement* (SPD EIS) is tiered from the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic EIS* (DOE/EIS-0229), issued in December 1996, and the associated Record of Decision (62 FR 3014), issued on January 14, 1997. DOE is producing the SPD EIS in compliance with the National Environmental Policy Act (NEPA) and Council on Environmental Quality regulations implementing NEPA, DOE's NEPA Implementing Regulations (10 CFR 1021), and other applicable federal and state environmental legislation.

The purpose and need for the proposed action is to reduce the threat of nuclear weapons proliferation worldwide by disposing of surplus plutonium in the United States in an environmentally safe and timely manner. The SPD Draft EIS, a copy of which is attached for your review, examines the potential environmental impacts for 24 alternatives for the proposed siting, construction, and operation of three types of



Ms. Lenora Seelatsee, Wanapum Band
10/30/98
Page 2

facilities: pit disassembly and conversion; mixed oxide (MOX) fuel fabrication; and plutonium conversion and immobilization.

If an alternative is selected that includes siting of surplus plutonium disposition facilities at the Hanford site (e.g., Alternative 2), a maximum of 15 hectares (37 acres) of land in previously disturbed portions of the 400 Area would be impacted. Based on previous investigations, no traditional cultural properties have been identified in the 400 Area or immediately adjacent areas.

If you have any specific concerns about the SPD EIS proposal, we would like to hear from you. Please contact me with your concerns or questions at:

Marcus Jones
SPD EIS Document Manager
U.S. Department of Energy
Office of Fissile Materials Disposition
P.O. Box 23786
Washington, DC 20026-3786
(202) 586-0149.

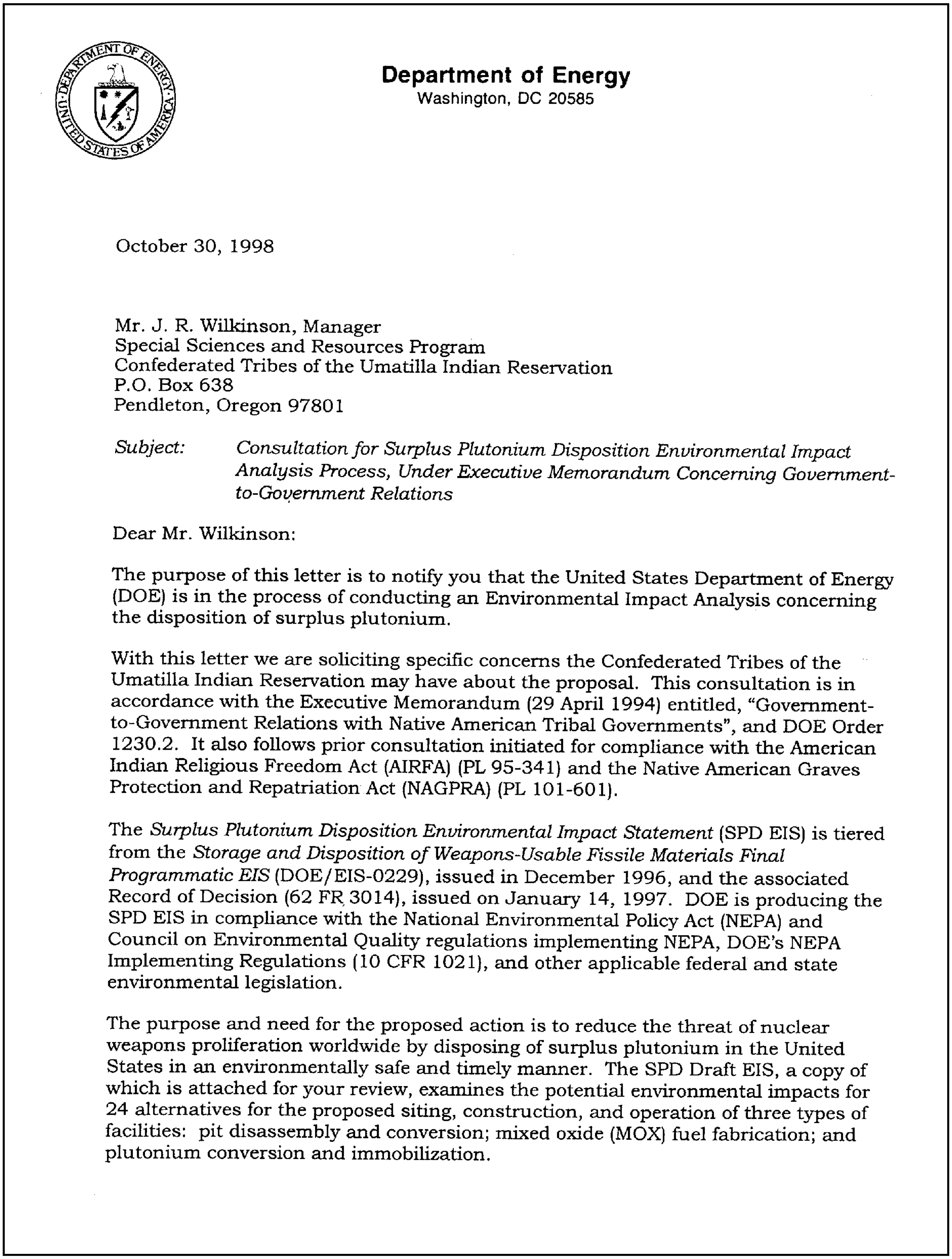
You may also contact Kevin Clark, Hanford Indian Nation Program Manager, at (509) 376-6332.

Sincerely,

Marcus Jones
SPD EIS Document Manager

cc: Rex Buck, Jr., Wanapum
Robert Tomanawash, Wanapum
Kevin V. Clark, Indian Nation Program Manager, Hanford
Brandt Petrasek, EM-20, DOE HQ

SPD EIS enclosure



Department of Energy
Washington, DC 20585

October 30, 1998

Mr. J. R. Wilkinson, Manager
Special Sciences and Resources Program
Confederated Tribes of the Umatilla Indian Reservation
P.O. Box 638
Pendleton, Oregon 97801

Subject: *Consultation for Surplus Plutonium Disposition Environmental Impact Analysis Process, Under Executive Memorandum Concerning Government-to-Government Relations*

Dear Mr. Wilkinson:

The purpose of this letter is to notify you that the United States Department of Energy (DOE) is in the process of conducting an Environmental Impact Analysis concerning the disposition of surplus plutonium.

With this letter we are soliciting specific concerns the Confederated Tribes of the Umatilla Indian Reservation may have about the proposal. This consultation is in accordance with the Executive Memorandum (29 April 1994) entitled, "Government-to-Government Relations with Native American Tribal Governments", and DOE Order 1230.2. It also follows prior consultation initiated for compliance with the American Indian Religious Freedom Act (AIRFA) (PL 95-341) and the Native American Graves Protection and Repatriation Act (NAGPRA) (PL 101-601).

The *Surplus Plutonium Disposition Environmental Impact Statement* (SPD EIS) is tiered from the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic EIS* (DOE/EIS-0229), issued in December 1996, and the associated Record of Decision (62 FR 3014), issued on January 14, 1997. DOE is producing the SPD EIS in compliance with the National Environmental Policy Act (NEPA) and Council on Environmental Quality regulations implementing NEPA, DOE's NEPA Implementing Regulations (10 CFR 1021), and other applicable federal and state environmental legislation.

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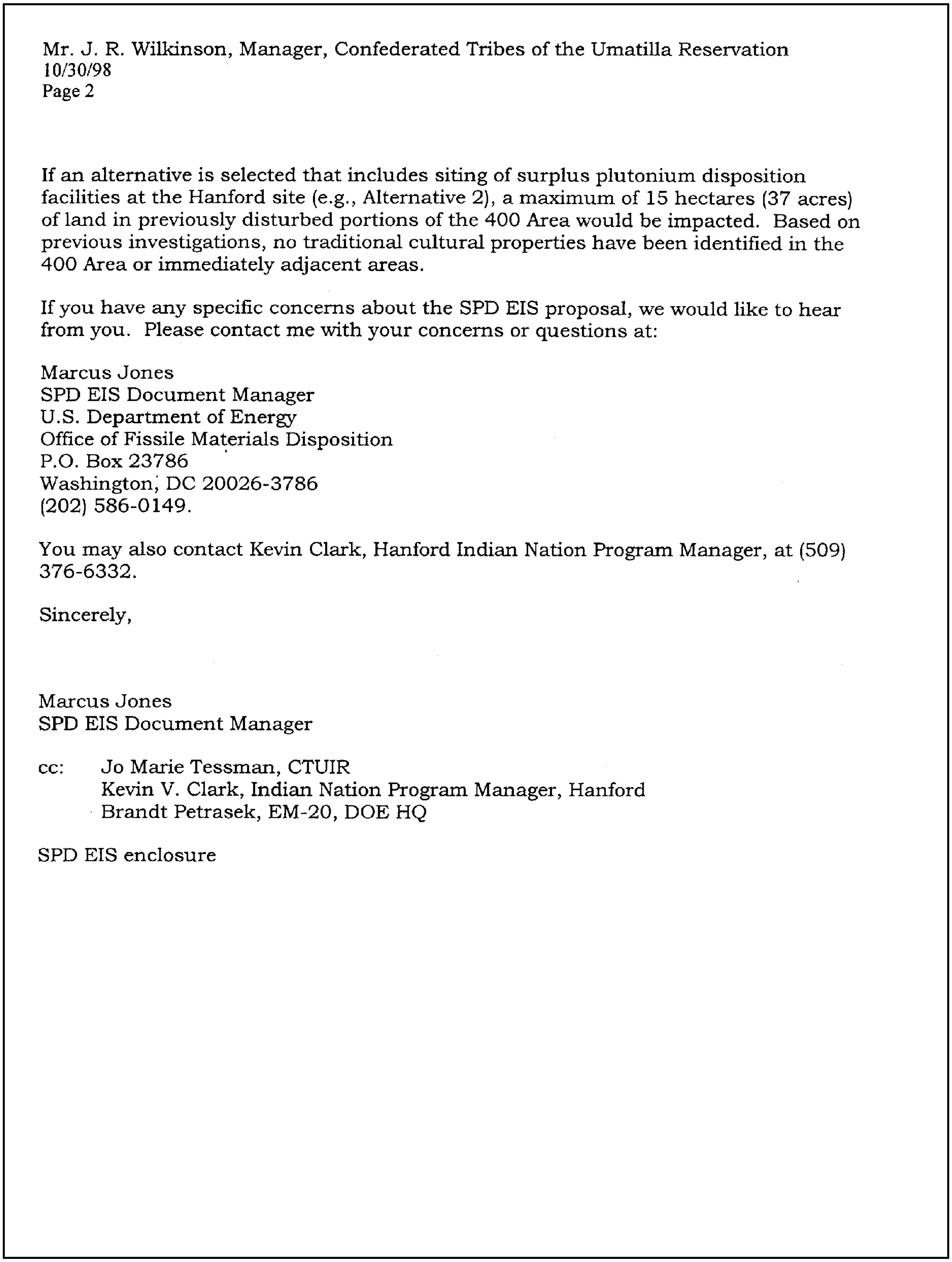


Mr. J. R. Wilkinson, Manager, Confederated Tribes of the Umatilla Reservation
10/30/98
Page 2

If an alternative is selected that includes siting of surplus plutonium disposition facilities at the Hanford site (e.g., Alternative 2), a maximum of 15 hectares (37 acres) of land in previously disturbed portions of the 400 Area would be impacted. Based on previous investigations, no traditional cultural properties have been identified in the 400 Area or immediately adjacent areas.

If you have any specific concerns about the SPD EIS proposal, we would like to hear from you. Please contact me with your concerns or questions at:

Marcus Jones
SPD EIS Document Manager
U.S. Department of Energy
Office of Fissile Materials Disposition
P.O. Box 23786
Washington, DC 20026-3786
(202) 586-0149.

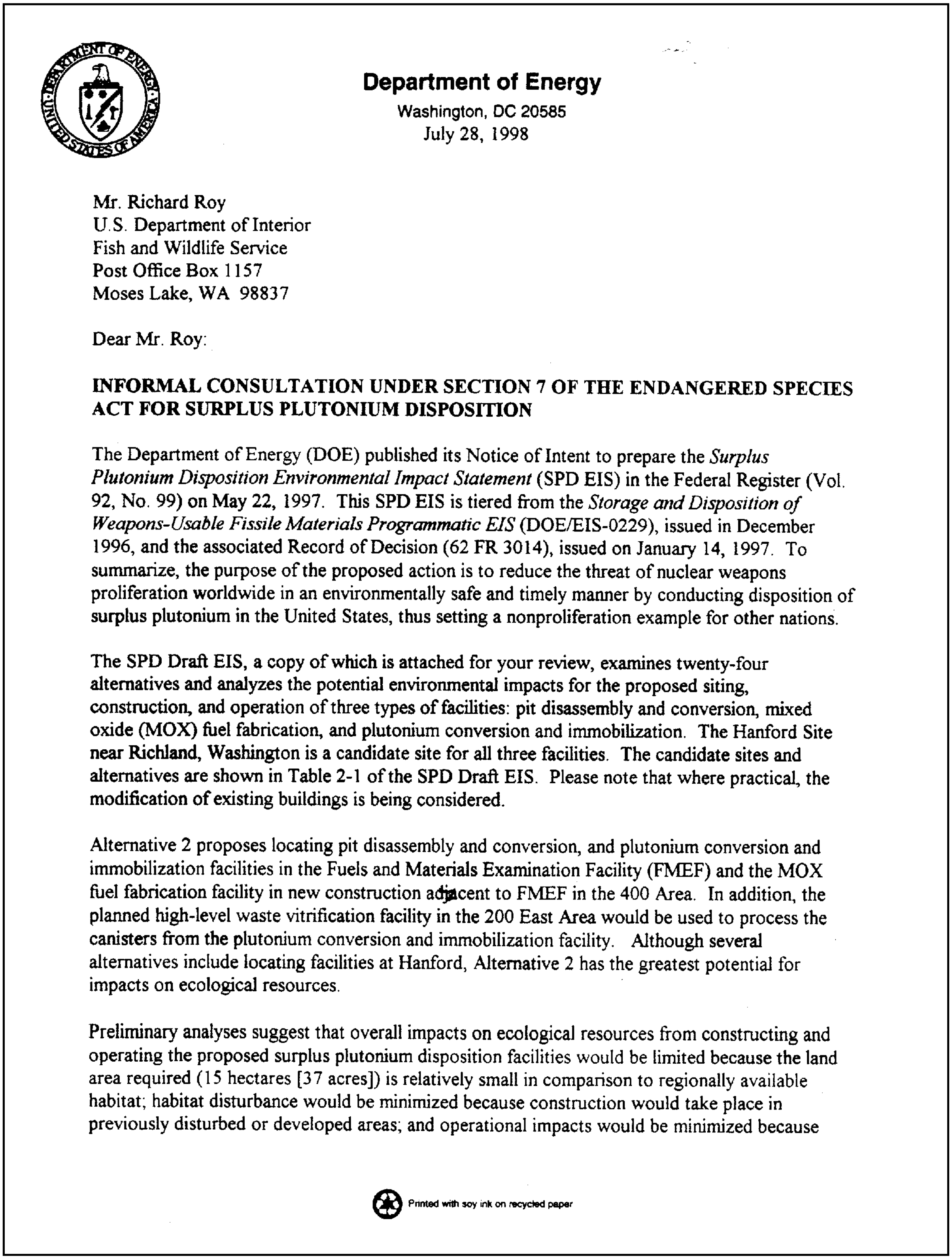
You may also contact Kevin Clark, Hanford Indian Nation Program Manager, at (509) 376-6332.

Sincerely,

Marcus Jones
SPD EIS Document Manager

cc: Jo Marie Tessman, CTUIR
Kevin V. Clark, Indian Nation Program Manager, Hanford
Brandt Petrasek, EM-20, DOE HQ

SPD EIS enclosure



Department of Energy
Washington, DC 20585

July 28, 1998

Mr. Richard Roy
U.S. Department of Interior
Fish and Wildlife Service
Post Office Box 1157
Moses Lake, WA 98837

Dear Mr. Roy:

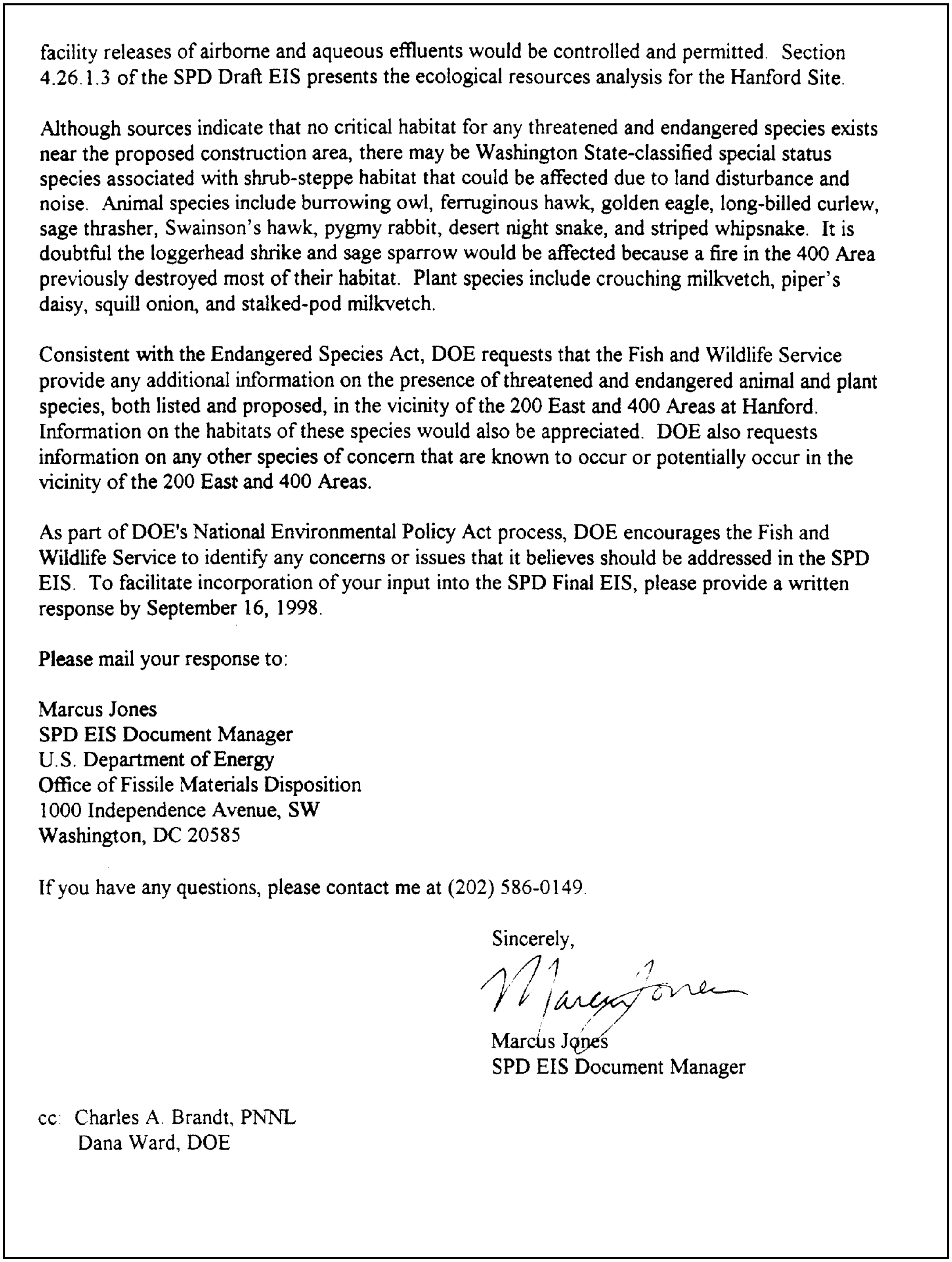
INFORMAL CONSULTATION UNDER SECTION 7 OF THE ENDANGERED SPECIES ACT FOR SURPLUS PLUTONIUM DISPOSITION

The Department of Energy (DOE) published its Notice of Intent to prepare the *Surplus Plutonium Disposition Environmental Impact Statement* (SPD EIS) in the Federal Register (Vol. 92, No. 99) on May 22, 1997. This SPD EIS is tiered from the *Storage and Disposition of Weapons-Usable Fissile Materials Programmatic EIS* (DOE/EIS-0229), issued in December 1996, and the associated Record of Decision (62 FR 3014), issued on January 14, 1997. To summarize, the purpose of the proposed action is to reduce the threat of nuclear weapons proliferation worldwide in an environmentally safe and timely manner by conducting disposition of surplus plutonium in the United States, thus setting a nonproliferation example for other nations.

The SPD Draft EIS, a copy of which is attached for your review, examines twenty-four alternatives and analyzes the potential environmental impacts for the proposed siting, construction, and operation of three types of facilities: pit disassembly and conversion, mixed oxide (MOX) fuel fabrication, and plutonium conversion and immobilization. The Hanford Site near Richland, Washington is a candidate site for all three facilities. The candidate sites and alternatives are shown in Table 2-1 of the SPD Draft EIS. Please note that where practical, the modification of existing buildings is being considered.

Alternative 2 proposes locating pit disassembly and conversion, and plutonium conversion and immobilization facilities in the Fuels and Materials Examination Facility (FMEF) and the MOX fuel fabrication facility in new construction adjacent to FMEF in the 400 Area. In addition, the planned high-level waste vitrification facility in the 200 East Area would be used to process the canisters from the plutonium conversion and immobilization facility. Although several alternatives include locating facilities at Hanford, Alternative 2 has the greatest potential for impacts on ecological resources.

Preliminary analyses suggest that overall impacts on ecological resources from constructing and operating the proposed surplus plutonium disposition facilities would be limited because the land area required (15 hectares [37 acres]) is relatively small in comparison to regionally available habitat; habitat disturbance would be minimized because construction would take place in previously disturbed or developed areas; and operational impacts would be minimized because



facility releases of airborne and aqueous effluents would be controlled and permitted. Section 4.26.1.3 of the SPD Draft EIS presents the ecological resources analysis for the Hanford Site.

Although sources indicate that no critical habitat for any threatened and endangered species exists near the proposed construction area, there may be Washington State-classified special status species associated with shrub-steppe habitat that could be affected due to land disturbance and noise. Animal species include burrowing owl, ferruginous hawk, golden eagle, long-billed curlew, sage thrasher, Swainson's hawk, pygmy rabbit, desert night snake, and striped whipsnake. It is doubtful the loggerhead shrike and sage sparrow would be affected because a fire in the 400 Area previously destroyed most of their habitat. Plant species include crouching milkvetch, piper's daisy, squill onion, and stalked-pod milkvetch.

Consistent with the Endangered Species Act, DOE requests that the Fish and Wildlife Service provide any additional information on the presence of threatened and endangered animal and plant species, both listed and proposed, in the vicinity of the 200 East and 400 Areas at Hanford. Information on the habitats of these species would also be appreciated. DOE also requests information on any other species of concern that are known to occur or potentially occur in the vicinity of the 200 East and 400 Areas.

As part of DOE's National Environmental Policy Act process, DOE encourages the Fish and Wildlife Service to identify any concerns or issues that it believes should be addressed in the SPD EIS. To facilitate incorporation of your input into the SPD Final EIS, please provide a written response by September 16, 1998.

Please mail your response to:

Marcus Jones
SPD EIS Document Manager
U.S. Department of Energy
Office of Fissile Materials Disposition
1000 Independence Avenue, SW
Washington, DC 20585

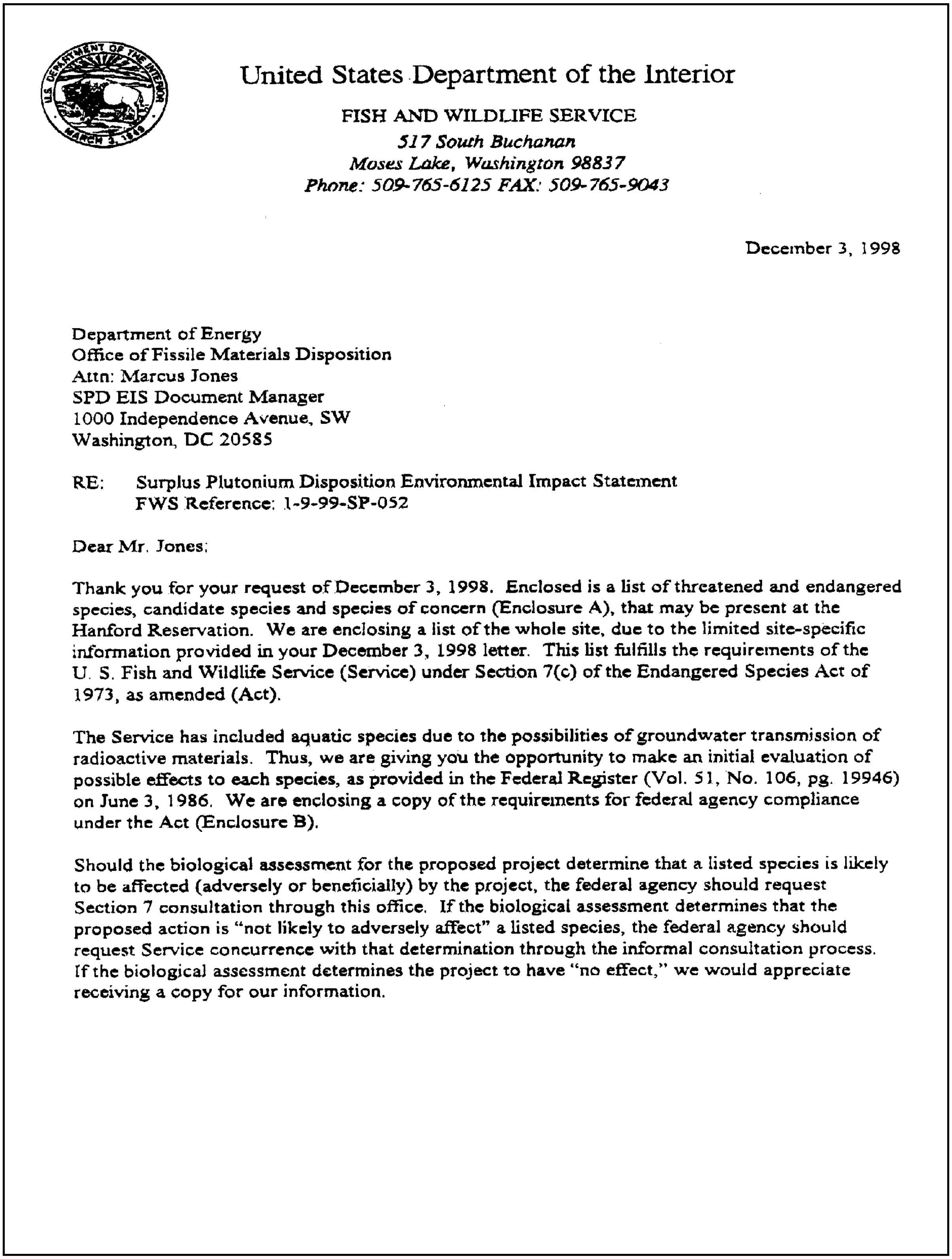
If you have any questions, please contact me at (202) 586-0149.

Sincerely,

Marcus Jones

Marcus Jones
SPD EIS Document Manager

cc: Charles A. Brandt, PNNL
Dana Ward, DOE



United States Department of the Interior

FISH AND WILDLIFE SERVICE
517 South Buchanan
Moses Lake, Washington 98837
Phone: 509-765-6125 FAX: 509-765-9043

December 3, 1998

Department of Energy
Office of Fissile Materials Disposition
Attn: Marcus Jones
SPD EIS Document Manager
1000 Independence Avenue, SW
Washington, DC 20585

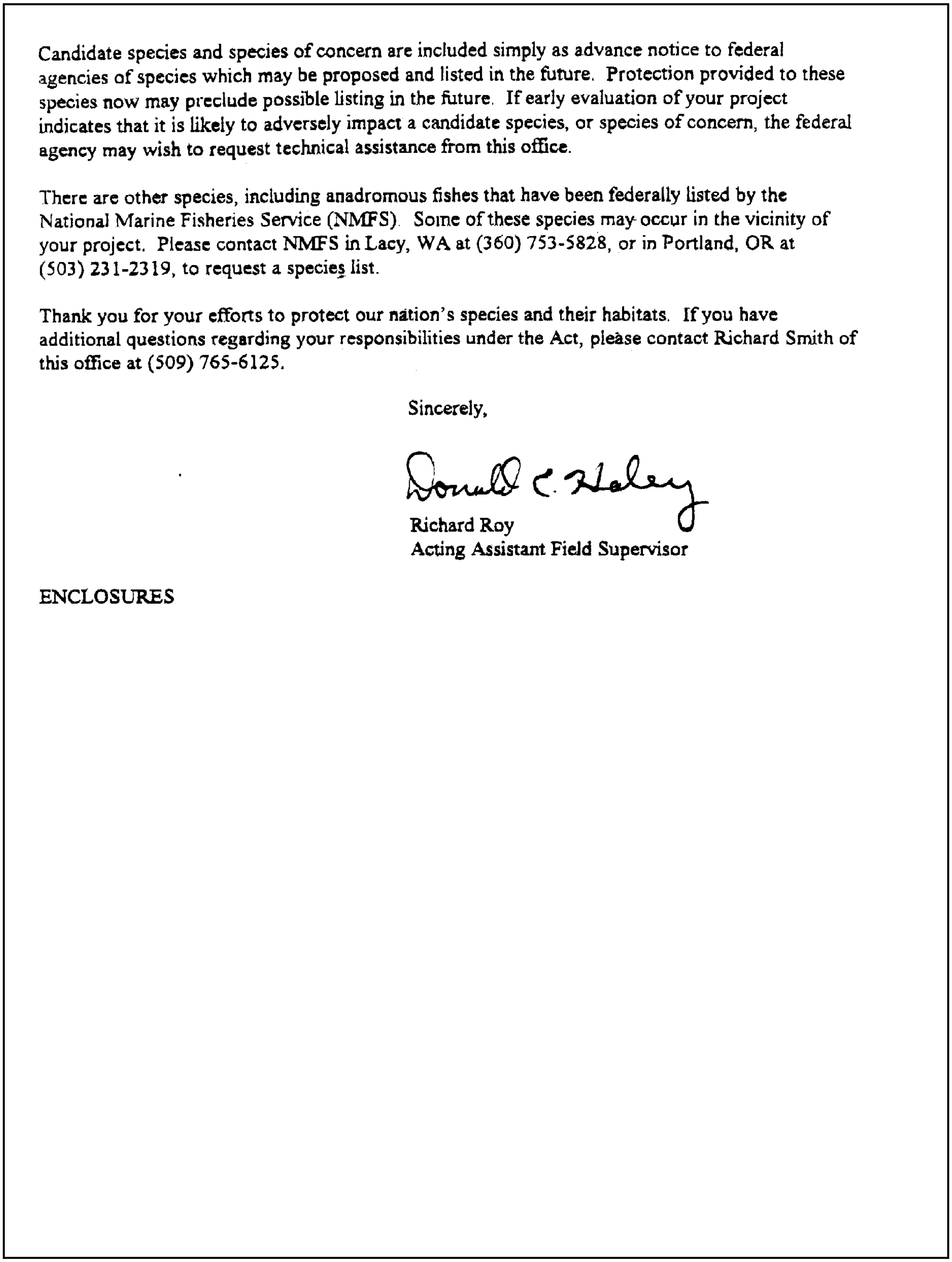
RE: Surplus Plutonium Disposition Environmental Impact Statement
FWS Reference: 1-9-99-SP-052

Dear Mr. Jones:

Thank you for your request of December 3, 1998. Enclosed is a list of threatened and endangered species, candidate species and species of concern (Enclosure A), that may be present at the Hanford Reservation. We are enclosing a list of the whole site, due to the limited site-specific information provided in your December 3, 1998 letter. This list fulfills the requirements of the U. S. Fish and Wildlife Service (Service) under Section 7(c) of the Endangered Species Act of 1973, as amended (Act).

The Service has included aquatic species due to the possibilities of groundwater transmission of radioactive materials. Thus, we are giving you the opportunity to make an initial evaluation of possible effects to each species, as provided in the Federal Register (Vol. 51, No. 106, pg. 19946) on June 3, 1986. We are enclosing a copy of the requirements for federal agency compliance under the Act (Enclosure B).

Should the biological assessment for the proposed project determine that a listed species is likely to be affected (adversely or beneficially) by the project, the federal agency should request Section 7 consultation through this office. If the biological assessment determines that the proposed action is "not likely to adversely affect" a listed species, the federal agency should request Service concurrence with that determination through the informal consultation process. If the biological assessment determines the project to have "no effect," we would appreciate receiving a copy for our information.



Candidate species and species of concern are included simply as advance notice to federal agencies of species which may be proposed and listed in the future. Protection provided to these species now may preclude possible listing in the future. If early evaluation of your project indicates that it is likely to adversely impact a candidate species, or species of concern, the federal agency may wish to request technical assistance from this office.

There are other species, including anadromous fishes that have been federally listed by the National Marine Fisheries Service (NMFS). Some of these species may occur in the vicinity of your project. Please contact NMFS in Lacy, WA at (360) 753-5828, or in Portland, OR at (503) 231-2319, to request a species list.

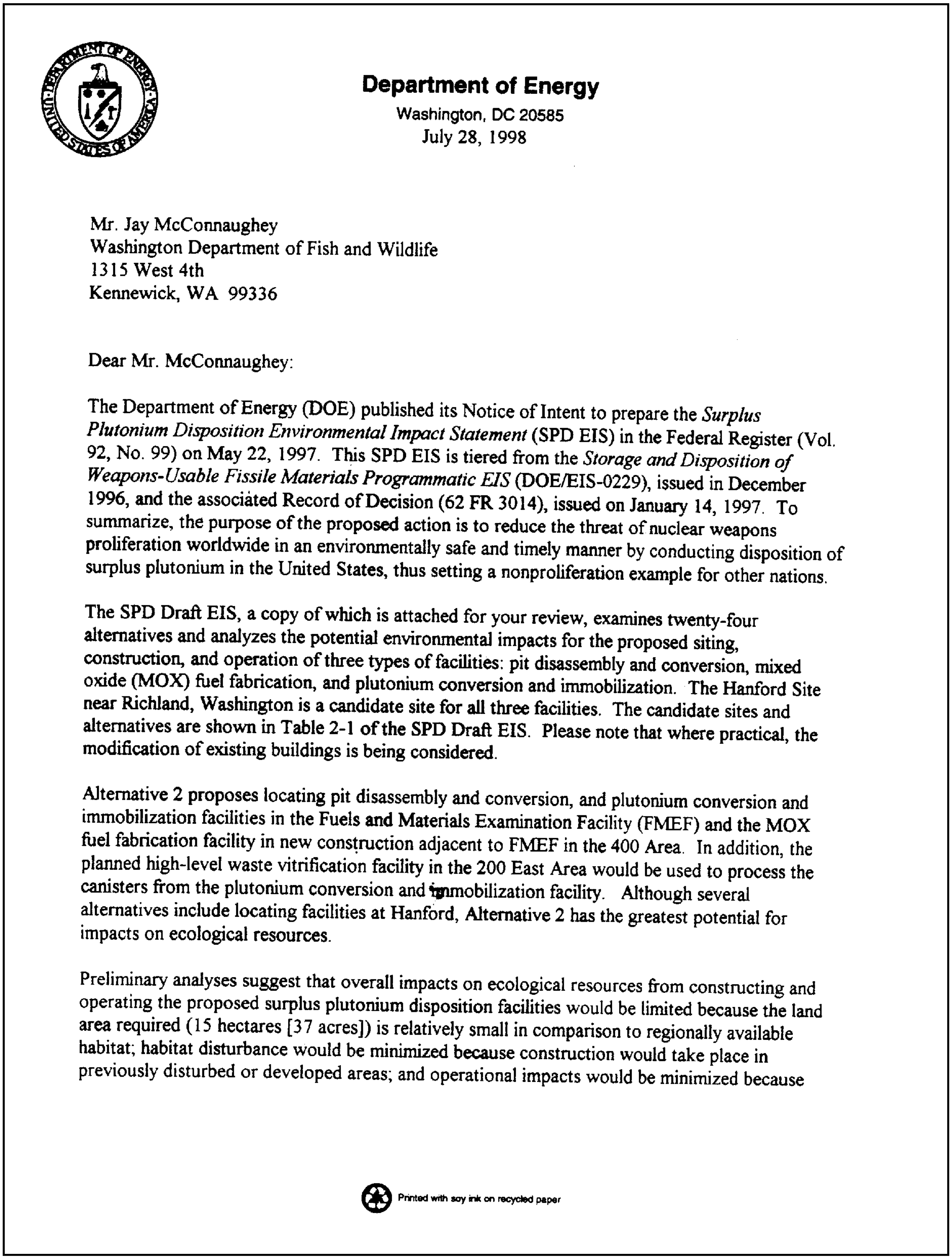
Thank you for your efforts to protect our nation's species and their habitats. If you have additional questions regarding your responsibilities under the Act, please contact Richard Smith of this office at (509) 765-6125.

Sincerely,

Donald C. Haley

Richard Roy
Acting Assistant Field Supervisor

ENCLOSURES



Department of Energy
Washington, DC 20585

July 28, 1998

Mr. Jay McConnaughey
Washington Department of Fish and Wildlife
1315 West 4th
Kennewick, WA 99336

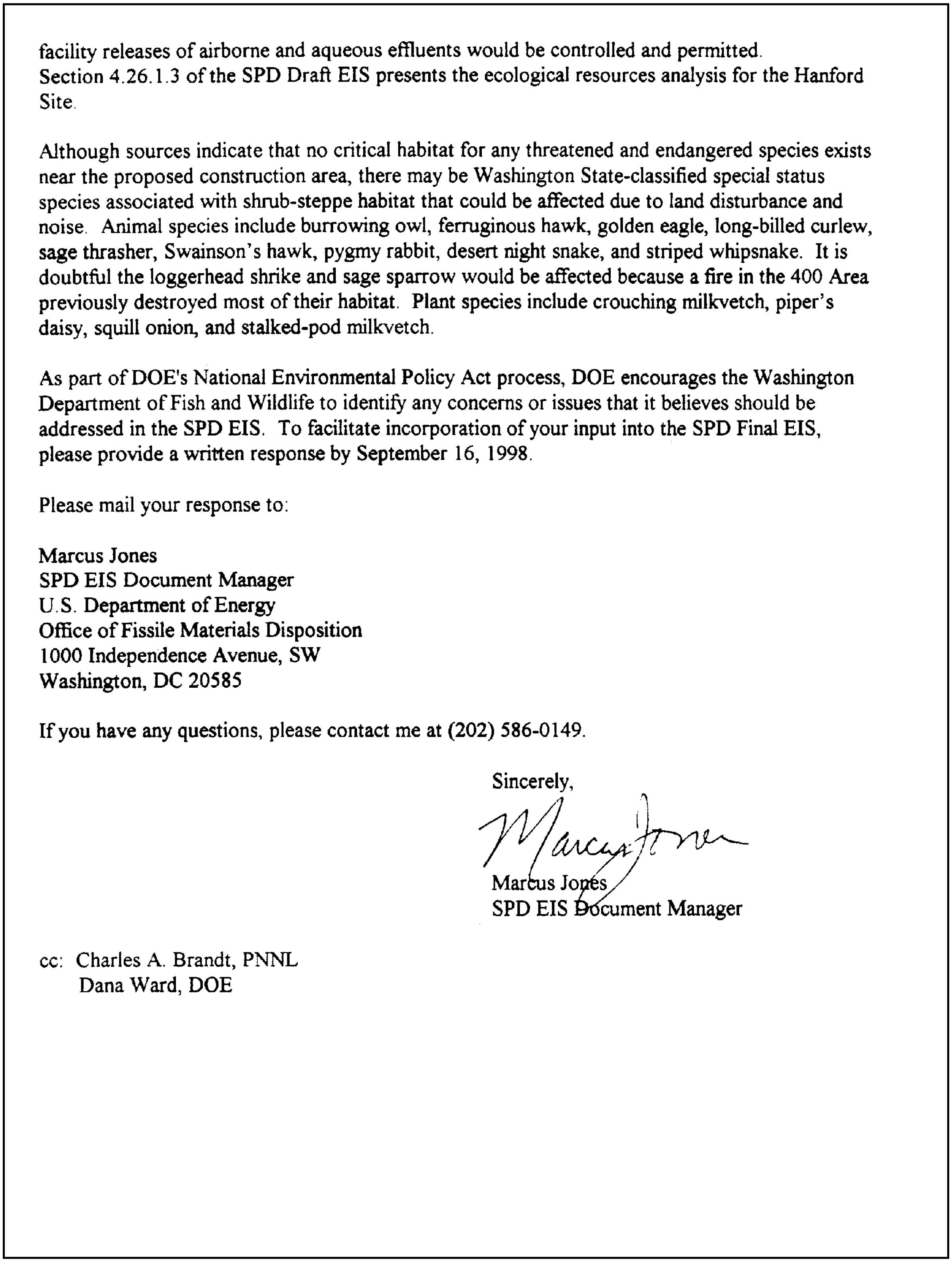
Dear Mr. McConnaughey:

The Department of Energy (DOE) published its Notice of Intent to prepare the *Surplus Plutonium Disposition Environmental Impact Statement* (SPD EIS) in the Federal Register (Vol. 92, No. 99) on May 22, 1997. This SPD EIS is tiered from the *Storage and Disposition of Weapons-Usable Fissile Materials Programmatic EIS* (DOE/EIS-0229), issued in December 1996, and the associated Record of Decision (62 FR 3014), issued on January 14, 1997. To summarize, the purpose of the proposed action is to reduce the threat of nuclear weapons proliferation worldwide in an environmentally safe and timely manner by conducting disposition of surplus plutonium in the United States, thus setting a nonproliferation example for other nations.

The SPD Draft EIS, a copy of which is attached for your review, examines twenty-four alternatives and analyzes the potential environmental impacts for the proposed siting, construction, and operation of three types of facilities: pit disassembly and conversion, mixed oxide (MOX) fuel fabrication, and plutonium conversion and immobilization. The Hanford Site near Richland, Washington is a candidate site for all three facilities. The candidate sites and alternatives are shown in Table 2-1 of the SPD Draft EIS. Please note that where practical, the modification of existing buildings is being considered.

Alternative 2 proposes locating pit disassembly and conversion, and plutonium conversion and immobilization facilities in the Fuels and Materials Examination Facility (FMEF) and the MOX fuel fabrication facility in new construction adjacent to FMEF in the 400 Area. In addition, the planned high-level waste vitrification facility in the 200 East Area would be used to process the canisters from the plutonium conversion and immobilization facility. Although several alternatives include locating facilities at Hanford, Alternative 2 has the greatest potential for impacts on ecological resources.

Preliminary analyses suggest that overall impacts on ecological resources from constructing and operating the proposed surplus plutonium disposition facilities would be limited because the land area required (15 hectares [37 acres]) is relatively small in comparison to regionally available habitat; habitat disturbance would be minimized because construction would take place in previously disturbed or developed areas; and operational impacts would be minimized because



facility releases of airborne and aqueous effluents would be controlled and permitted. Section 4.26.1.3 of the SPD Draft EIS presents the ecological resources analysis for the Hanford Site.

Although sources indicate that no critical habitat for any threatened and endangered species exists near the proposed construction area, there may be Washington State-classified special status species associated with shrub-steppe habitat that could be affected due to land disturbance and noise. Animal species include burrowing owl, ferruginous hawk, golden eagle, long-billed curlew, sage thrasher, Swainson's hawk, pygmy rabbit, desert night snake, and striped whipsnake. It is doubtful the loggerhead shrike and sage sparrow would be affected because a fire in the 400 Area previously destroyed most of their habitat. Plant species include crouching milkvetch, piper's daisy, squill onion, and stalked-pod milkvetch.

As part of DOE's National Environmental Policy Act process, DOE encourages the Washington Department of Fish and Wildlife to identify any concerns or issues that it believes should be addressed in the SPD EIS. To facilitate incorporation of your input into the SPD Final EIS, please provide a written response by September 16, 1998.

Please mail your response to:

Marcus Jones
SPD EIS Document Manager
U.S. Department of Energy
Office of Fissile Materials Disposition
1000 Independence Avenue, SW
Washington, DC 20585

If you have any questions, please contact me at (202) 586-0149.

Sincerely,

Marcus Jones

Marcus Jones
SPD EIS Document Manager

cc: Charles A. Brandt, PNNL
Dana Ward, DOE

STATE OF WASHINGTON
DEPARTMENT OF FISH AND WILDLIFE
1701 S 24th Avenue • Yakima, Washington 98902-5720 • (509) 575-2740 FAX (509) 575-2474
c/o Department of Ecology
1315 W 4th Ave, Kennewick, WA 99336

7 December, 1998

Marcus Jones
SPD EIS Document Manager
U.S. Department of Energy
Office of Fissile Materials Disposition
1000 Independence Ave. SW
Washington, DC 20585

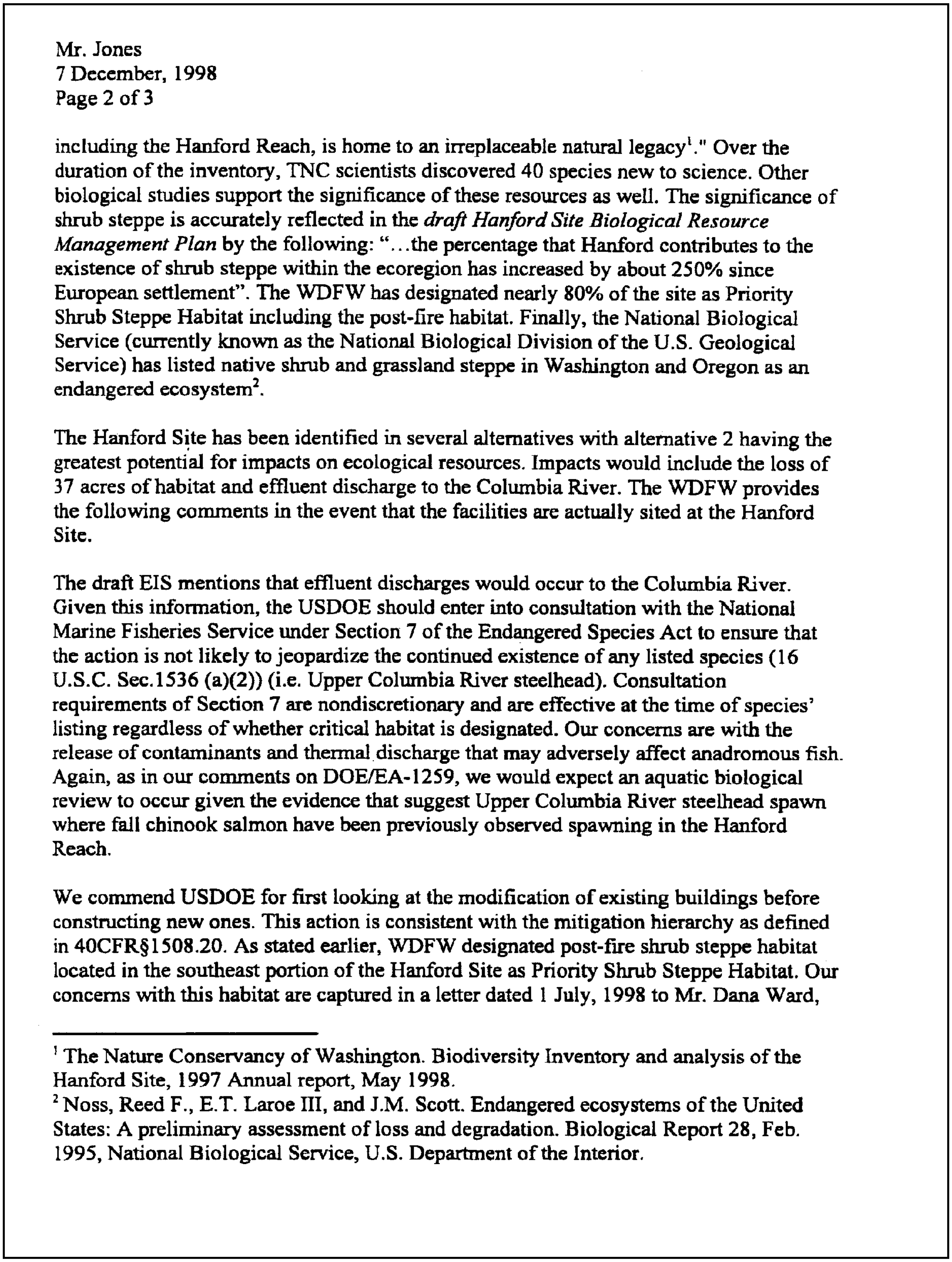
Dear Mr. Jones:

Subject: Comments on the *Surplus Plutonium Disposition Draft Environmental Impact Statement, July 1998*, DOE/EIS-0283-D.

Upon a recent request for comments on the aforementioned document by U.S. Department of Energy (USDOE) Washington DC staff, the Washington Department of Fish and Wildlife (WDFW) is providing comments and greatly appreciates the invitation to submit comments even after the official closing of the comment period.

The WDFW supports the identified preferred alternatives in the draft EIS for siting plutonium disposition facilities (i.e. Immobilization at SRS, MOX Fuel Fabrication at SRS and Pit Disassembly and Conversion at SRS or Pantex). We concur with USDOE's determination as stated in the *Summary* "that Hanford's cleanup mission is critical, therefore … prefers that the cleanup mission remain the site's top priority…" It is important that cleanup continue to remain the focus of the Hanford Site to be protective of the Columbia River ecosystem.

The Hanford Site ecosystem contains biological resources of regional, national, and international significance. The Hanford Reach supports a healthy stock of upriver bright fall chinook salmon (*Oncorhynchus tshawytscha*) and provides essential habitat for the federally listed Upper Columbia River steelhead (*Oncorhynchus mykiss*) which has been listed as endangered. The Nature Conservancy of Washington findings from a multi-year biodiversity inventory confirm the importance of the Hanford Site, and the 1997 annual report states "Findings from the biodiversity inventory to date show that the Hanford Site,



Mr. Jones
7 December, 1998
Page 2 of 3

including the Hanford Reach, is home to an irreplaceable natural legacy[1]." Over the duration of the inventory, TNC scientists discovered 40 species new to science. Other biological studies support the significance of these resources as well. The significance of shrub steppe is accurately reflected in the *draft Hanford Site Biological Resource Management Plan* by the following: "…the percentage that Hanford contributes to the existence of shrub steppe within the ecoregion has increased by about 250% since European settlement". The WDFW has designated nearly 80% of the site as Priority Shrub Steppe Habitat including the post-fire habitat. Finally, the National Biological Service (currently known as the National Biological Division of the U.S. Geological Service) has listed native shrub and grassland steppe in Washington and Oregon as an endangered ecosystem[2].

The Hanford Site has been identified in several alternatives with alternative 2 having the greatest potential for impacts on ecological resources. Impacts would include the loss of 37 acres of habitat and effluent discharge to the Columbia River. The WDFW provides the following comments in the event that the facilities are actually sited at the Hanford Site.

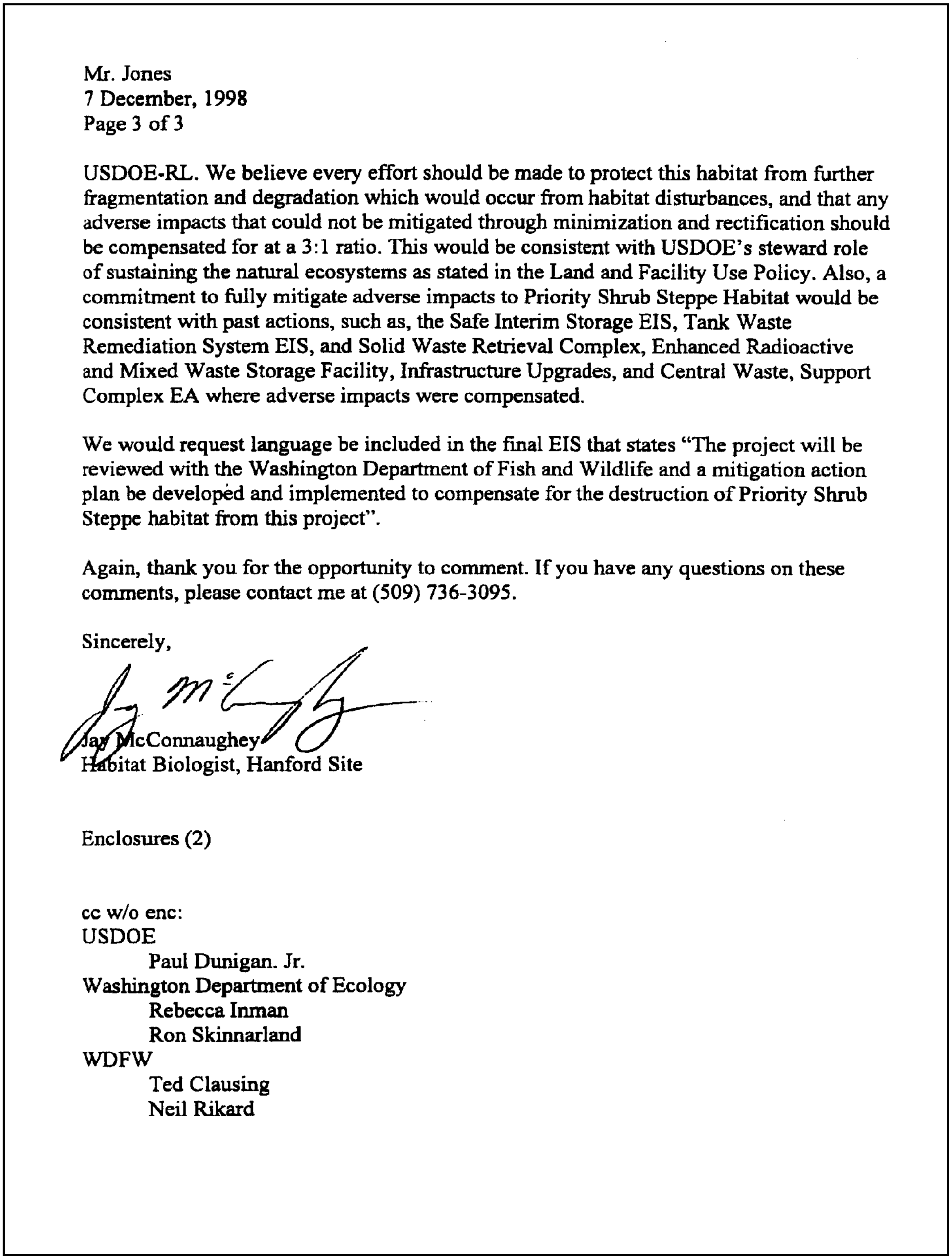
The draft EIS mentions that effluent discharges would occur to the Columbia River. Given this information, the USDOE should enter into consultation with the National Marine Fisheries Service under Section 7 of the Endangered Species Act to ensure that the action is not likely to jeopardize the continued existence of any listed species (16 U.S.C. Sec.1536 (a)(2)) (i.e. Upper Columbia River steelhead). Consultation requirements of Section 7 are nondiscretionary and are effective at the time of species' listing regardless of whether critical habitat is designated. Our concerns are with the release of contaminants and thermal discharge that may adversely affect anadromous fish. Again, as in our comments on DOE/EA-1259, we would expect an aquatic biological review to occur given the evidence that suggest Upper Columbia River steelhead spawn where fall chinook salmon have been previously observed spawning in the Hanford Reach.

We commend USDOE for first looking at the modification of existing buildings before constructing new ones. This action is consistent with the mitigation hierarchy as defined in 40CFR§1508.20. As stated earlier, WDFW designated post-fire shrub steppe habitat located in the southeast portion of the Hanford Site as Priority Shrub Steppe Habitat. Our concerns with this habitat are captured in a letter dated 1 July, 1998 to Mr. Dana Ward,

---

[1] The Nature Conservancy of Washington. Biodiversity Inventory and analysis of the Hanford Site, 1997 Annual report, May 1998.

[2] Noss, Reed F., E.T. Laroe III, and J.M. Scott. Endangered ecosystems of the United States: A preliminary assessment of loss and degradation. Biological Report 28, Feb. 1995, National Biological Service, U.S. Department of the Interior.



Mr. Jones
7 December, 1998
Page 3 of 3

USDOE-RL. We believe every effort should be made to protect this habitat from further fragmentation and degradation which would occur from habitat disturbances, and that any adverse impacts that could not be mitigated through minimization and rectification should be compensated for at a 3:1 ratio. This would be consistent with USDOE's steward role of sustaining the natural ecosystems as stated in the Land and Facility Use Policy. Also, a commitment to fully mitigate adverse impacts to Priority Shrub Steppe Habitat would be consistent with past actions, such as, the Safe Interim Storage EIS, Tank Waste Remediation System EIS, and Solid Waste Retrieval Complex, Enhanced Radioactive and Mixed Waste Storage Facility, Infrastructure Upgrades, and Central Waste, Support Complex EA where adverse impacts were compensated.

We would request language be included in the final EIS that states "The project will be reviewed with the Washington Department of Fish and Wildlife and a mitigation action plan be developed and implemented to compensate for the destruction of Priority Shrub Steppe habitat from this project".

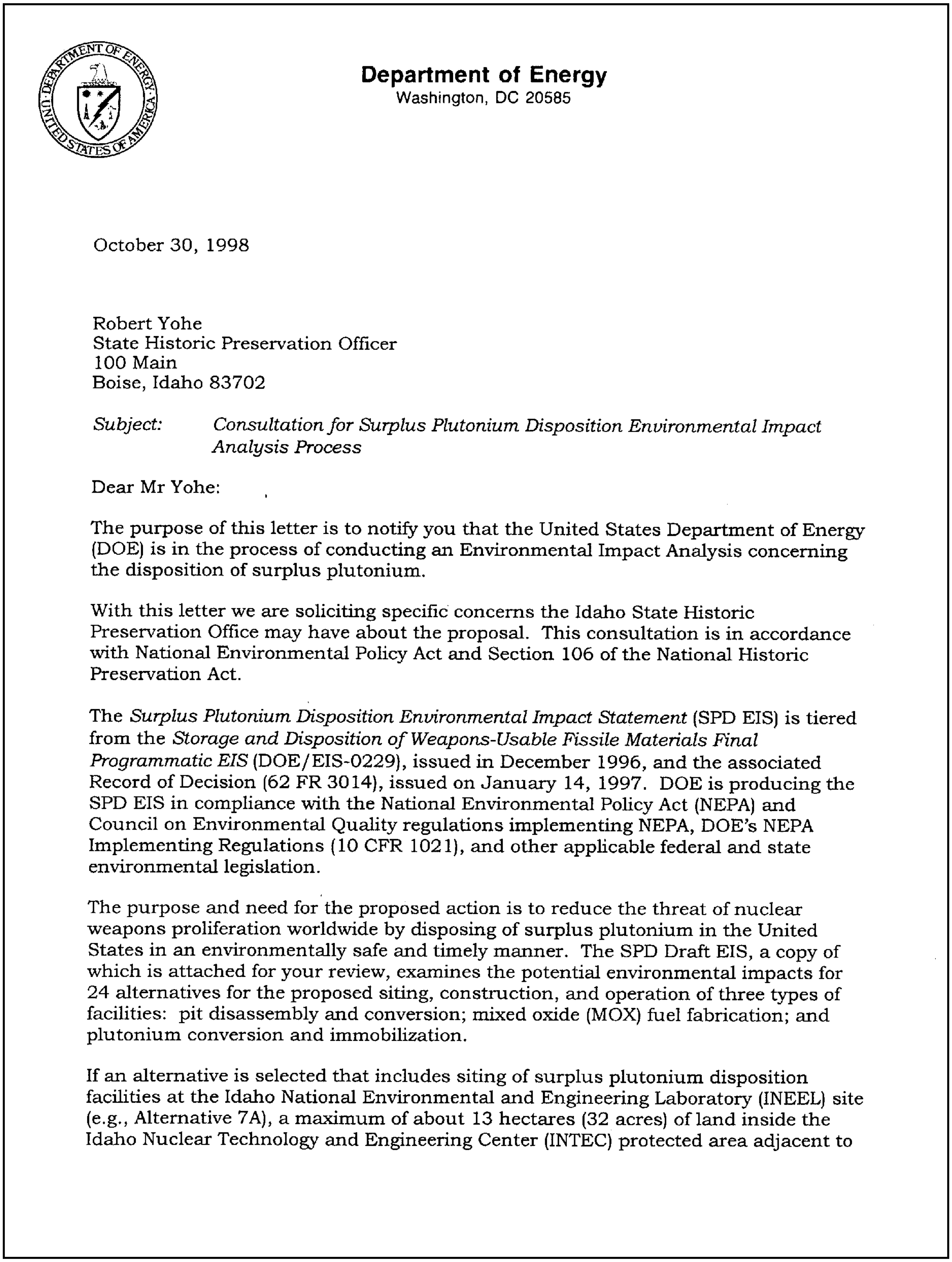
Again, thank you for the opportunity to comment. If you have any questions on these comments, please contact me at (509) 736-3095.

Sincerely,

Jay McConnaughey
Habitat Biologist, Hanford Site

Enclosures (2)

cc w/o enc:
USDOE
    Paul Dunigan. Jr.
Washington Department of Ecology
    Rebecca Inman
    Ron Skinnarland
WDFW
    Ted Clausing
    Neil Rikard



Department of Energy
Washington, DC 20585

October 30, 1998

Robert Yohe
State Historic Preservation Officer
100 Main
Boise, Idaho 83702

Subject: *Consultation for Surplus Plutonium Disposition Environmental Impact Analysis Process*

Dear Mr Yohe:

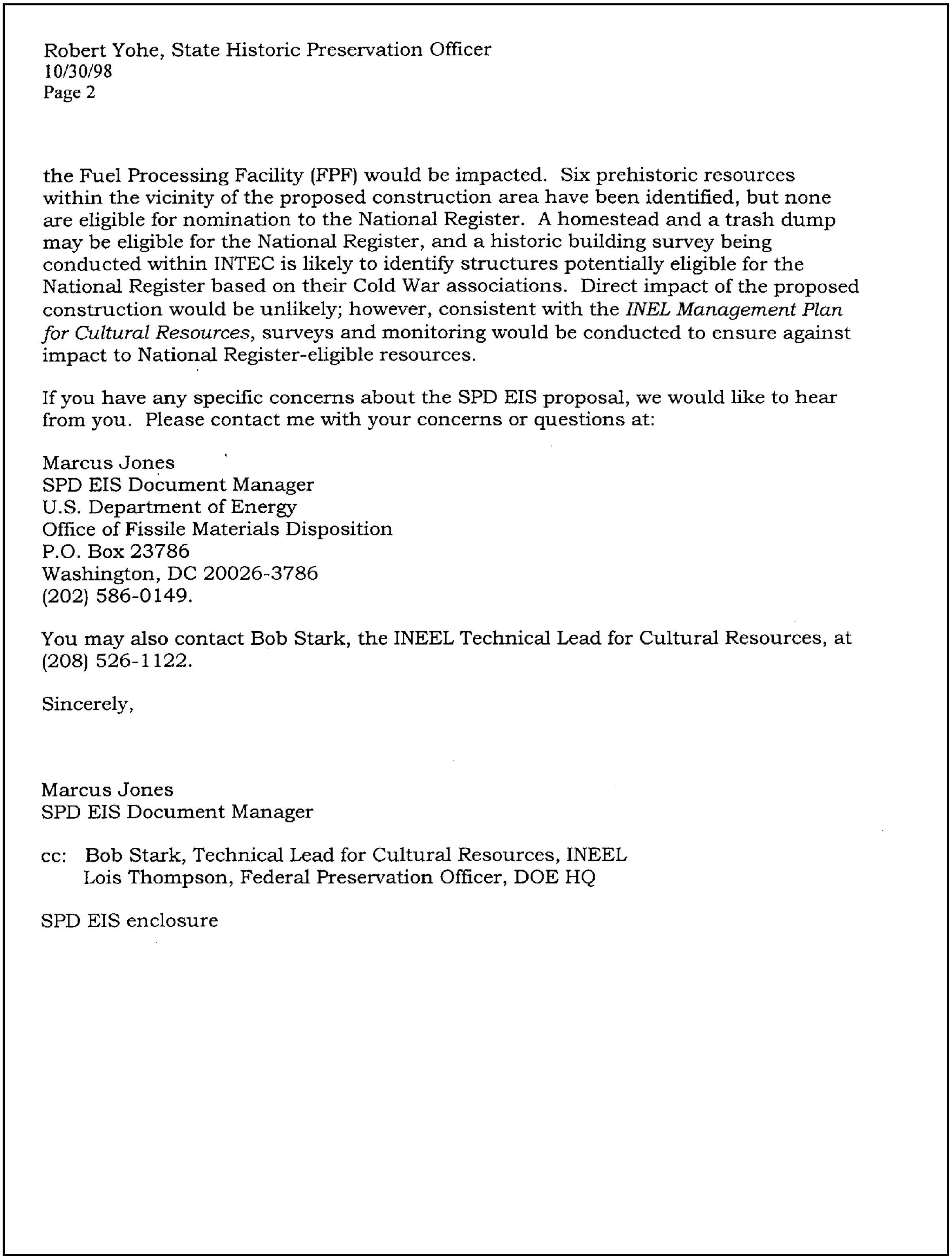
The purpose of this letter is to notify you that the United States Department of Energy (DOE) is in the process of conducting an Environmental Impact Analysis concerning the disposition of surplus plutonium.

With this letter we are soliciting specific concerns the Idaho State Historic Preservation Office may have about the proposal. This consultation is in accordance with National Environmental Policy Act and Section 106 of the National Historic Preservation Act.

The *Surplus Plutonium Disposition Environmental Impact Statement* (SPD EIS) is tiered from the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic EIS* (DOE/EIS-0229), issued in December 1996, and the associated Record of Decision (62 FR 3014), issued on January 14, 1997. DOE is producing the SPD EIS in compliance with the National Environmental Policy Act (NEPA) and Council on Environmental Quality regulations implementing NEPA, DOE's NEPA Implementing Regulations (10 CFR 1021), and other applicable federal and state environmental legislation.

The purpose and need for the proposed action is to reduce the threat of nuclear weapons proliferation worldwide by disposing of surplus plutonium in the United States in an environmentally safe and timely manner. The SPD Draft EIS, a copy of which is attached for your review, examines the potential environmental impacts for 24 alternatives for the proposed siting, construction, and operation of three types of facilities: pit disassembly and conversion; mixed oxide (MOX) fuel fabrication; and plutonium conversion and immobilization.

If an alternative is selected that includes siting of surplus plutonium disposition facilities at the Idaho National Environmental and Engineering Laboratory (INEEL) site (e.g., Alternative 7A), a maximum of about 13 hectares (32 acres) of land inside the Idaho Nuclear Technology and Engineering Center (INTEC) protected area adjacent to



Robert Yohe, State Historic Preservation Officer
10/30/98
Page 2

the Fuel Processing Facility (FPF) would be impacted. Six prehistoric resources within the vicinity of the proposed construction area have been identified, but none are eligible for nomination to the National Register. A homestead and a trash dump may be eligible for the National Register, and a historic building survey being conducted within INTEC is likely to identify structures potentially eligible for the National Register based on their Cold War associations. Direct impact of the proposed construction would be unlikely; however, consistent with the *INEL Management Plan for Cultural Resources*, surveys and monitoring would be conducted to ensure against impact to National Register-eligible resources.

If you have any specific concerns about the SPD EIS proposal, we would like to hear from you. Please contact me with your concerns or questions at:

Marcus Jones
SPD EIS Document Manager
U.S. Department of Energy
Office of Fissile Materials Disposition
P.O. Box 23786
Washington, DC 20026-3786
(202) 586-0149.

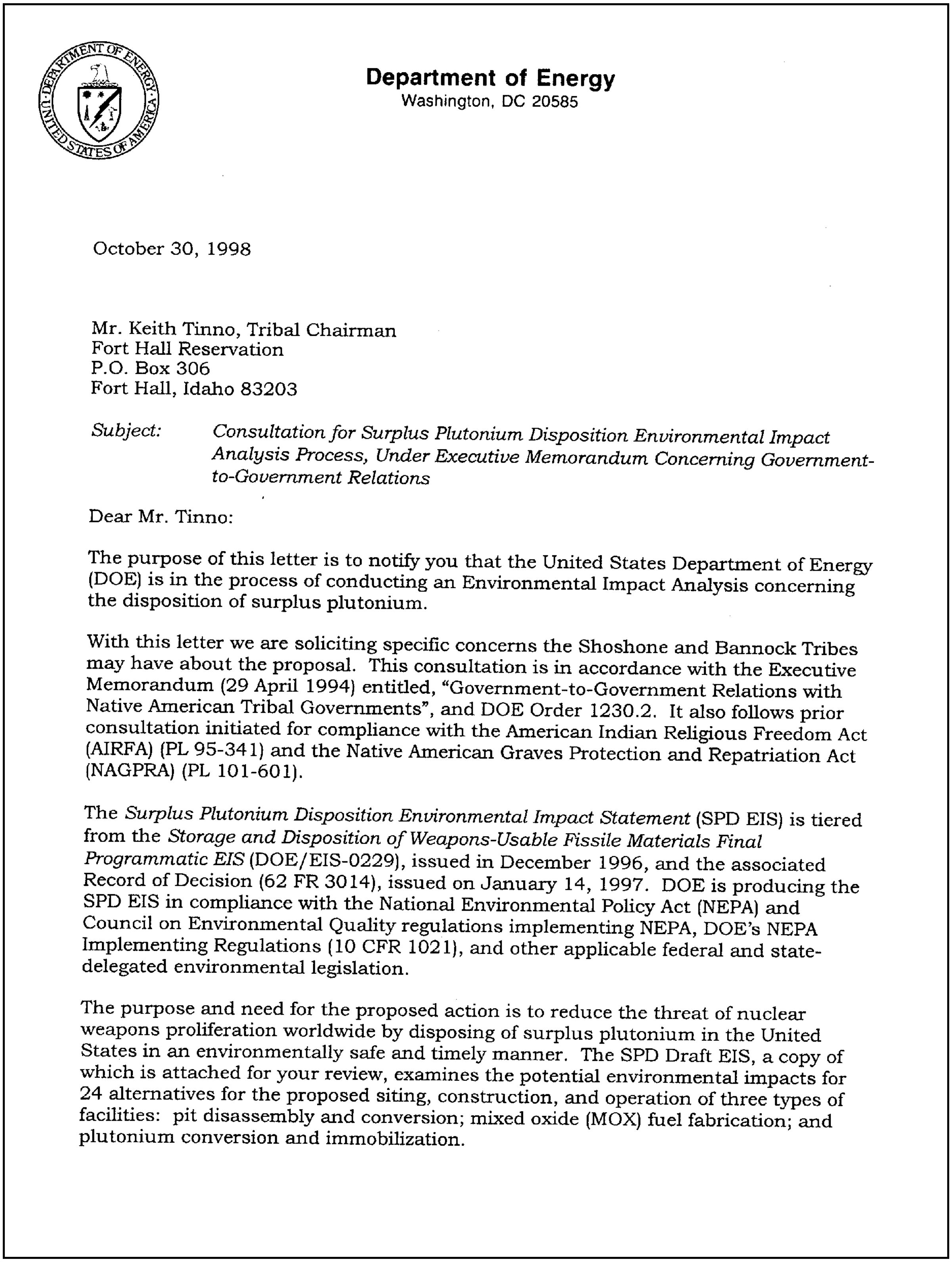
You may also contact Bob Stark, the INEEL Technical Lead for Cultural Resources, at (208) 526-1122.

Sincerely,

Marcus Jones
SPD EIS Document Manager

cc: Bob Stark, Technical Lead for Cultural Resources, INEEL
Lois Thompson, Federal Preservation Officer, DOE HQ

SPD EIS enclosure



Department of Energy
Washington, DC 20585

October 30, 1998

Mr. Keith Tinno, Tribal Chairman
Fort Hall Reservation
P.O. Box 306
Fort Hall, Idaho 83203

Subject: *Consultation for Surplus Plutonium Disposition Environmental Impact Analysis Process, Under Executive Memorandum Concerning Government-to-Government Relations*

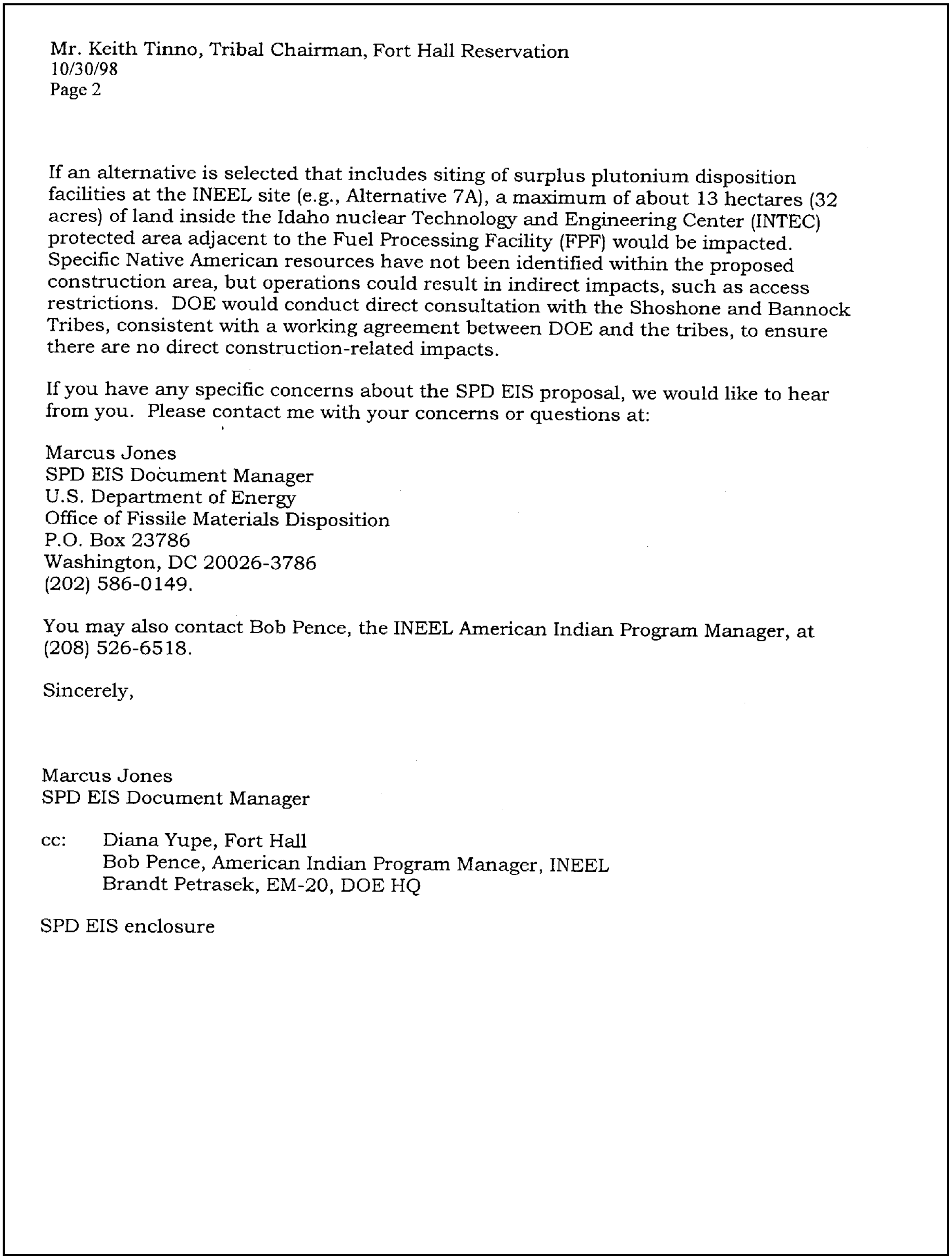
Dear Mr. Tinno:

The purpose of this letter is to notify you that the United States Department of Energy (DOE) is in the process of conducting an Environmental Impact Analysis concerning the disposition of surplus plutonium.

With this letter we are soliciting specific concerns the Shoshone and Bannock Tribes may have about the proposal. This consultation is in accordance with the Executive Memorandum (29 April 1994) entitled, "Government-to-Government Relations with Native American Tribal Governments", and DOE Order 1230.2. It also follows prior consultation initiated for compliance with the American Indian Religious Freedom Act (AIRFA) (PL 95-341) and the Native American Graves Protection and Repatriation Act (NAGPRA) (PL 101-601).

The *Surplus Plutonium Disposition Environmental Impact Statement* (SPD EIS) is tiered from the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic EIS* (DOE/EIS-0229), issued in December 1996, and the associated Record of Decision (62 FR 3014), issued on January 14, 1997. DOE is producing the SPD EIS in compliance with the National Environmental Policy Act (NEPA) and Council on Environmental Quality regulations implementing NEPA, DOE's NEPA Implementing Regulations (10 CFR 1021), and other applicable federal and state-delegated environmental legislation.

The purpose and need for the proposed action is to reduce the threat of nuclear weapons proliferation worldwide by disposing of surplus plutonium in the United States in an environmentally safe and timely manner. The SPD Draft EIS, a copy of which is attached for your review, examines the potential environmental impacts for 24 alternatives for the proposed siting, construction, and operation of three types of facilities: pit disassembly and conversion; mixed oxide (MOX) fuel fabrication; and plutonium conversion and immobilization.



Mr. Keith Tinno, Tribal Chairman, Fort Hall Reservation
10/30/98
Page 2

If an alternative is selected that includes siting of surplus plutonium disposition facilities at the INEEL site (e.g., Alternative 7A), a maximum of about 13 hectares (32 acres) of land inside the Idaho nuclear Technology and Engineering Center (INTEC) protected area adjacent to the Fuel Processing Facility (FPF) would be impacted. Specific Native American resources have not been identified within the proposed construction area, but operations could result in indirect impacts, such as access restrictions. DOE would conduct direct consultation with the Shoshone and Bannock Tribes, consistent with a working agreement between DOE and the tribes, to ensure there are no direct construction-related impacts.

If you have any specific concerns about the SPD EIS proposal, we would like to hear from you. Please contact me with your concerns or questions at:

Marcus Jones
SPD EIS Document Manager
U.S. Department of Energy
Office of Fissile Materials Disposition
P.O. Box 23786
Washington, DC 20026-3786
(202) 586-0149.

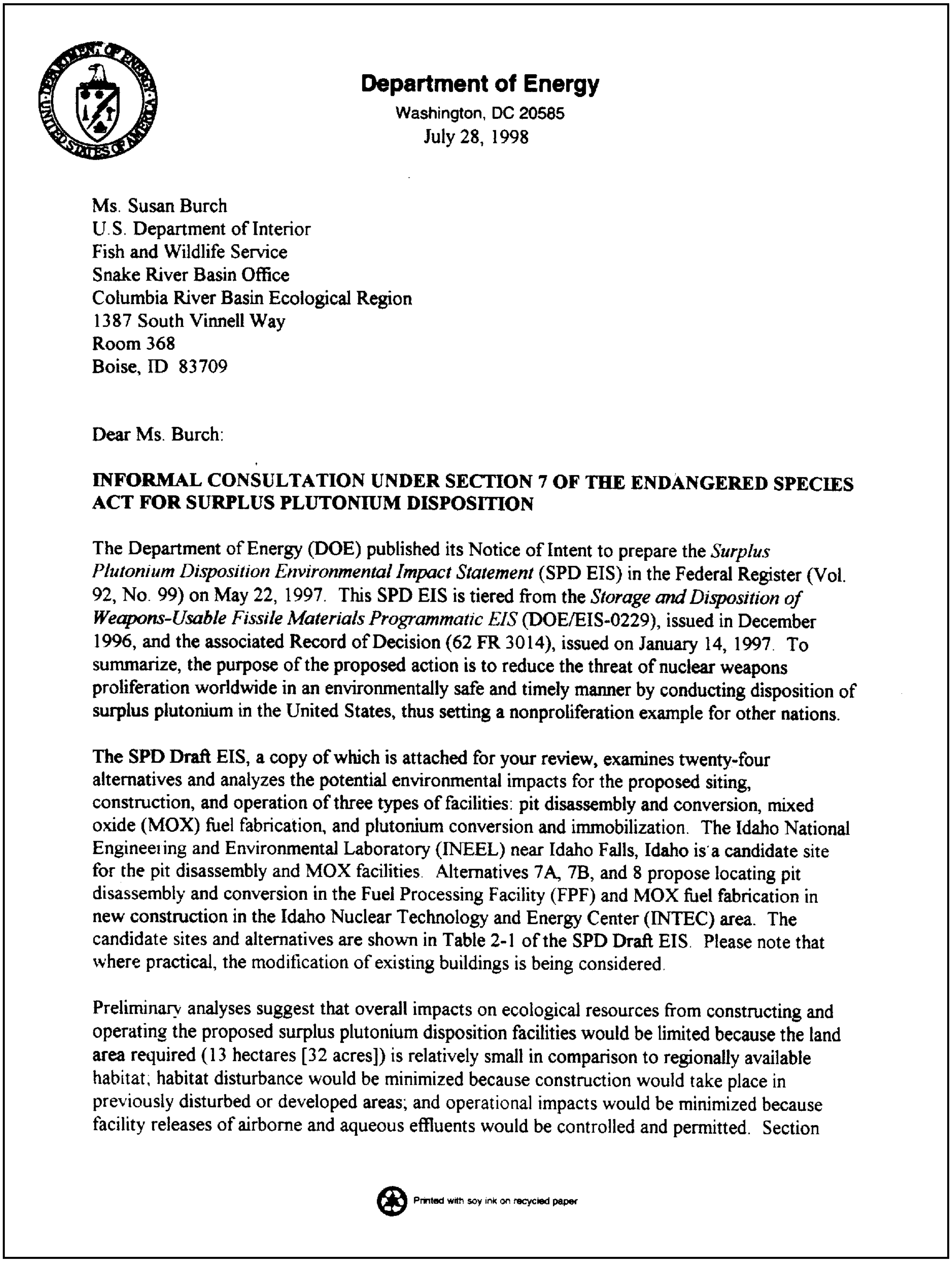
You may also contact Bob Pence, the INEEL American Indian Program Manager, at (208) 526-6518.

Sincerely,

Marcus Jones
SPD EIS Document Manager

cc: Diana Yupe, Fort Hall
Bob Pence, American Indian Program Manager, INEEL
Brandt Petrasek, EM-20, DOE HQ

SPD EIS enclosure



Department of Energy
Washington, DC 20585

July 28, 1998

Ms. Susan Burch
U.S. Department of Interior
Fish and Wildlife Service
Snake River Basin Office
Columbia River Basin Ecological Region
1387 South Vinnell Way
Room 368
Boise, ID 83709

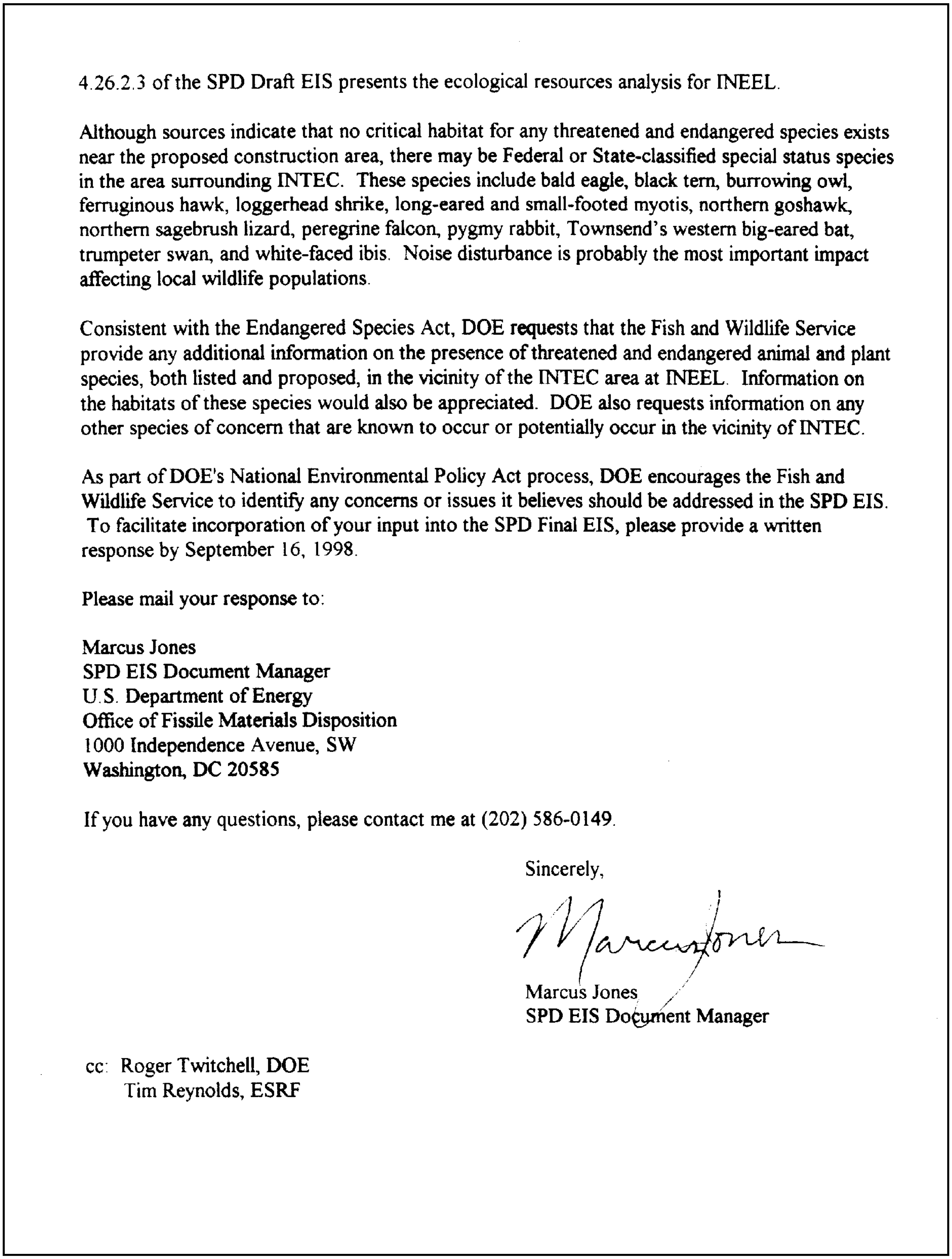
Dear Ms. Burch:

INFORMAL CONSULTATION UNDER SECTION 7 OF THE ENDANGERED SPECIES ACT FOR SURPLUS PLUTONIUM DISPOSITION

The Department of Energy (DOE) published its Notice of Intent to prepare the *Surplus Plutonium Disposition Environmental Impact Statement* (SPD EIS) in the Federal Register (Vol. 92, No. 99) on May 22, 1997. This SPD EIS is tiered from the *Storage and Disposition of Weapons-Usable Fissile Materials Programmatic EIS* (DOE/EIS-0229), issued in December 1996, and the associated Record of Decision (62 FR 3014), issued on January 14, 1997. To summarize, the purpose of the proposed action is to reduce the threat of nuclear weapons proliferation worldwide in an environmentally safe and timely manner by conducting disposition of surplus plutonium in the United States, thus setting a nonproliferation example for other nations.

The SPD Draft EIS, a copy of which is attached for your review, examines twenty-four alternatives and analyzes the potential environmental impacts for the proposed siting, construction, and operation of three types of facilities: pit disassembly and conversion, mixed oxide (MOX) fuel fabrication, and plutonium conversion and immobilization. The Idaho National Engineering and Environmental Laboratory (INEEL) near Idaho Falls, Idaho is a candidate site for the pit disassembly and MOX facilities. Alternatives 7A, 7B, and 8 propose locating pit disassembly and conversion in the Fuel Processing Facility (FPF) and MOX fuel fabrication in new construction in the Idaho Nuclear Technology and Energy Center (INTEC) area. The candidate sites and alternatives are shown in Table 2-1 of the SPD Draft EIS. Please note that where practical, the modification of existing buildings is being considered.

Preliminary analyses suggest that overall impacts on ecological resources from constructing and operating the proposed surplus plutonium disposition facilities would be limited because the land area required (13 hectares [32 acres]) is relatively small in comparison to regionally available habitat; habitat disturbance would be minimized because construction would take place in previously disturbed or developed areas; and operational impacts would be minimized because facility releases of airborne and aqueous effluents would be controlled and permitted. Section



4.26.2.3 of the SPD Draft EIS presents the ecological resources analysis for INEEL.

Although sources indicate that no critical habitat for any threatened and endangered species exists near the proposed construction area, there may be Federal or State-classified special status species in the area surrounding INTEC. These species include bald eagle, black tern, burrowing owl, ferruginous hawk, loggerhead shrike, long-eared and small-footed myotis, northern goshawk, northern sagebrush lizard, peregrine falcon, pygmy rabbit, Townsend's western big-eared bat, trumpeter swan, and white-faced ibis. Noise disturbance is probably the most important impact affecting local wildlife populations.

Consistent with the Endangered Species Act, DOE requests that the Fish and Wildlife Service provide any additional information on the presence of threatened and endangered animal and plant species, both listed and proposed, in the vicinity of the INTEC area at INEEL. Information on the habitats of these species would also be appreciated. DOE also requests information on any other species of concern that are known to occur or potentially occur in the vicinity of INTEC.

As part of DOE's National Environmental Policy Act process, DOE encourages the Fish and Wildlife Service to identify any concerns or issues it believes should be addressed in the SPD EIS. To facilitate incorporation of your input into the SPD Final EIS, please provide a written response by September 16, 1998.

Please mail your response to:

Marcus Jones
SPD EIS Document Manager
U.S. Department of Energy
Office of Fissile Materials Disposition
1000 Independence Avenue, SW
Washington, DC 20585

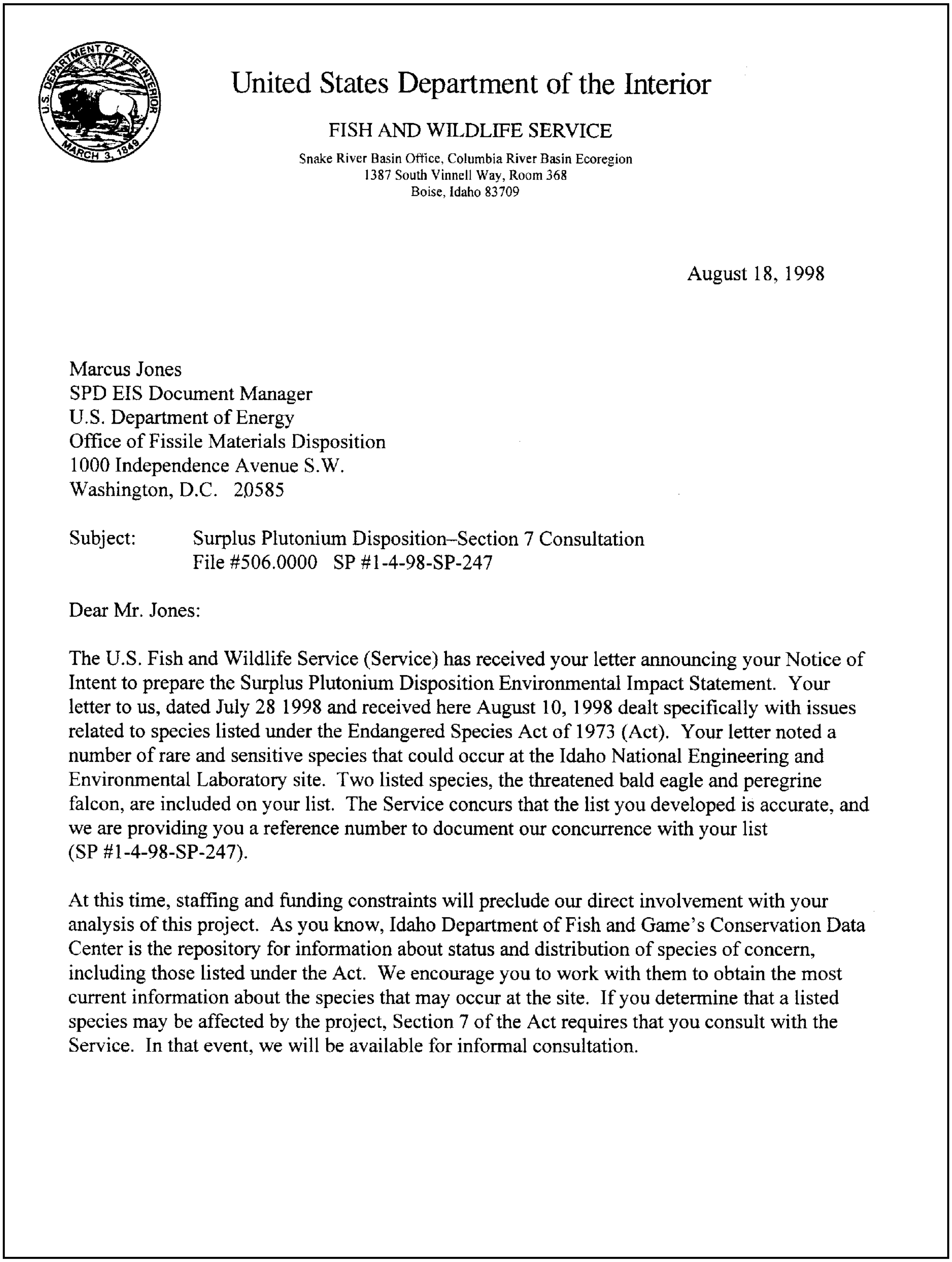
If you have any questions, please contact me at (202) 586-0149.

Sincerely,

Marcus Jones

Marcus Jones
SPD EIS Document Manager

cc: Roger Twitchell, DOE
Tim Reynolds, ESRF



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Snake River Basin Office, Columbia River Basin Ecoregion
1387 South Vinnell Way, Room 368
Boise, Idaho 83709

August 18, 1998

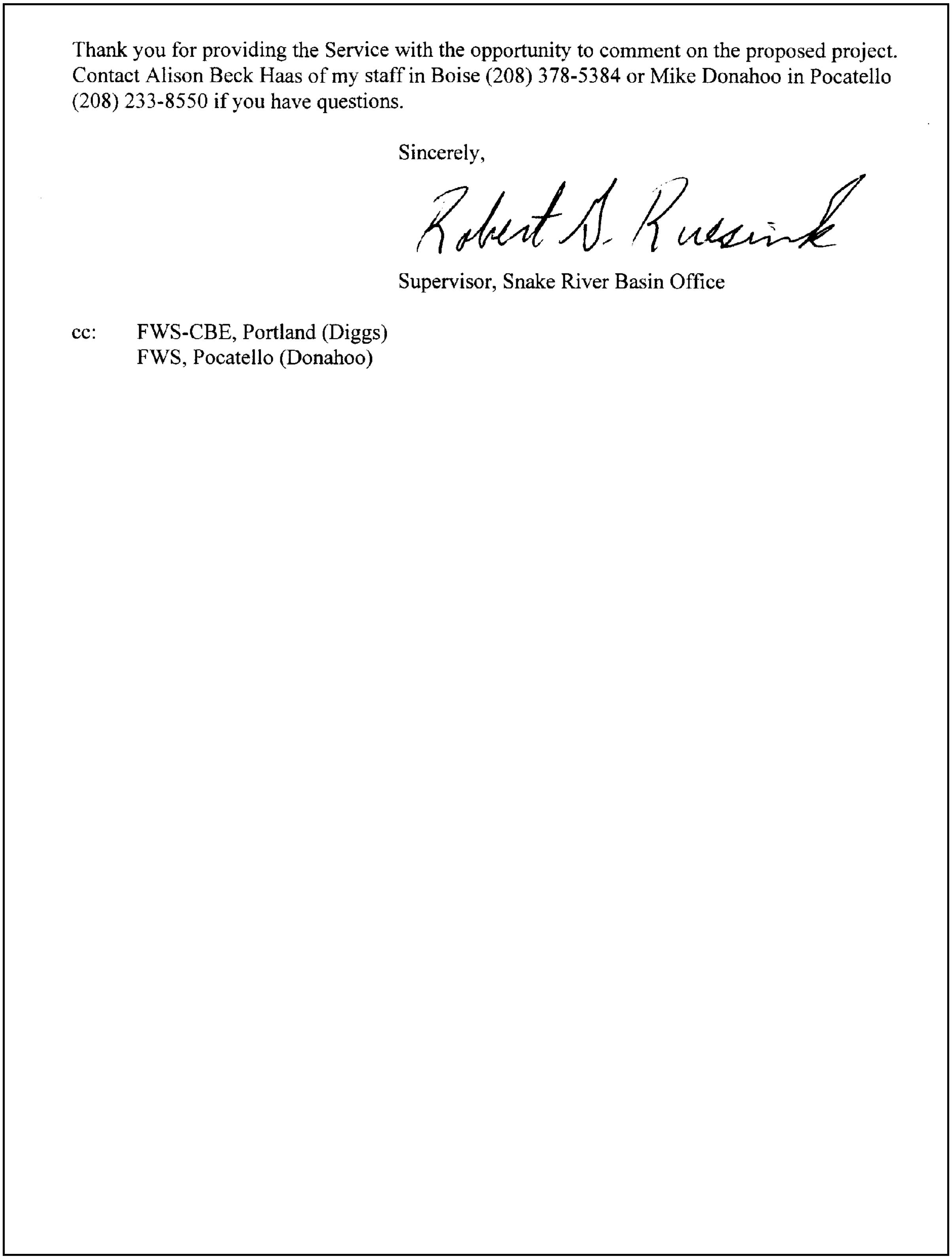
Marcus Jones
SPD EIS Document Manager
U.S. Department of Energy
Office of Fissile Materials Disposition
1000 Independence Avenue S.W.
Washington, D.C. 20585

Subject: Surplus Plutonium Disposition–Section 7 Consultation
File #506.0000 SP #1-4-98-SP-247

Dear Mr. Jones:

The U.S. Fish and Wildlife Service (Service) has received your letter announcing your Notice of Intent to prepare the Surplus Plutonium Disposition Environmental Impact Statement. Your letter to us, dated July 28 1998 and received here August 10, 1998 dealt specifically with issues related to species listed under the Endangered Species Act of 1973 (Act). Your letter noted a number of rare and sensitive species that could occur at the Idaho National Engineering and Environmental Laboratory site. Two listed species, the threatened bald eagle and peregrine falcon, are included on your list. The Service concurs that the list you developed is accurate, and we are providing you a reference number to document our concurrence with your list (SP #1-4-98-SP-247).

At this time, staffing and funding constraints will preclude our direct involvement with your analysis of this project. As you know, Idaho Department of Fish and Game's Conservation Data Center is the repository for information about status and distribution of species of concern, including those listed under the Act. We encourage you to work with them to obtain the most current information about the species that may occur at the site. If you determine that a listed species may be affected by the project, Section 7 of the Act requires that you consult with the Service. In that event, we will be available for informal consultation.



Thank you for providing the Service with the opportunity to comment on the proposed project. Contact Alison Beck Haas of my staff in Boise (208) 378-5384 or Mike Donahoo in Pocatello (208) 233-8550 if you have questions.

Sincerely,

Robert D. Ruesink

Supervisor, Snake River Basin Office

cc: FWS-CBE, Portland (Diggs)
FWS, Pocatello (Donahoo)

Department of Energy
Washington, DC 20585
July 28, 1998

Mr. George Stephens
Idaho Department of Fish and Game
Conservation Data Center
600 South Walnut
Boise, ID 83705

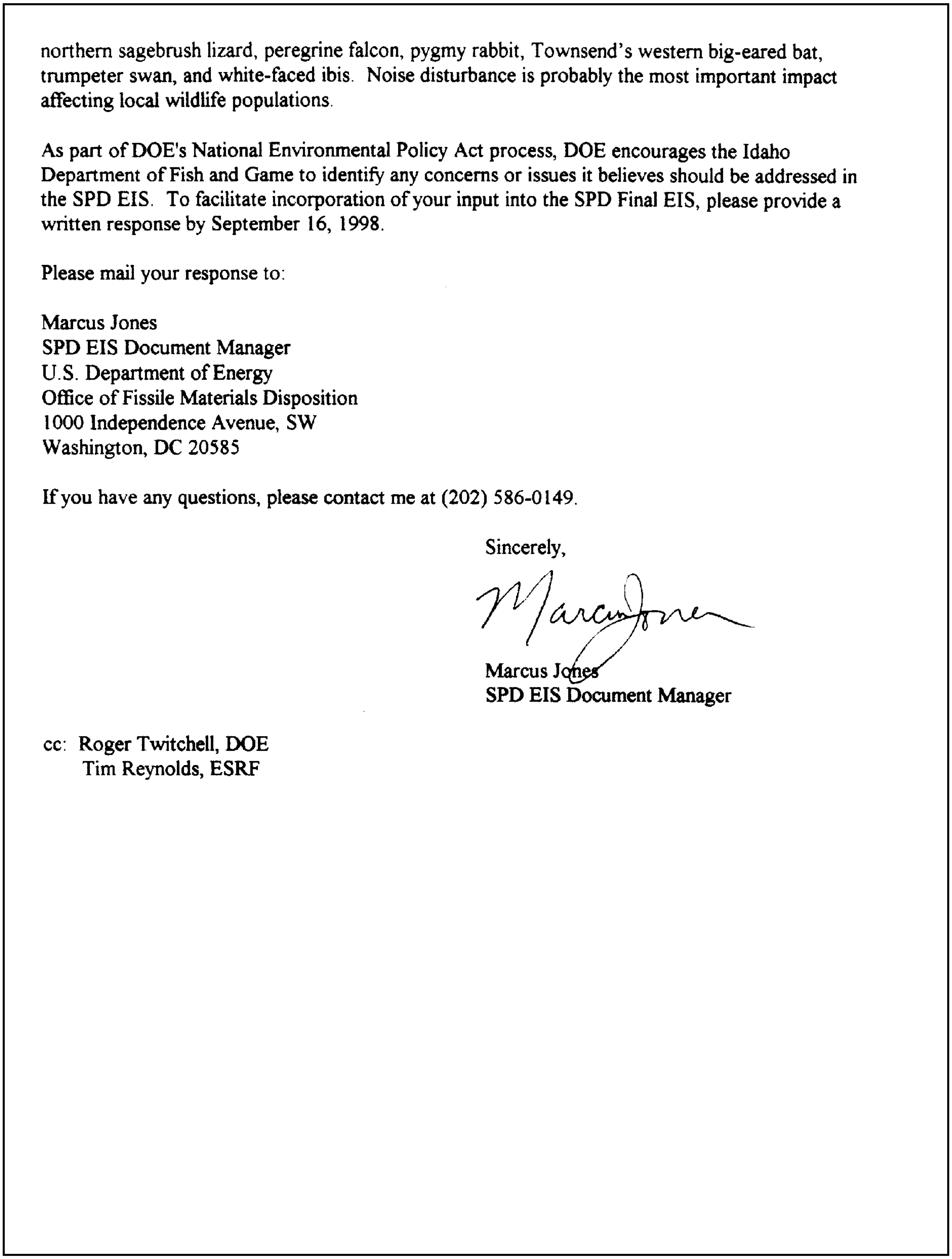
Dear Mr. Stephens:

The Department of Energy (DOE) published its Notice of Intent to prepare the *Surplus Plutonium Disposition Environmental Impact Statement* (SPD EIS) in the Federal Register (Vol. 92, No. 99) on May 22, 1997. This SPD EIS is tiered from the *Storage and Disposition of Weapons-Usable Fissile Materials Programmatic EIS* (DOE/EIS-0229), issued in December 1996, and the associated Record of Decision (62 FR 3014), issued on January 14, 1997. To summarize, the purpose of the proposed action is to reduce the threat of nuclear weapons proliferation worldwide in an environmentally safe and timely manner by conducting disposition of surplus plutonium in the United States, thus setting a nonproliferation example for other nations.

The SPD Draft EIS, a copy of which is attached for your review, examines twenty-four alternatives and analyzes the potential environmental impacts for the proposed siting, construction, and operation of three types of facilities: pit disassembly and conversion, mixed oxide (MOX) fuel fabrication, and plutonium conversion and immobilization. The Idaho National Engineering and Environmental Laboratory (INEEL) near Idaho Falls, Idaho is a candidate site for the pit disassembly and MOX facilities. Alternatives 7A, 7B, and 8 propose locating pit disassembly and conversion in the Fuel Processing Facility (FPF) and MOX fuel fabrication in new construction in the Idaho Nuclear Technology and Energy Center (INTEC) area. The candidate sites and alternatives are shown in Table 2-1 of the SPD Draft EIS. Please note that where practical, the modification of existing buildings is being considered.

Preliminary analyses suggest that overall impacts on ecological resources from constructing and operating the proposed surplus plutonium disposition facilities would be limited because the land area required (13 hectares [32 acres]) is relatively small in comparison to regionally available habitat; habitat disturbance would be minimized because construction would take place in previously disturbed or developed areas; and operational impacts would be minimized because facility releases of airborne and aqueous effluents would be controlled and permitted. Section 4.26.2.3 of the SPD Draft EIS presents the ecological resources analysis for INEEL.

Although sources indicate that no critical habitat for any threatened and endangered species exists near the proposed construction area, there may be Federal or State-classified special status species in the area surrounding INTEC. These species include bald eagle, black tern, burrowing owl, ferruginous hawk, loggerhead shrike, long-eared and small-footed myotis, northern goshawk,



northern sagebrush lizard, peregrine falcon, pygmy rabbit, Townsend's western big-eared bat, trumpeter swan, and white-faced ibis. Noise disturbance is probably the most important impact affecting local wildlife populations.

As part of DOE's National Environmental Policy Act process, DOE encourages the Idaho Department of Fish and Game to identify any concerns or issues it believes should be addressed in the SPD EIS. To facilitate incorporation of your input into the SPD Final EIS, please provide a written response by September 16, 1998.

Please mail your response to:

Marcus Jones
SPD EIS Document Manager
U.S. Department of Energy
Office of Fissile Materials Disposition
1000 Independence Avenue, SW
Washington, DC 20585

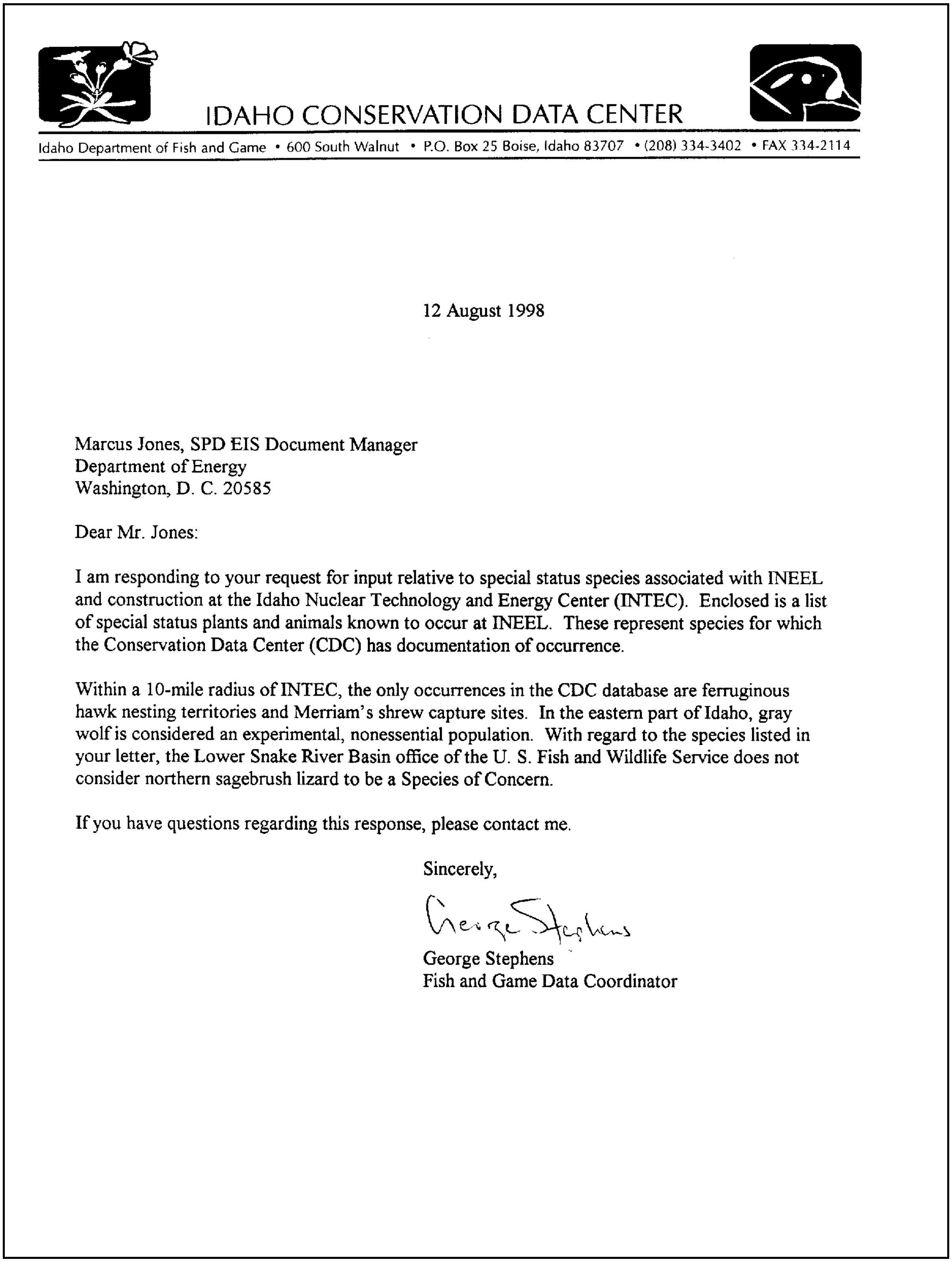
If you have any questions, please contact me at (202) 586-0149.

Sincerely,

Marcus Jones

Marcus Jones
SPD EIS Document Manager

cc: Roger Twitchell, DOE
Tim Reynolds, ESRF



IDAHO CONSERVATION DATA CENTER

Idaho Department of Fish and Game • 600 South Walnut • P.O. Box 25 Boise, Idaho 83707 • (208) 334-3402 • FAX 334-2114

12 August 1998

Marcus Jones, SPD EIS Document Manager
Department of Energy
Washington, D. C. 20585

Dear Mr. Jones:

I am responding to your request for input relative to special status species associated with INEEL and construction at the Idaho Nuclear Technology and Energy Center (INTEC). Enclosed is a list of special status plants and animals known to occur at INEEL. These represent species for which the Conservation Data Center (CDC) has documentation of occurrence.

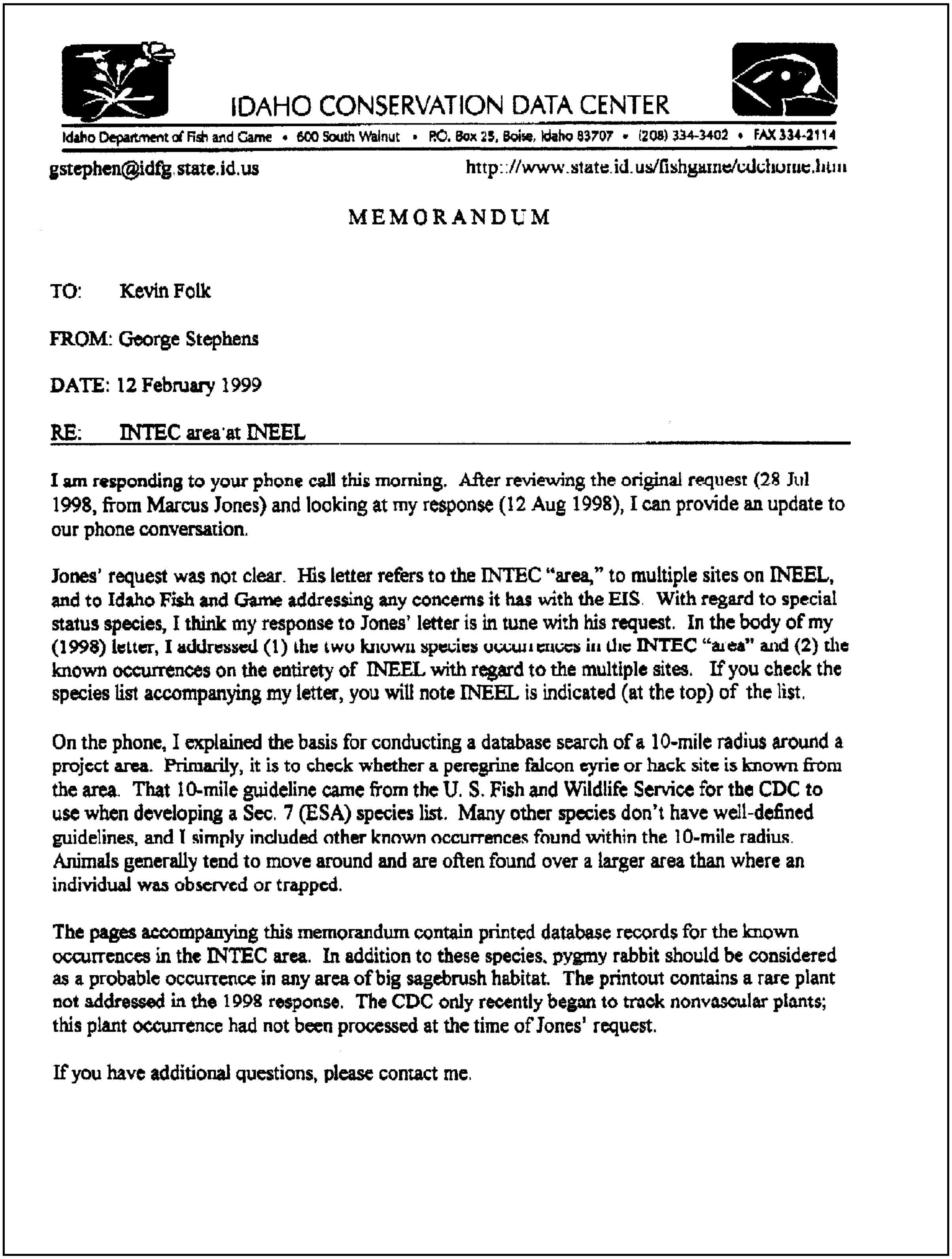
Within a 10-mile radius of INTEC, the only occurrences in the CDC database are ferruginous hawk nesting territories and Merriam's shrew capture sites. In the eastern part of Idaho, gray wolf is considered an experimental, nonessential population. With regard to the species listed in your letter, the Lower Snake River Basin office of the U. S. Fish and Wildlife Service does not consider northern sagebrush lizard to be a Species of Concern.

If you have questions regarding this response, please contact me.

Sincerely,

George Stephens

George Stephens
Fish and Game Data Coordinator



IDAHO CONSERVATION DATA CENTER
Idaho Department of Fish and Game • 600 South Walnut • P.O. Box 25, Boise, Idaho 83707 • (208) 334-3402 • FAX 334-2114
gstephen@idfg.state.id.us http://www.state.id.us/fishgame/cdchome.htm

MEMORANDUM

TO: Kevin Folk

FROM: George Stephens

DATE: 12 February 1999

RE: INTEC area at INEEL

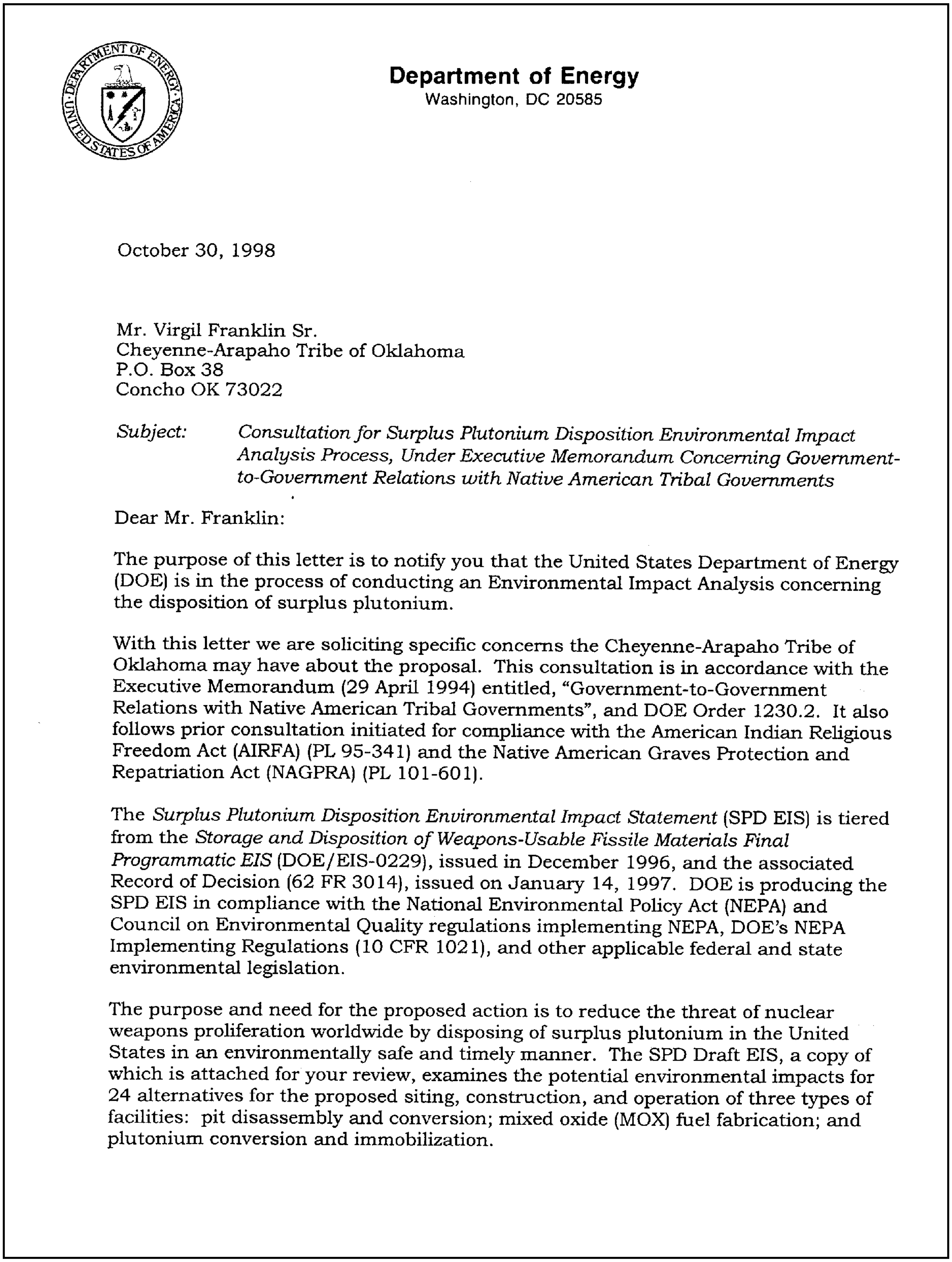
I am responding to your phone call this morning. After reviewing the original request (28 Jul 1998, from Marcus Jones) and looking at my response (12 Aug 1998), I can provide an update to our phone conversation.

Jones' request was not clear. His letter refers to the INTEC "area," to multiple sites on INEEL, and to Idaho Fish and Game addressing any concerns it has with the EIS. With regard to special status species, I think my response to Jones' letter is in tune with his request. In the body of my (1998) letter, I addressed (1) the two known species occurrences in the INTEC "area" and (2) the known occurrences on the entirety of INEEL with regard to the multiple sites. If you check the species list accompanying my letter, you will note INEEL is indicated (at the top) of the list.

On the phone, I explained the basis for conducting a database search of a 10-mile radius around a project area. Primarily, it is to check whether a peregrine falcon eyrie or hack site is known from the area. That 10-mile guideline came from the U. S. Fish and Wildlife Service for the CDC to use when developing a Sec. 7 (ESA) species list. Many other species don't have well-defined guidelines, and I simply included other known occurrences found within the 10-mile radius. Animals generally tend to move around and are often found over a larger area than where an individual was observed or trapped.

The pages accompanying this memorandum contain printed database records for the known occurrences in the INTEC area. In addition to these species, pygmy rabbit should be considered as a probable occurrence in any area of big sagebrush habitat. The printout contains a rare plant not addressed in the 1998 response. The CDC only recently began to track nonvascular plants; this plant occurrence had not been processed at the time of Jones' request.

If you have additional questions, please contact me.



Department of Energy
Washington, DC 20585

October 30, 1998

Mr. Virgil Franklin Sr.
Cheyenne-Arapaho Tribe of Oklahoma
P.O. Box 38
Concho OK 73022

Subject: *Consultation for Surplus Plutonium Disposition Environmental Impact Analysis Process, Under Executive Memorandum Concerning Government-to-Government Relations with Native American Tribal Governments*

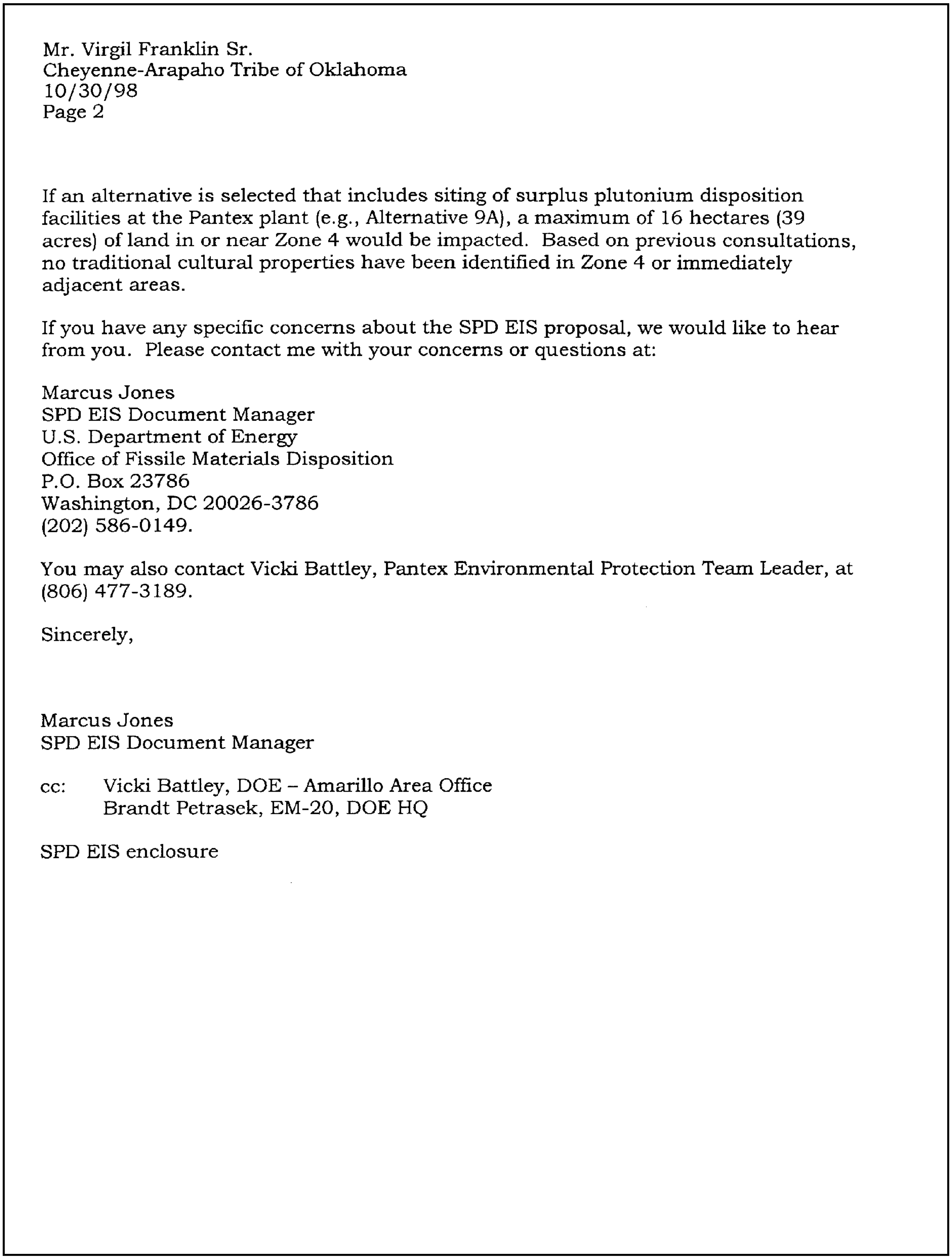
Dear Mr. Franklin:

The purpose of this letter is to notify you that the United States Department of Energy (DOE) is in the process of conducting an Environmental Impact Analysis concerning the disposition of surplus plutonium.

With this letter we are soliciting specific concerns the Cheyenne-Arapaho Tribe of Oklahoma may have about the proposal. This consultation is in accordance with the Executive Memorandum (29 April 1994) entitled, "Government-to-Government Relations with Native American Tribal Governments", and DOE Order 1230.2. It also follows prior consultation initiated for compliance with the American Indian Religious Freedom Act (AIRFA) (PL 95-341) and the Native American Graves Protection and Repatriation Act (NAGPRA) (PL 101-601).

The *Surplus Plutonium Disposition Environmental Impact Statement* (SPD EIS) is tiered from the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic EIS* (DOE/EIS-0229), issued in December 1996, and the associated Record of Decision (62 FR 3014), issued on January 14, 1997. DOE is producing the SPD EIS in compliance with the National Environmental Policy Act (NEPA) and Council on Environmental Quality regulations implementing NEPA, DOE's NEPA Implementing Regulations (10 CFR 1021), and other applicable federal and state environmental legislation.

The purpose and need for the proposed action is to reduce the threat of nuclear weapons proliferation worldwide by disposing of surplus plutonium in the United States in an environmentally safe and timely manner. The SPD Draft EIS, a copy of which is attached for your review, examines the potential environmental impacts for 24 alternatives for the proposed siting, construction, and operation of three types of facilities: pit disassembly and conversion; mixed oxide (MOX) fuel fabrication; and plutonium conversion and immobilization.



Mr. Virgil Franklin Sr.
Cheyenne-Arapaho Tribe of Oklahoma
10/30/98
Page 2

If an alternative is selected that includes siting of surplus plutonium disposition facilities at the Pantex plant (e.g., Alternative 9A), a maximum of 16 hectares (39 acres) of land in or near Zone 4 would be impacted. Based on previous consultations, no traditional cultural properties have been identified in Zone 4 or immediately adjacent areas.

If you have any specific concerns about the SPD EIS proposal, we would like to hear from you. Please contact me with your concerns or questions at:

Marcus Jones
SPD EIS Document Manager
U.S. Department of Energy
Office of Fissile Materials Disposition
P.O. Box 23786
Washington, DC 20026-3786
(202) 586-0149.

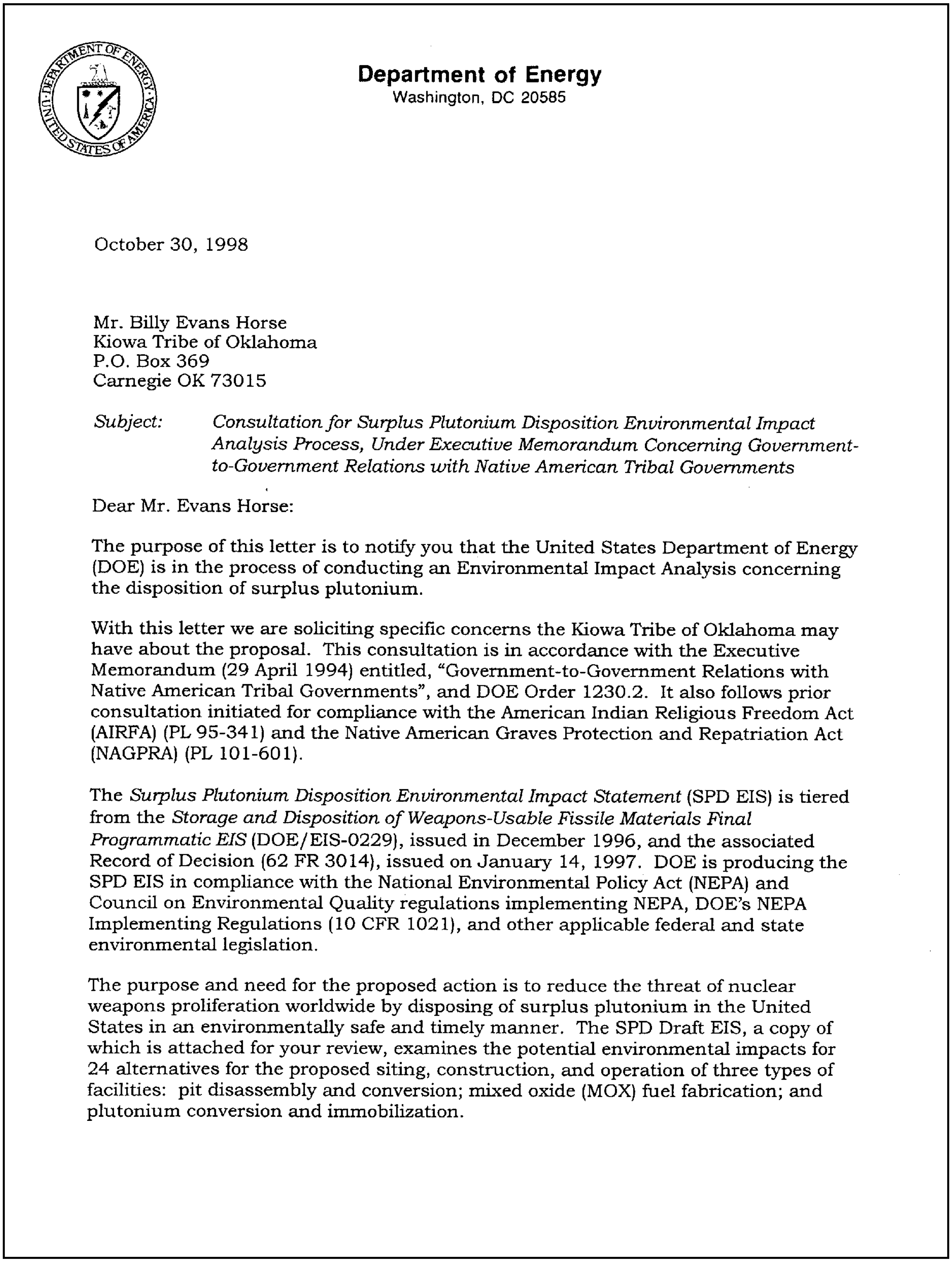
You may also contact Vicki Battley, Pantex Environmental Protection Team Leader, at (806) 477-3189.

Sincerely,

Marcus Jones
SPD EIS Document Manager

cc: Vicki Battley, DOE – Amarillo Area Office
Brandt Petrasek, EM-20, DOE HQ

SPD EIS enclosure



Department of Energy
Washington, DC 20585

October 30, 1998

Mr. Billy Evans Horse
Kiowa Tribe of Oklahoma
P.O. Box 369
Carnegie OK 73015

Subject: *Consultation for Surplus Plutonium Disposition Environmental Impact Analysis Process, Under Executive Memorandum Concerning Government-to-Government Relations with Native American Tribal Governments*

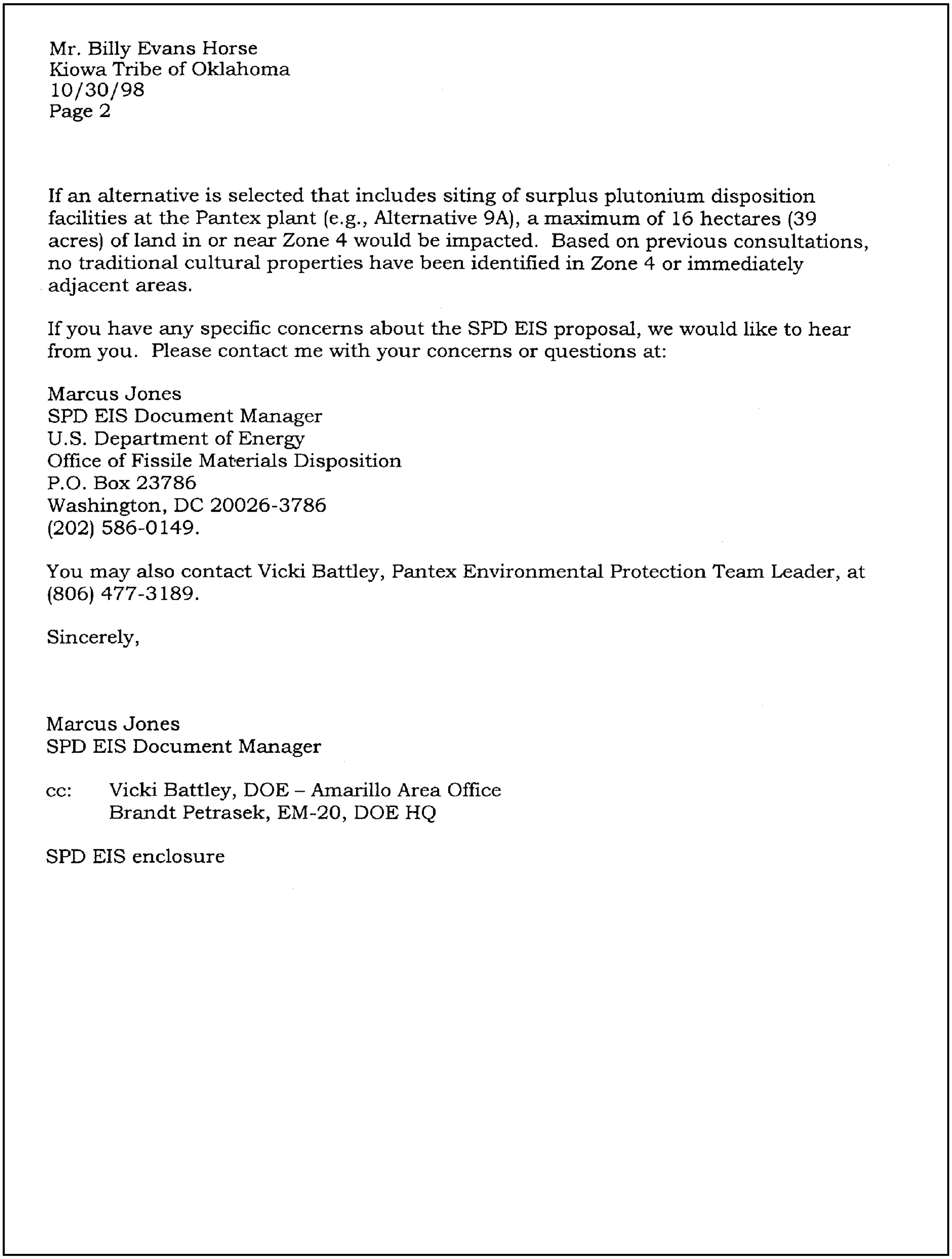
Dear Mr. Evans Horse:

The purpose of this letter is to notify you that the United States Department of Energy (DOE) is in the process of conducting an Environmental Impact Analysis concerning the disposition of surplus plutonium.

With this letter we are soliciting specific concerns the Kiowa Tribe of Oklahoma may have about the proposal. This consultation is in accordance with the Executive Memorandum (29 April 1994) entitled, "Government-to-Government Relations with Native American Tribal Governments", and DOE Order 1230.2. It also follows prior consultation initiated for compliance with the American Indian Religious Freedom Act (AIRFA) (PL 95-341) and the Native American Graves Protection and Repatriation Act (NAGPRA) (PL 101-601).

The *Surplus Plutonium Disposition Environmental Impact Statement* (SPD EIS) is tiered from the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic EIS* (DOE/EIS-0229), issued in December 1996, and the associated Record of Decision (62 FR 3014), issued on January 14, 1997. DOE is producing the SPD EIS in compliance with the National Environmental Policy Act (NEPA) and Council on Environmental Quality regulations implementing NEPA, DOE's NEPA Implementing Regulations (10 CFR 1021), and other applicable federal and state environmental legislation.

The purpose and need for the proposed action is to reduce the threat of nuclear weapons proliferation worldwide by disposing of surplus plutonium in the United States in an environmentally safe and timely manner. The SPD Draft EIS, a copy of which is attached for your review, examines the potential environmental impacts for 24 alternatives for the proposed siting, construction, and operation of three types of facilities: pit disassembly and conversion; mixed oxide (MOX) fuel fabrication; and plutonium conversion and immobilization.



Mr. Billy Evans Horse
Kiowa Tribe of Oklahoma
10/30/98
Page 2

If an alternative is selected that includes siting of surplus plutonium disposition facilities at the Pantex plant (e.g., Alternative 9A), a maximum of 16 hectares (39 acres) of land in or near Zone 4 would be impacted. Based on previous consultations, no traditional cultural properties have been identified in Zone 4 or immediately adjacent areas.

If you have any specific concerns about the SPD EIS proposal, we would like to hear from you. Please contact me with your concerns or questions at:

Marcus Jones
SPD EIS Document Manager
U.S. Department of Energy
Office of Fissile Materials Disposition
P.O. Box 23786
Washington, DC 20026-3786
(202) 586-0149.

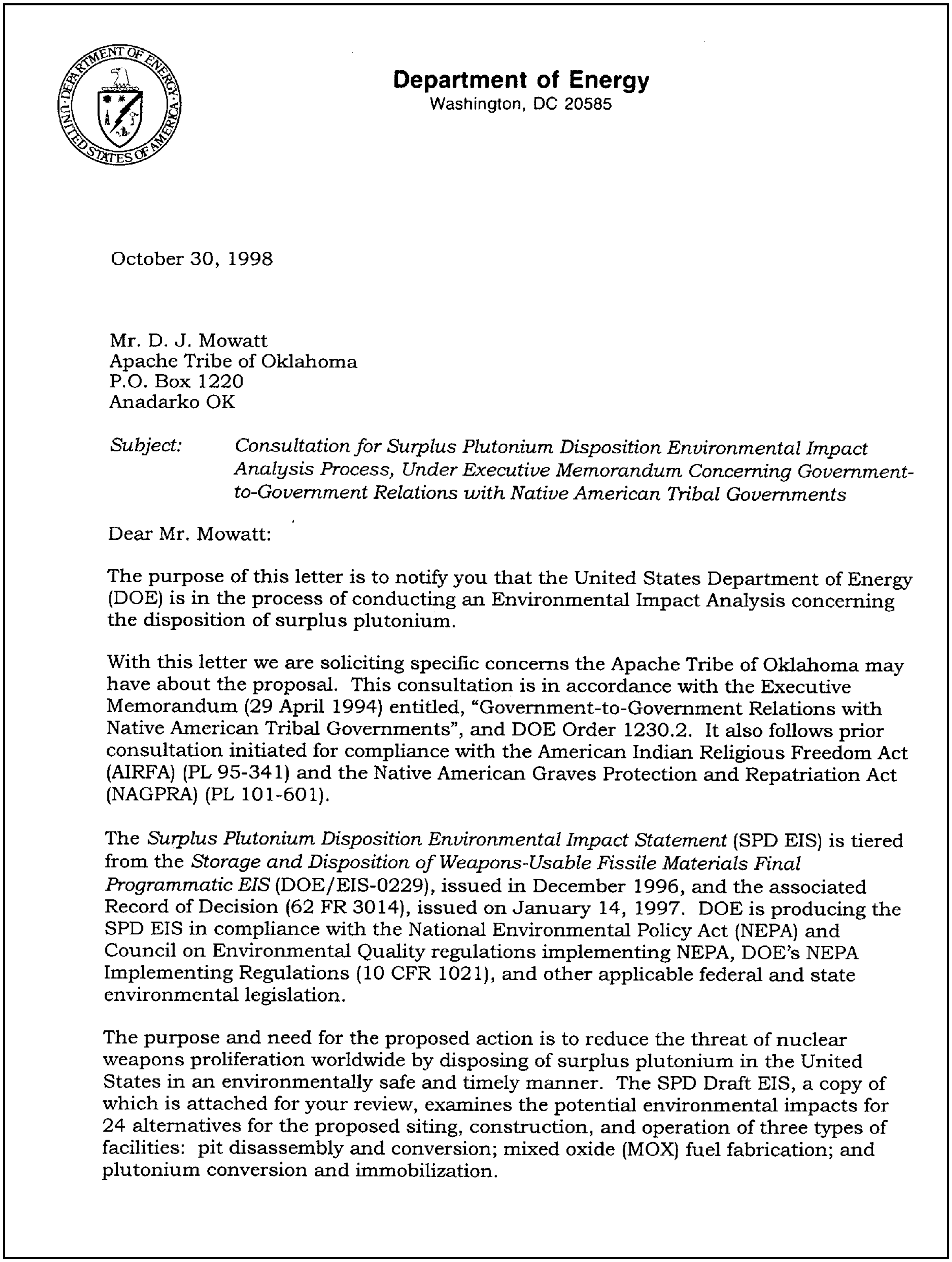
You may also contact Vicki Battley, Pantex Environmental Protection Team Leader, at (806) 477-3189.

Sincerely,

Marcus Jones
SPD EIS Document Manager

cc: Vicki Battley, DOE – Amarillo Area Office
Brandt Petrasek, EM-20, DOE HQ

SPD EIS enclosure



Department of Energy
Washington, DC 20585

October 30, 1998

Mr. D. J. Mowatt
Apache Tribe of Oklahoma
P.O. Box 1220
Anadarko OK

Subject: *Consultation for Surplus Plutonium Disposition Environmental Impact Analysis Process, Under Executive Memorandum Concerning Government-to-Government Relations with Native American Tribal Governments*

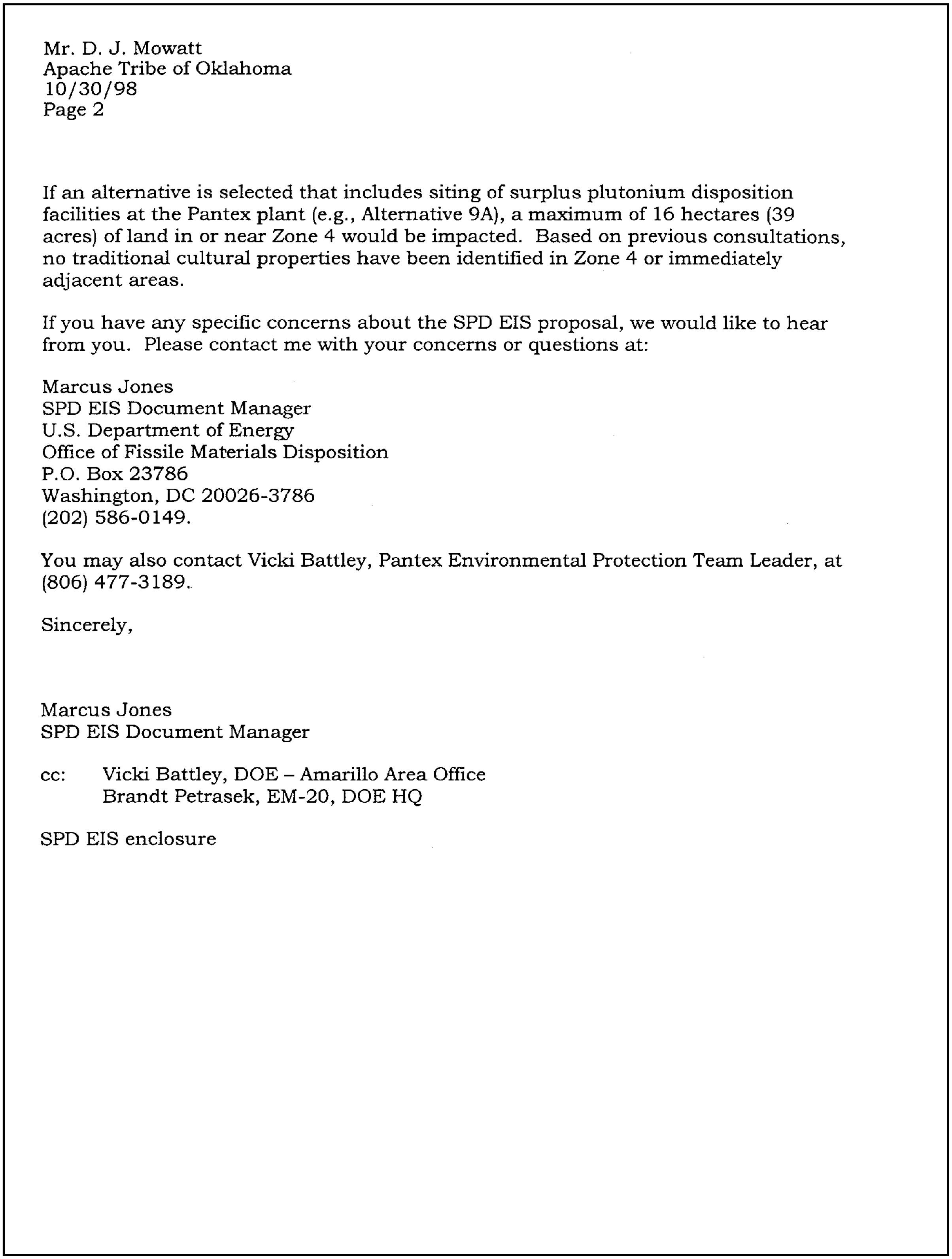
Dear Mr. Mowatt:

The purpose of this letter is to notify you that the United States Department of Energy (DOE) is in the process of conducting an Environmental Impact Analysis concerning the disposition of surplus plutonium.

With this letter we are soliciting specific concerns the Apache Tribe of Oklahoma may have about the proposal. This consultation is in accordance with the Executive Memorandum (29 April 1994) entitled, "Government-to-Government Relations with Native American Tribal Governments", and DOE Order 1230.2. It also follows prior consultation initiated for compliance with the American Indian Religious Freedom Act (AIRFA) (PL 95-341) and the Native American Graves Protection and Repatriation Act (NAGPRA) (PL 101-601).

The *Surplus Plutonium Disposition Environmental Impact Statement* (SPD EIS) is tiered from the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic EIS* (DOE/EIS-0229), issued in December 1996, and the associated Record of Decision (62 FR 3014), issued on January 14, 1997. DOE is producing the SPD EIS in compliance with the National Environmental Policy Act (NEPA) and Council on Environmental Quality regulations implementing NEPA, DOE's NEPA Implementing Regulations (10 CFR 1021), and other applicable federal and state environmental legislation.

The purpose and need for the proposed action is to reduce the threat of nuclear weapons proliferation worldwide by disposing of surplus plutonium in the United States in an environmentally safe and timely manner. The SPD Draft EIS, a copy of which is attached for your review, examines the potential environmental impacts for 24 alternatives for the proposed siting, construction, and operation of three types of facilities: pit disassembly and conversion; mixed oxide (MOX) fuel fabrication; and plutonium conversion and immobilization.



Mr. D. J. Mowatt
Apache Tribe of Oklahoma
10/30/98
Page 2

If an alternative is selected that includes siting of surplus plutonium disposition facilities at the Pantex plant (e.g., Alternative 9A), a maximum of 16 hectares (39 acres) of land in or near Zone 4 would be impacted. Based on previous consultations, no traditional cultural properties have been identified in Zone 4 or immediately adjacent areas.

If you have any specific concerns about the SPD EIS proposal, we would like to hear from you. Please contact me with your concerns or questions at:

Marcus Jones
SPD EIS Document Manager
U.S. Department of Energy
Office of Fissile Materials Disposition
P.O. Box 23786
Washington, DC 20026-3786
(202) 586-0149.

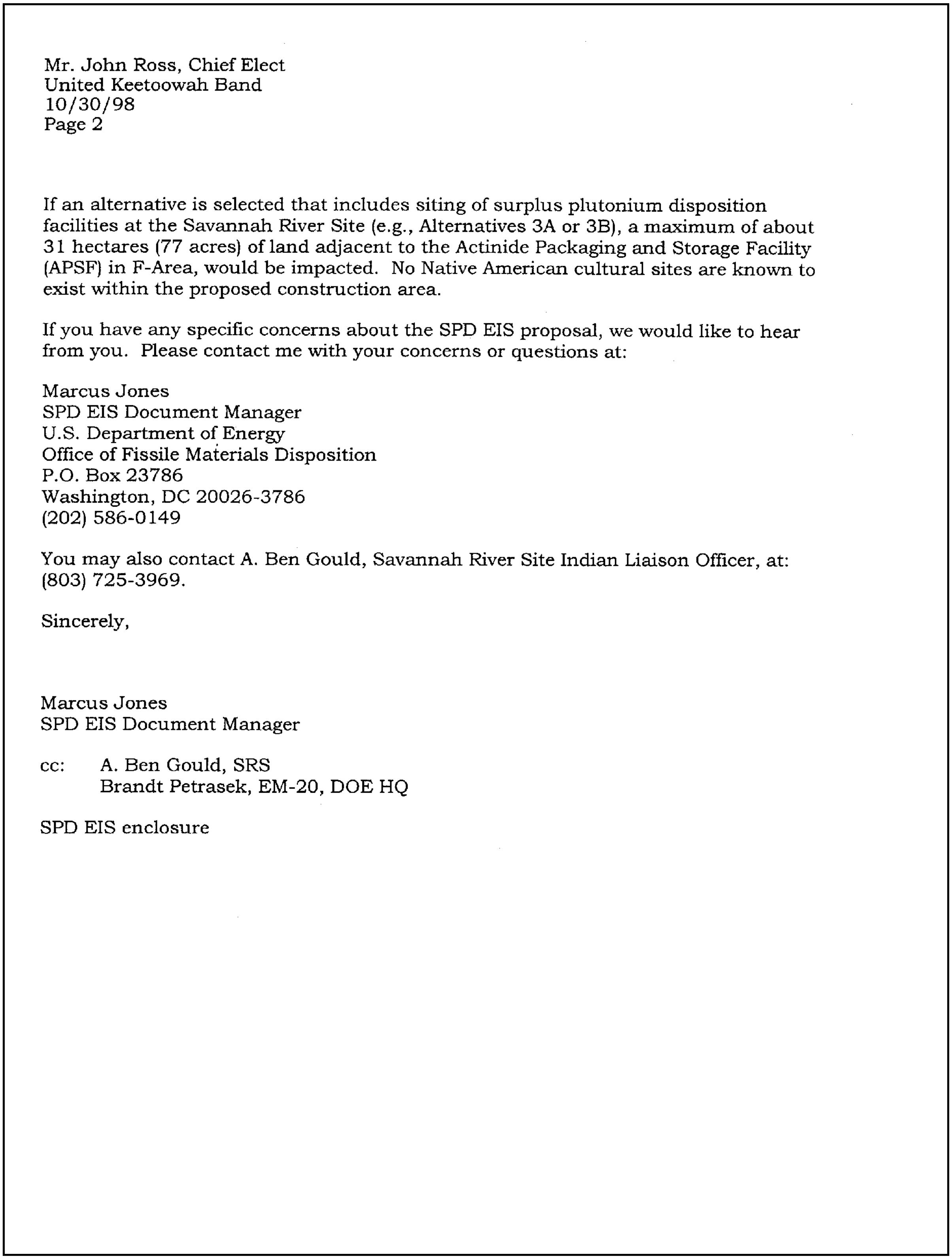
You may also contact Vicki Battley, Pantex Environmental Protection Team Leader, at (806) 477-3189.

Sincerely,

Marcus Jones
SPD EIS Document Manager

cc: Vicki Battley, DOE – Amarillo Area Office
Brandt Petrasek, EM-20, DOE HQ

SPD EIS enclosure



Mr. John Ross, Chief Elect
United Keetoowah Band
10/30/98
Page 2

If an alternative is selected that includes siting of surplus plutonium disposition facilities at the Savannah River Site (e.g., Alternatives 3A or 3B), a maximum of about 31 hectares (77 acres) of land adjacent to the Actinide Packaging and Storage Facility (APSF) in F-Area, would be impacted. No Native American cultural sites are known to exist within the proposed construction area.

If you have any specific concerns about the SPD EIS proposal, we would like to hear from you. Please contact me with your concerns or questions at:

Marcus Jones
SPD EIS Document Manager
U.S. Department of Energy
Office of Fissile Materials Disposition
P.O. Box 23786
Washington, DC 20026-3786
(202) 586-0149

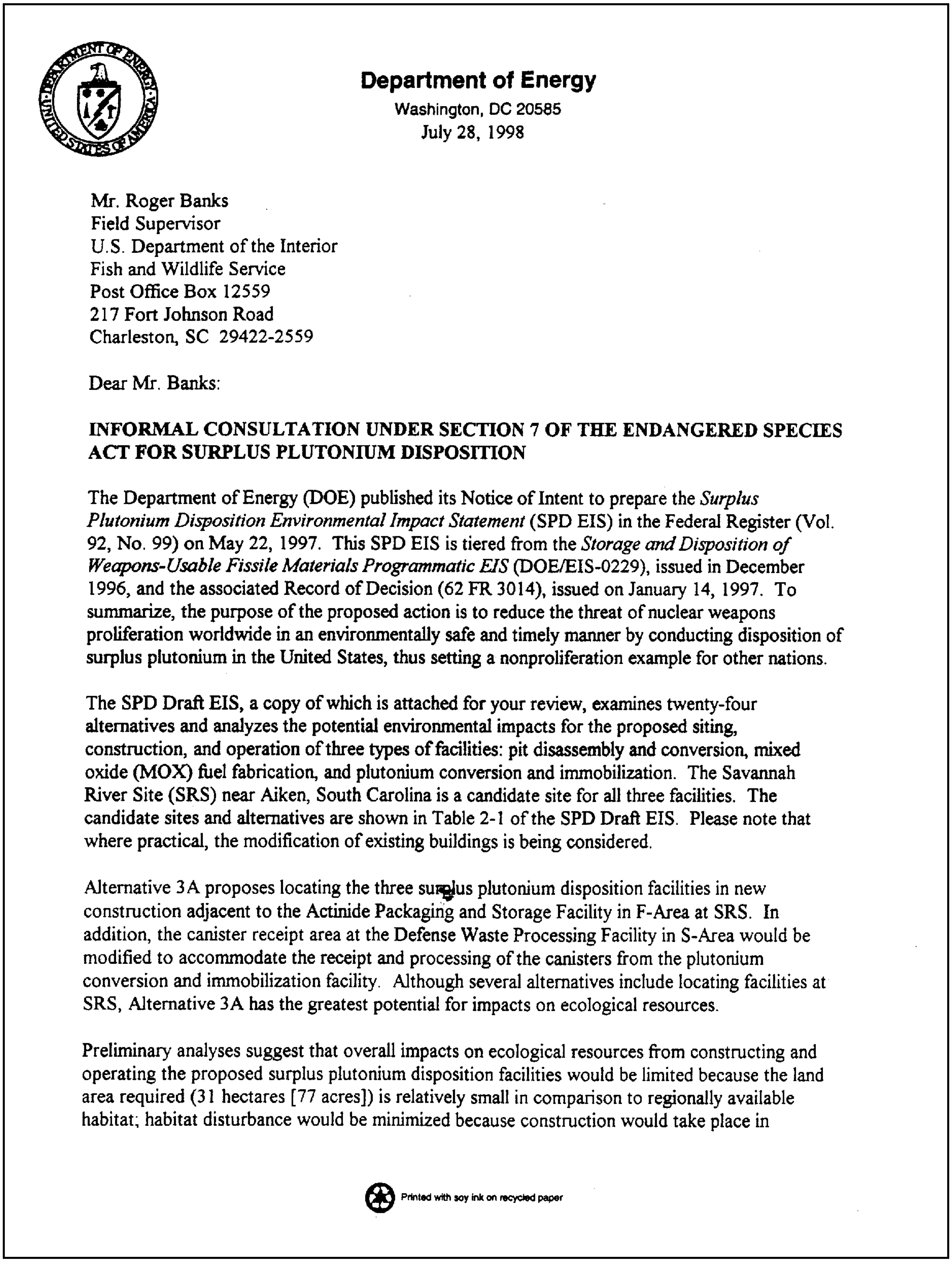
You may also contact A. Ben Gould, Savannah River Site Indian Liaison Officer, at: (803) 725-3969.

Sincerely,

Marcus Jones
SPD EIS Document Manager

cc: A. Ben Gould, SRS
Brandt Petrasek, EM-20, DOE HQ

SPD EIS enclosure



Department of Energy
Washington, DC 20585

July 28, 1998

Mr. Roger Banks
Field Supervisor
U.S. Department of the Interior
Fish and Wildlife Service
Post Office Box 12559
217 Fort Johnson Road
Charleston, SC 29422-2559

Dear Mr. Banks:

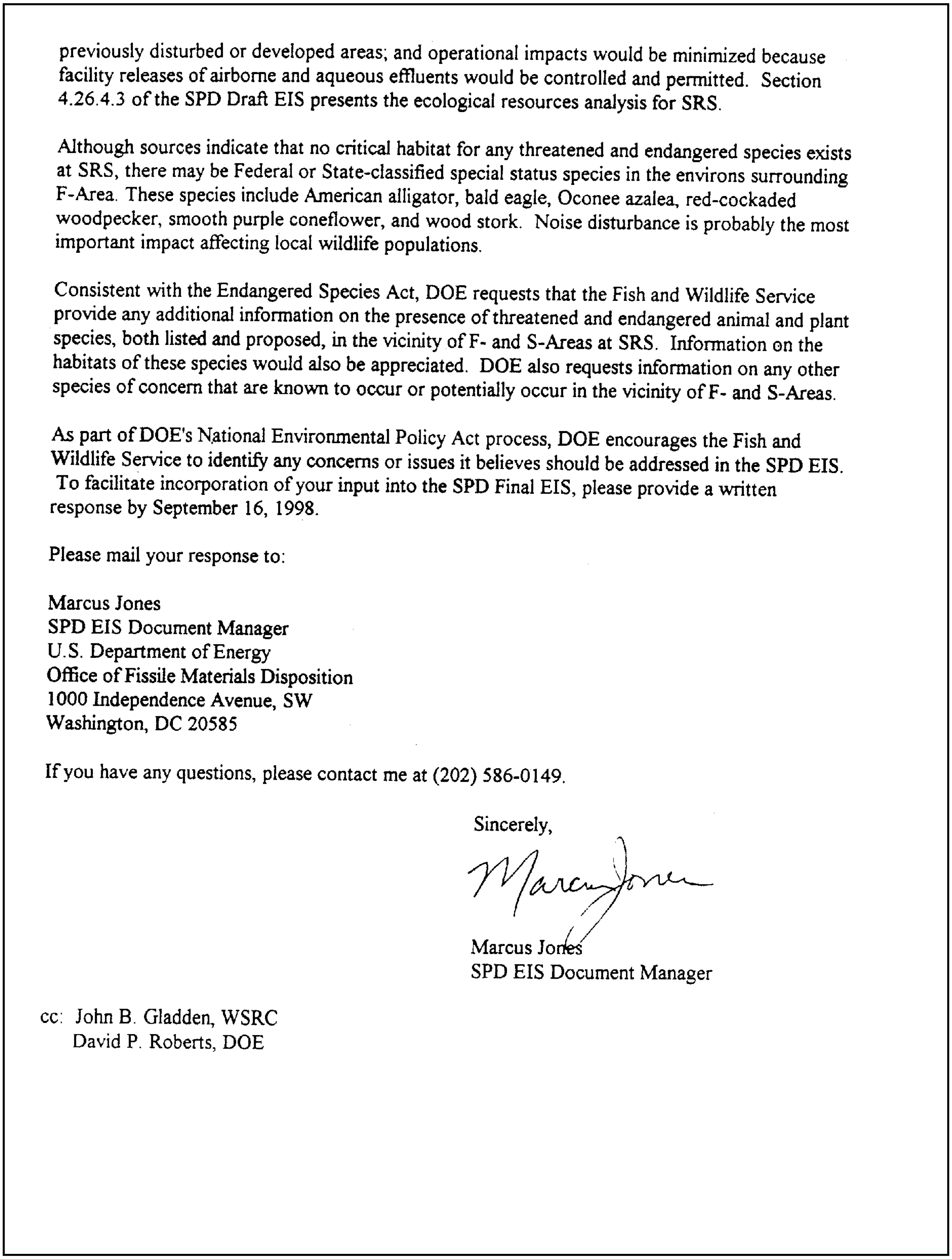
INFORMAL CONSULTATION UNDER SECTION 7 OF THE ENDANGERED SPECIES ACT FOR SURPLUS PLUTONIUM DISPOSITION

The Department of Energy (DOE) published its Notice of Intent to prepare the *Surplus Plutonium Disposition Environmental Impact Statement* (SPD EIS) in the Federal Register (Vol. 92, No. 99) on May 22, 1997. This SPD EIS is tiered from the *Storage and Disposition of Weapons-Usable Fissile Materials Programmatic EIS* (DOE/EIS-0229), issued in December 1996, and the associated Record of Decision (62 FR 3014), issued on January 14, 1997. To summarize, the purpose of the proposed action is to reduce the threat of nuclear weapons proliferation worldwide in an environmentally safe and timely manner by conducting disposition of surplus plutonium in the United States, thus setting a nonproliferation example for other nations.

The SPD Draft EIS, a copy of which is attached for your review, examines twenty-four alternatives and analyzes the potential environmental impacts for the proposed siting, construction, and operation of three types of facilities: pit disassembly and conversion, mixed oxide (MOX) fuel fabrication, and plutonium conversion and immobilization. The Savannah River Site (SRS) near Aiken, South Carolina is a candidate site for all three facilities. The candidate sites and alternatives are shown in Table 2-1 of the SPD Draft EIS. Please note that where practical, the modification of existing buildings is being considered.

Alternative 3A proposes locating the three surplus plutonium disposition facilities in new construction adjacent to the Actinide Packaging and Storage Facility in F-Area at SRS. In addition, the canister receipt area at the Defense Waste Processing Facility in S-Area would be modified to accommodate the receipt and processing of the canisters from the plutonium conversion and immobilization facility. Although several alternatives include locating facilities at SRS, Alternative 3A has the greatest potential for impacts on ecological resources.

Preliminary analyses suggest that overall impacts on ecological resources from constructing and operating the proposed surplus plutonium disposition facilities would be limited because the land area required (31 hectares [77 acres]) is relatively small in comparison to regionally available habitat; habitat disturbance would be minimized because construction would take place in



previously disturbed or developed areas; and operational impacts would be minimized because facility releases of airborne and aqueous effluents would be controlled and permitted. Section 4.26.4.3 of the SPD Draft EIS presents the ecological resources analysis for SRS.

Although sources indicate that no critical habitat for any threatened and endangered species exists at SRS, there may be Federal or State-classified special status species in the environs surrounding F-Area. These species include American alligator, bald eagle, Oconee azalea, red-cockaded woodpecker, smooth purple coneflower, and wood stork. Noise disturbance is probably the most important impact affecting local wildlife populations.

Consistent with the Endangered Species Act, DOE requests that the Fish and Wildlife Service provide any additional information on the presence of threatened and endangered animal and plant species, both listed and proposed, in the vicinity of F- and S-Areas at SRS. Information on the habitats of these species would also be appreciated. DOE also requests information on any other species of concern that are known to occur or potentially occur in the vicinity of F- and S-Areas.

As part of DOE's National Environmental Policy Act process, DOE encourages the Fish and Wildlife Service to identify any concerns or issues it believes should be addressed in the SPD EIS. To facilitate incorporation of your input into the SPD Final EIS, please provide a written response by September 16, 1998.

Please mail your response to:

Marcus Jones
SPD EIS Document Manager
U.S. Department of Energy
Office of Fissile Materials Disposition
1000 Independence Avenue, SW
Washington, DC 20585

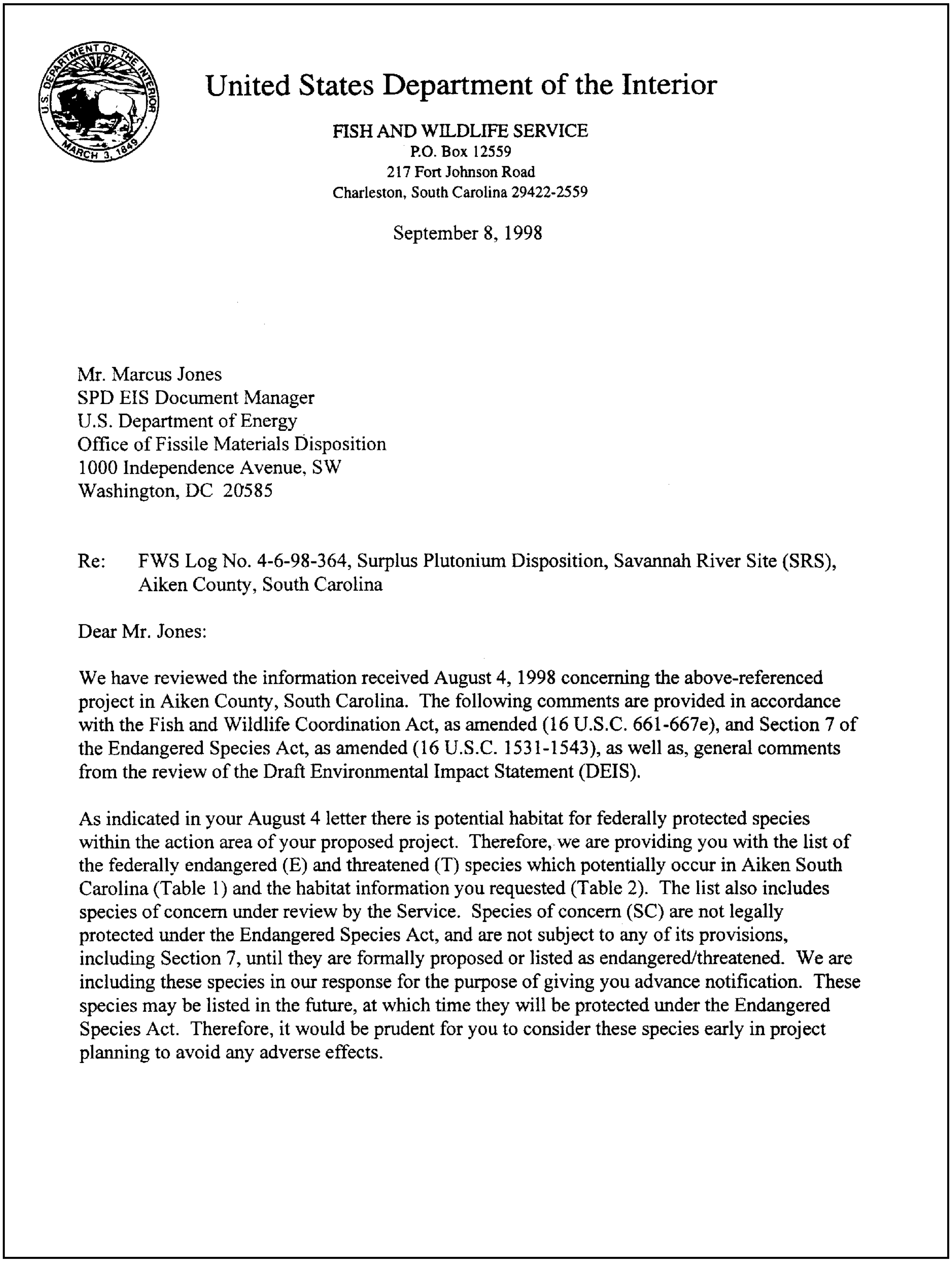
If you have any questions, please contact me at (202) 586-0149.

Sincerely,

Marcus Jones

Marcus Jones
SPD EIS Document Manager

cc: John B. Gladden, WSRC
David P. Roberts, DOE



United States Department of the Interior

FISH AND WILDLIFE SERVICE
P.O. Box 12559
217 Fort Johnson Road
Charleston, South Carolina 29422-2559

September 8, 1998

Mr. Marcus Jones
SPD EIS Document Manager
U.S. Department of Energy
Office of Fissile Materials Disposition
1000 Independence Avenue, SW
Washington, DC 20585

Re: FWS Log No. 4-6-98-364, Surplus Plutonium Disposition, Savannah River Site (SRS), Aiken County, South Carolina

Dear Mr. Jones:

We have reviewed the information received August 4, 1998 concerning the above-referenced project in Aiken County, South Carolina. The following comments are provided in accordance with the Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661-667e), and Section 7 of the Endangered Species Act, as amended (16 U.S.C. 1531-1543), as well as, general comments from the review of the Draft Environmental Impact Statement (DEIS).

As indicated in your August 4 letter there is potential habitat for federally protected species within the action area of your proposed project. Therefore, we are providing you with the list of the federally endangered (E) and threatened (T) species which potentially occur in Aiken South Carolina (Table 1) and the habitat information you requested (Table 2). The list also includes species of concern under review by the Service. Species of concern (SC) are not legally protected under the Endangered Species Act, and are not subject to any of its provisions, including Section 7, until they are formally proposed or listed as endangered/threatened. We are including these species in our response for the purpose of giving you advance notification. These species may be listed in the future, at which time they will be protected under the Endangered Species Act. Therefore, it would be prudent for you to consider these species early in project planning to avoid any adverse effects.

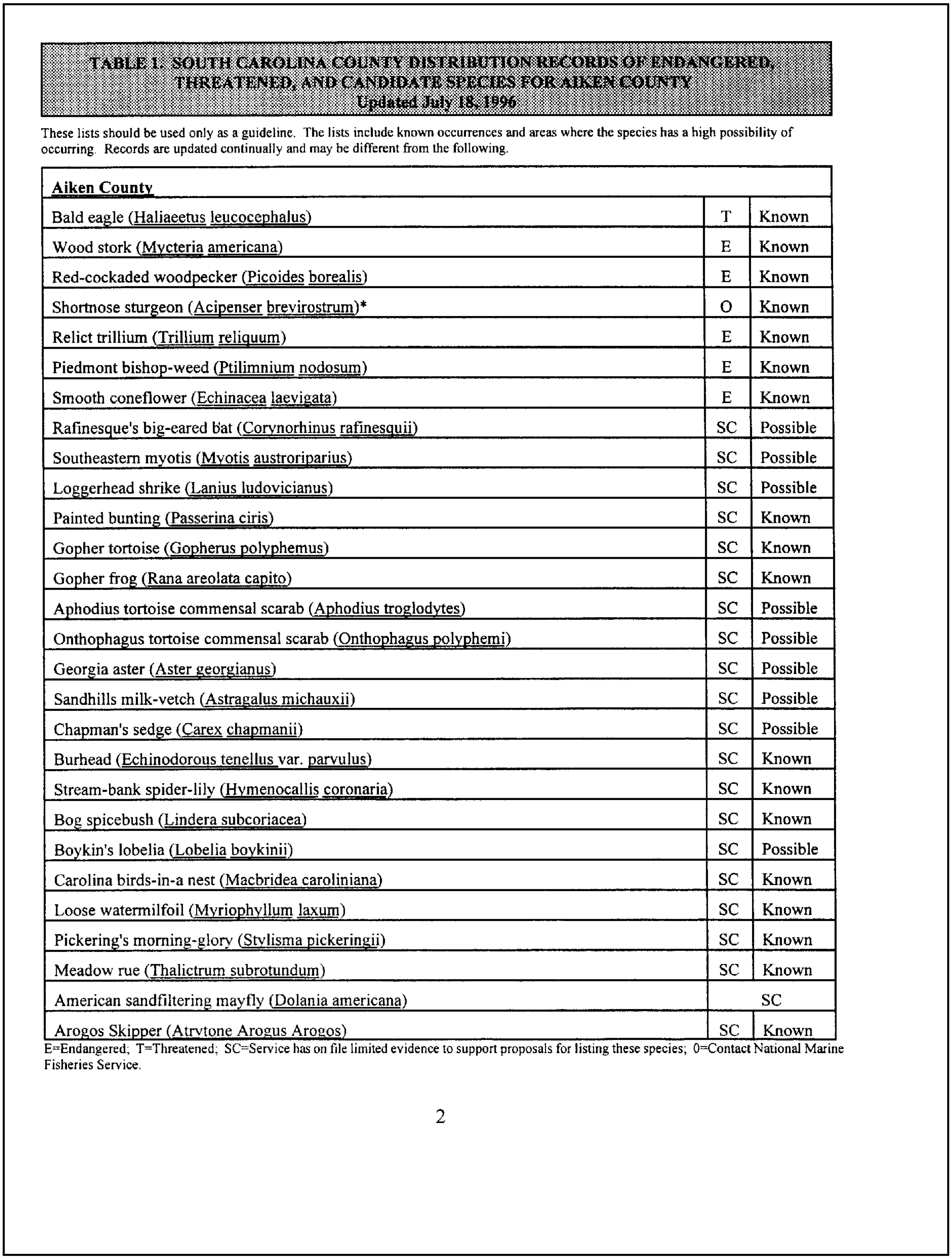
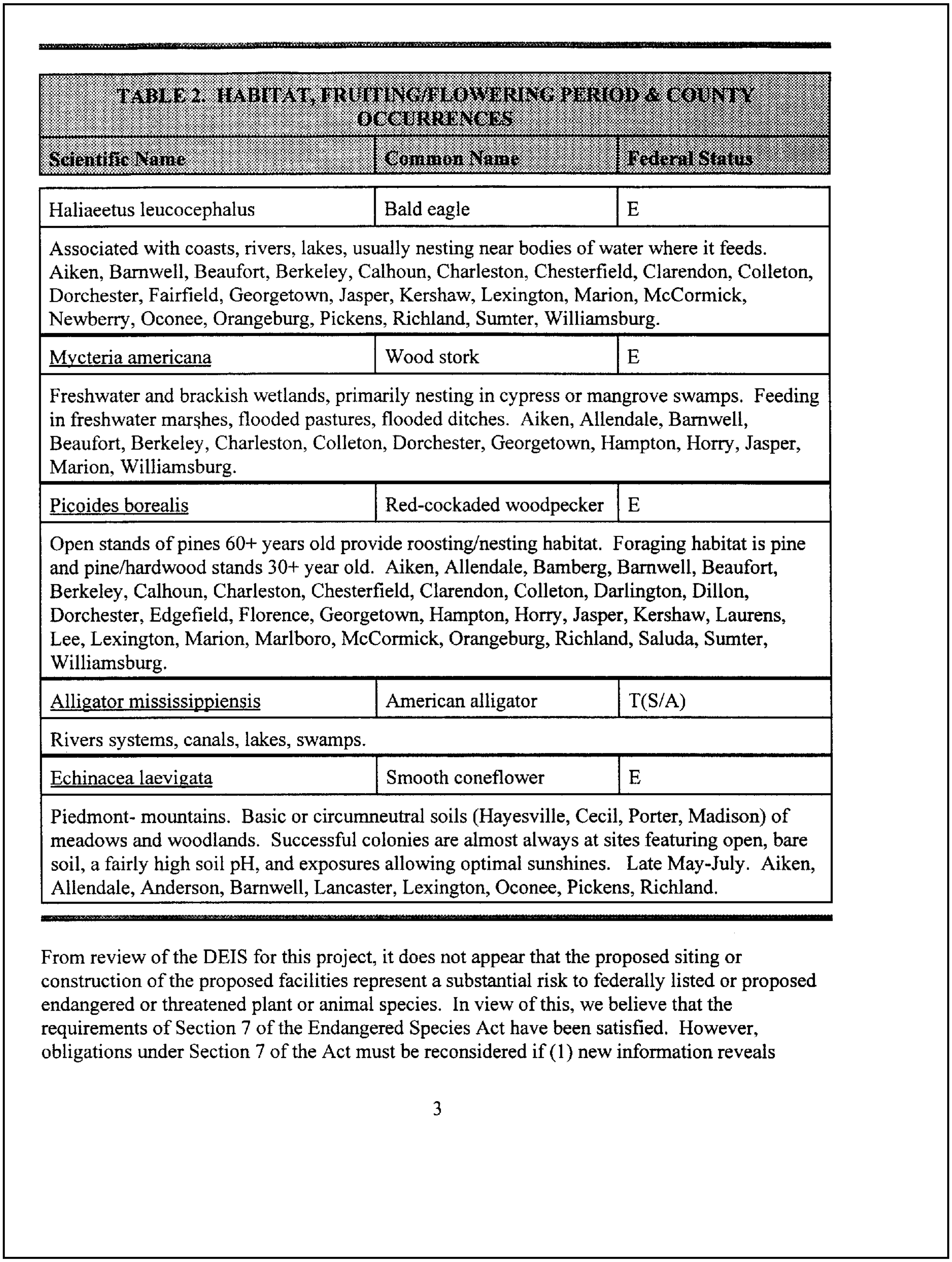


TABLE 1. SOUTH CAROLINA COUNTY DISTRIBUTION RECORDS OF ENDANGERED, THREATENED, AND CANDIDATE SPECIES FOR AIKEN COUNTY
Updated July 18, 1996

These lists should be used only as a guideline. The lists include known occurrences and areas where the species has a high possibility of occurring. Records are updated continually and may be different from the following.

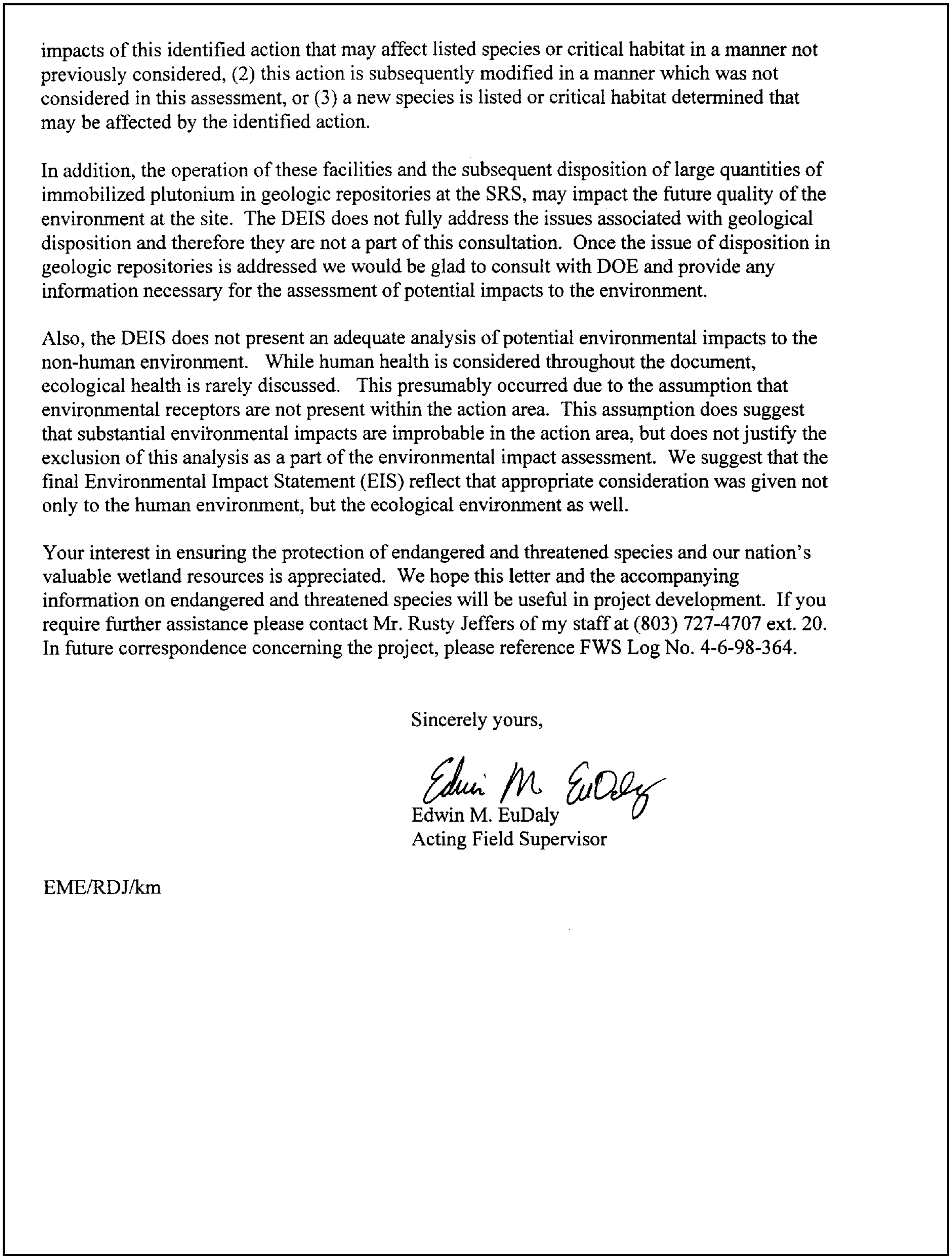
Aiken County		
Bald eagle (Haliaeetus leucocephalus)	T	Known
Wood stork (Mycteria americana)	E	Known
Red-cockaded woodpecker (Picoides borealis)	E	Known
Shortnose sturgeon (Acipenser brevirostrum)*	O	Known
Relict trillium (Trillium reliquum)	E	Known
Piedmont bishop-weed (Ptilimnium nodosum)	E	Known
Smooth coneflower (Echinacea laevigata)	E	Known
Rafinesque's big-eared bat (Corynorhinus rafinesquii)	SC	Possible
Southeastern myotis (Myotis austroriparius)	SC	Possible
Loggerhead shrike (Lanius ludovicianus)	SC	Possible
Painted bunting (Passerina ciris)	SC	Known
Gopher tortoise (Gopherus polyphemus)	SC	Known
Gopher frog (Rana areolata capito)	SC	Known
Aphodius tortoise commensal scarab (Aphodius troglodytes)	SC	Possible
Onthophagus tortoise commensal scarab (Onthophagus polyphemi)	SC	Possible
Georgia aster (Aster georgianus)	SC	Possible
Sandhills milk-vetch (Astragalus michauxii)	SC	Possible
Chapman's sedge (Carex chapmanii)	SC	Possible
Burhead (Echinodorous tenellus var. parvulus)	SC	Known
Stream-bank spider-lily (Hymenocallis coronaria)	SC	Known
Bog spicebush (Lindera subcoriacea)	SC	Known
Boykin's lobelia (Lobelia boykinii)	SC	Possible
Carolina birds-in-a nest (Macbridea caroliniana)	SC	Known
Loose watermilfoil (Myriophyllum laxum)	SC	Known
Pickering's morning-glory (Stylisma pickeringii)	SC	Known
Meadow rue (Thalictrum subrotundum)	SC	Known
American sandfiltering mayfly (Dolania americana)		SC
Arogos Skipper (Atrytone Arogus Arogos)	SC	Known

E=Endangered; T=Threatened; SC=Service has on file limited evidence to support proposals for listing these species; 0=Contact National Marine Fisheries Service.



<table>
<tr><th colspan="3">TABLE 2. HABITAT, FRUITING/FLOWERING PERIOD & COUNTY OCCURRENCES</th></tr>
<tr><th>Scientific Name</th><th>Common Name</th><th>Federal Status</th></tr>
<tr><td>Haliaeetus leucocephalus</td><td>Bald eagle</td><td>E</td></tr>
<tr><td colspan="3">Associated with coasts, rivers, lakes, usually nesting near bodies of water where it feeds. Aiken, Barnwell, Beaufort, Berkeley, Calhoun, Charleston, Chesterfield, Clarendon, Colleton, Dorchester, Fairfield, Georgetown, Jasper, Kershaw, Lexington, Marion, McCormick, Newberry, Oconee, Orangeburg, Pickens, Richland, Sumter, Williamsburg.</td></tr>
<tr><td>Mycteria americana</td><td>Wood stork</td><td>E</td></tr>
<tr><td colspan="3">Freshwater and brackish wetlands, primarily nesting in cypress or mangrove swamps. Feeding in freshwater marshes, flooded pastures, flooded ditches. Aiken, Allendale, Barnwell, Beaufort, Berkeley, Charleston, Colleton, Dorchester, Georgetown, Hampton, Horry, Jasper, Marion, Williamsburg.</td></tr>
<tr><td>Picoides borealis</td><td>Red-cockaded woodpecker</td><td>E</td></tr>
<tr><td colspan="3">Open stands of pines 60+ years old provide roosting/nesting habitat. Foraging habitat is pine and pine/hardwood stands 30+ year old. Aiken, Allendale, Bamberg, Barnwell, Beaufort, Berkeley, Calhoun, Charleston, Chesterfield, Clarendon, Colleton, Darlington, Dillon, Dorchester, Edgefield, Florence, Georgetown, Hampton, Horry, Jasper, Kershaw, Laurens, Lee, Lexington, Marion, Marlboro, McCormick, Orangeburg, Richland, Saluda, Sumter, Williamsburg.</td></tr>
<tr><td>Alligator mississippiensis</td><td>American alligator</td><td>T(S/A)</td></tr>
<tr><td colspan="3">Rivers systems, canals, lakes, swamps.</td></tr>
<tr><td>Echinacea laevigata</td><td>Smooth coneflower</td><td>E</td></tr>
<tr><td colspan="3">Piedmont- mountains. Basic or circumneutral soils (Hayesville, Cecil, Porter, Madison) of meadows and woodlands. Successful colonies are almost always at sites featuring open, bare soil, a fairly high soil pH, and exposures allowing optimal sunshines. Late May-July. Aiken, Allendale, Anderson, Barnwell, Lancaster, Lexington, Oconee, Pickens, Richland.</td></tr>
</table>

From review of the DEIS for this project, it does not appear that the proposed siting or construction of the proposed facilities represent a substantial risk to federally listed or proposed endangered or threatened plant or animal species. In view of this, we believe that the requirements of Section 7 of the Endangered Species Act have been satisfied. However, obligations under Section 7 of the Act must be reconsidered if (1) new information reveals



impacts of this identified action that may affect listed species or critical habitat in a manner not previously considered, (2) this action is subsequently modified in a manner which was not considered in this assessment, or (3) a new species is listed or critical habitat determined that may be affected by the identified action.

In addition, the operation of these facilities and the subsequent disposition of large quantities of immobilized plutonium in geologic repositories at the SRS, may impact the future quality of the environment at the site. The DEIS does not fully address the issues associated with geological disposition and therefore they are not a part of this consultation. Once the issue of disposition in geologic repositories is addressed we would be glad to consult with DOE and provide any information necessary for the assessment of potential impacts to the environment.

Also, the DEIS does not present an adequate analysis of potential environmental impacts to the non-human environment. While human health is considered throughout the document, ecological health is rarely discussed. This presumably occurred due to the assumption that environmental receptors are not present within the action area. This assumption does suggest that substantial environmental impacts are improbable in the action area, but does not justify the exclusion of this analysis as a part of the environmental impact assessment. We suggest that the final Environmental Impact Statement (EIS) reflect that appropriate consideration was given not only to the human environment, but the ecological environment as well.

Your interest in ensuring the protection of endangered and threatened species and our nation's valuable wetland resources is appreciated. We hope this letter and the accompanying information on endangered and threatened species will be useful in project development. If you require further assistance please contact Mr. Rusty Jeffers of my staff at (803) 727-4707 ext. 20. In future correspondence concerning the project, please reference FWS Log No. 4-6-98-364.

Sincerely yours,

Edwin M. EuDaly

Edwin M. EuDaly
Acting Field Supervisor

EME/RDJ/km

Department of Energy
Washington, DC 20585

July 28, 1998

Mr. Tom Murphy
South Carolina Department of Natural Resources
Lower Coastal Wildlife Diversity
585 Donnelley Drive
Green Pond, SC 29446

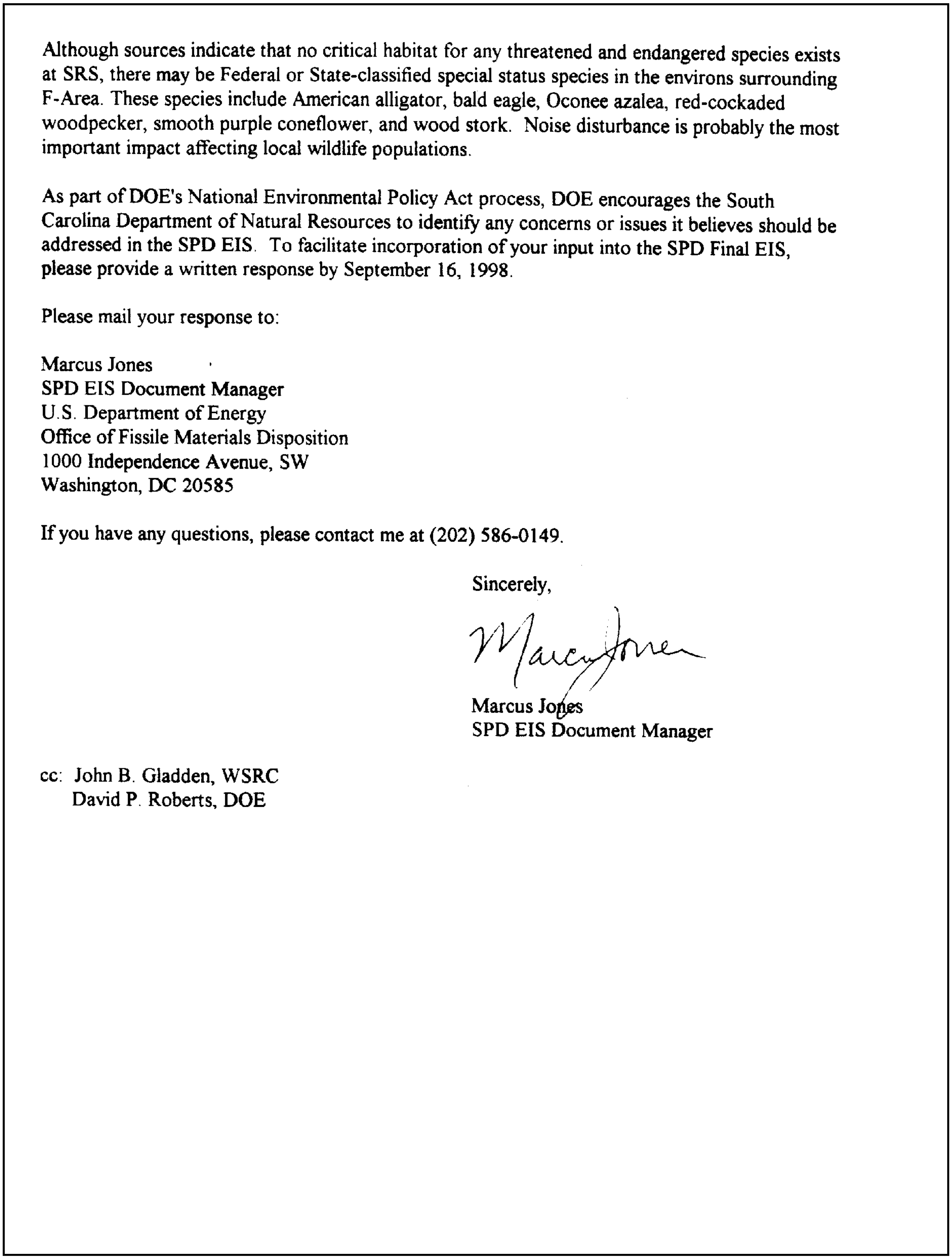
Dear Mr. Murphy:

The Department of Energy (DOE) published its Notice of Intent to prepare the *Surplus Plutonium Disposition Environmental Impact Statement* (SPD EIS) in the Federal Register (Vol. 92, No. 99) on May 22, 1997. This SPD EIS is tiered from the *Storage and Disposition of Weapons-Usable Fissile Materials Programmatic EIS* (DOE/EIS-0229), issued in December 1996, and the associated Record of Decision (62 FR 3014), issued on January 14, 1997. To summarize, the purpose of the proposed action is to reduce the threat of nuclear weapons proliferation worldwide in an environmentally safe and timely manner by conducting disposition of surplus plutonium in the United States, thus setting a nonproliferation example for other nations.

The SPD Draft EIS, a copy of which is attached for your review, examines twenty-four alternatives and analyzes the potential environmental impacts for the proposed siting, construction, and operation of three types of facilities: pit disassembly and conversion, mixed oxide (MOX) fuel fabrication, and plutonium conversion and immobilization. The Savannah River Site (SRS) near Aiken, South Carolina is a candidate site for all three facilities. The candidate sites and alternatives are shown in Table 2-1 of the SPD Draft EIS. Please note that where practical, the modification of existing buildings is being considered.

Alternative 3A proposes locating the three surplus plutonium disposition facilities in new construction adjacent to the Actinide Packaging and Storage Facility in F-Area at SRS. In addition, the canister receipt area at the Defense Waste Processing Facility in S-Area would be modified to accommodate the receipt and processing of the canisters from the plutonium conversion and immobilization facility. Although several alternatives include locating facilities at SRS, Alternative 3A has the greatest potential for impacts on ecological resources.

Preliminary analyses suggest that overall impacts on ecological resources from constructing and operating the proposed surplus plutonium disposition facilities would be limited because the land area required (31 hectares [77 acres]) is relatively small in comparison to regionally available habitat; habitat disturbance would be minimized because construction would take place in previously disturbed or developed areas; and operational impacts would be minimized because facility releases of airborne and aqueous effluents would be controlled and permitted. Section 4.26.4.3 of the SPD Draft EIS presents the ecological resources analysis for SRS.



Although sources indicate that no critical habitat for any threatened and endangered species exists at SRS, there may be Federal or State-classified special status species in the environs surrounding F-Area. These species include American alligator, bald eagle, Oconee azalea, red-cockaded woodpecker, smooth purple coneflower, and wood stork. Noise disturbance is probably the most important impact affecting local wildlife populations.

As part of DOE's National Environmental Policy Act process, DOE encourages the South Carolina Department of Natural Resources to identify any concerns or issues it believes should be addressed in the SPD EIS. To facilitate incorporation of your input into the SPD Final EIS, please provide a written response by September 16, 1998.

Please mail your response to:

Marcus Jones
SPD EIS Document Manager
U.S. Department of Energy
Office of Fissile Materials Disposition
1000 Independence Avenue, SW
Washington, DC 20585

If you have any questions, please contact me at (202) 586-0149.

Sincerely,

Marcus Jones

Marcus Jones
SPD EIS Document Manager

cc: John B. Gladden, WSRC
David P. Roberts, DOE

Appendix P
Environmental Synopsis

ENVIRONMENTAL SYNOPSIS
OF INFORMATION PROVIDED IN RESPONSE TO
THE REQUEST FOR PROPOSALS FOR
MOX FUEL FABRICATION AND REACTOR IRRADIATION SERVICES

April 1999

1.0 INTRODUCTION

In the aftermath of the Cold War, significant quantities of weapons-usable fissile materials (primarily plutonium and highly enriched uranium) have become surplus to national defense needs both in the United States and Russia. President Clinton announced, on September 27, 1993, the establishment of a framework for United States efforts to prevent the proliferation of weapons of mass destruction. As key elements of the President's policy, the United States will:

X Seek to eliminate, where possible, accumulation of stockpiles of highly enriched uranium and plutonium,
X Ensure that where these materials already exist, they are subject to the highest standards of safety, security, and international accountability, and
X Initiate a comprehensive review of long-term options for plutonium disposition, taking into account technical, nonproliferation, environmental, budgetary, and economic considerations.

In January 1994, President Clinton and Russian President Yeltsin agreed that the proliferation of weapons of mass destruction and their delivery systems represent an acute threat to international security. They declared that both Nations would cooperate actively and closely with each other, and also with other interested nations, for the purpose of preventing and reducing this threat.

The Secretary of Energy and the Congress took action in October 1994 to create a permanent Office of Fissile Materials Disposition (MD) within the Department of Energy (DOE) to focus on the important national security objective of eliminating surplus weapons-usable fissile materials. As one of its major responsibilities, MD is tasked with determining how to disposition surplus weapons-usable plutonium. In January 1997, DOE issued a Record of Decision (ROD) for the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement* (S&D PEIS)[1]. In that decision document, DOE decided to pursue a strategy that would allow for the possibility of both the immobilization of surplus plutonium and the use of surplus plutonium as mixed oxide (MOX) fuel in existing domestic, commercial reactors. In July, 1998, DOE issued the *Draft Surplus Plutonium Disposition Environmental Impact Statement* (SPD Draft EIS)[2] which analyzes sites for plutonium disposition activities and plutonium disposition technologies to support this strategy.

To support the timely undertaking of the surplus plutonium disposition program, DOE initiated a procurement action to contract for fuel fabrication and reactor irradiation services. On May 19, 1998, DOE issued a Request for Proposals (RFP) for these services (Solicitation Number DE-RP02-

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[1] DOE/EIS-0229; December 1996
[2] DOE/EIS-0283D; July 1998

98CH10888). The services requested in this procurement process include design, licensing, construction, operation, and eventual decontamination and decommissioning of a MOX facility as well as irradiation of the MOX fuel in existing domestic, commercial reactors should the decision be made by DOE in the SPD EIS ROD to go forward with the MOX program.

In accordance with DOE's National Environmental Policy Act (NEPA) regulations (10 CFR 1021.216), DOE required offerors to submit reasonably available environmental data and analyses as a part of their proposals. DOE independently evaluated and verified the accuracy of the data provided by the offeror in the competitive range, and prepared and considered an Environmental Critique before the procurement selection was made.

As required by Section 216, the Environmental Critique included a discussion of the purpose of the procurement; the salient characteristics of the offeror's proposal; any licenses, permits or approvals needed to support the program; and an evaluation of the potential environmental impacts of the offer. In March 1999, after considering the Environmental Critique, DOE awarded a contract for MOX fuel fabrication and reactor irradiation services. Under this contract, MOX fuel would be fabricated at a DOE site to be selected in the SPD EIS ROD and then irradiated in six domestic commercial nuclear reactors at three commercial reactor sites. Additionally, under the contract only limited activities may be performed prior to issuance of the SPD EIS ROD. These activities include non-site-specific work primarily associated with the development of the initial conceptual design for the fuel fabrication facility, and plans (paper studies) for outreach, long lead-time procurements, regulatory management, facility quality assurance, safeguards, security, fuel qualifications, and deactivation. There would be no construction started on a MOX fuel fabrication facility until the SPD EIS ROD is issued. The MOX facility, if built, would be government-owned, licensed by the Nuclear Regulatory Commission (NRC), and located at one of four candidate DOE sites.

This Synopsis is based on the Environmental Critique and provides a publicly available assessment of the potential environmental impacts associated with the proposal based on an independent review of the representations and data contained in the proposal. The Synopsis serves as a record that DOE has considered the environmental factors and potential consequences of the reasonable alternatives analyzed during the selection process. The Synopsis will be filed with the U.S. Environmental Protection Agency and made publicly available. The Synopsis will also be incorporated into a Supplement to the SPD Draft EIS, which is to be issued in the near future.

2.0 ASSESSMENT METHODS

The analyses in this Synopsis (and in the Environmental Critique) were performed using information submitted by the offeror in the competitive range, independently developed information, publicly available information, and standard computer models and techniques.

In order to evaluate the reasonableness of the offeror's projected environmental impacts compared to those projected by DOE, the offeror's data for the MOX facility was compared to information in the SPD Draft EIS; for the use of MOX fuel in domestic commercial reactors, the offeror's data was compared to information in the S&D PEIS.[3]

Data developed independently to support these analyses include the projection of populations around the proposed reactor sites[4] and information related to the topography surrounding the proposed reactor sites for evaluating air dispersal patterns. Information was also provided by Oak Ridge National Laboratory (ORNL) on the expected ratio of radionuclide activities in MOX fuel compared to that in low enriched uranium (LEU) fuel for use in reactor accident analyses. Standard models for determining radiation doses from normal operations and accident scenarios, and air pollutant concentrations at the proposed disposition facility sites and reactors were run using data provided by the offeror. Reactor accident analyses assumed a 40 percent MOX core because this is a conservative estimate of the amount of MOX fuel that would be used in each of the reactors. The environmental analyses were prepared using the following computer models: GENII for estimating radiation doses to the public from normal operation of the MOX fuel fabrication facility and the proposed reactors; MACCS2 for design-basis and beyond-design-basis accident analyses at the proposed reactors; and ISC3 and SCREEN3 for estimated air pollutant concentrations as a result of normal MOX facility and reactor operations.

3.0 DESCRIPTION OF THE OFFER

The offeror has proposed to build a MOX facility on a DOE site[5] with subsequent irradiation services being provided in six existing reactors at three commercial nuclear power plants in the Eastern United States.

The proposed MOX facility design, which is based on an existing MOX facility in France, will be modified to meet U.S. regulations. Under the proposed design, plutonium dioxide powder would be received from DOE’s proposed pit disassembly and conversion facility. The plutonium dioxide would be aqueously processed (polished) to ensure that it meets the agreed-to fuel specification for MOX fuel. Following the polishing step, the plutonium in solution would then be converted back into plutonium dioxide. At that point, the process proposed by the offeror would be similar to that described in Chapter 2 of the SPD Draft EIS[6]. The plutonium dioxide would be mixed with uranium dioxide and formed into MOX fuel pellets.

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[3] Such information is also summarized in the SPD Draft EIS.

[4] Population projections for the area encompassed in a 50-mile radius around the proposed reactor sites were projected to 2015 to approximate the mid-point of the irradiation services program. By 2015, the MOX program would be firmly established at all of the proposed reactor sites and would be expected to remain stable through the end of the program. Using 1990 census data as the base year and state-provided population increase factors for all counties included in this analysis, the population around the sites was projected for 2015. Baseline projections were needed for two of the reactor sites because the population information provided in the proposal was based on 1970 census data. Recent (i.e., 1990) census data were provided for the other proposed site and projected by the offeror to the years 2010 and 2020. From these data points, 2015 projections were interpolated.

[5] This site would be selected in the SPD EIS ROD. As explained in the SPD Draft EIS, DOE’s preference is to locate the MOX fuel fabrication plant at DOE’s Savannah River site.

[6] The SPD Draft EIS also included evaluation of an aqueous processing facility in Appendix N, that could be added to either the pit conversion or the MOX facility. Based on public comments received and information presented by the offeror subsequent to the release of the SPD Draft EIS, DOE is now considering whether to add the aqueous polishing process to the front end of the MOX facility. The environmental impacts associated with this option will be presented in Chapter 4 of the SPD Final EIS.

These pellets would be baked at high temperature, ground to exact dimensions, then loaded into fuel rods. The MOX fuel rods would then be bundled with standard LEU fuel rods to form MOX fuel assemblies. The MOX fuel assemblies would be shipped to the proposed reactor sites in DOE-provided safe, secure transport vehicles on a near just-in-time basis to minimize the amount of time the fresh MOX fuel would be stored at a reactor site prior to loading into the reactor.

Three sites, each with two operating pressurized light water reactors (PWRs), have been proposed for MOX fuel irradiation. The proposed sites are: the Catawba nuclear generation station near York, South Carolina; the McGuire nuclear generation station near Huntersville, North Carolina; and the North Anna nuclear generation station near Mineral, Virginia. All of these sites have been operating safely for a number of years. Table 1 provides some general information about each of the proposed plants.

Table 1. Reactor Plant Operating Information

Plant	Operator	Capacity (net MWe)	Date of First Operation (mo/yr)
Catawba No. 1	Duke Power Co.	1,129	01/85
Catawba No. 2	Duke Power Co.	1,129	05/86
McGuire No. 1	Duke Power Co.	1,129	07/81
McGuire No. 2	Duke Power Co.	1,129	05/83
North Anna No. 1	Virginia Power Co.	900	04/78
North Anna No. 2	Virginia Power Co.	887	08/80

Table 2 shows the results of the most recent Systematic Assessment of Licensee Performance performed by NRC for each of the proposed reactors. As can be seen in this table, all the proposed reactors have been operated and maintained in a safe manner.

Table 2. Systematic Assessment of Licensee Performance Results

	Catawba	McGuire	North Anna
Date of Latest SALP	06/97	04/97	02/97
Operations	Superior	Superior	Superior
Maintenance	Good	Good	Superior
Engineering	Superior	Good	Good
Plant Support	Superior	Superior	Superior

As proposed by the offeror, both MOX and LEU fuel assemblies would be loaded into the reactor. The MOX fuel assemblies are scheduled to remain in the core for two 18-month cycles and the LEU assemblies for either two or three cycles. After completing a normal (full) fuel cycle, the spent MOX fuel assemblies would be removed from the reactor in accordance with the plant's standard refueling procedures and placed in the plant's spent fuel pool for cooling along with other spent fuel. The offeror has stated that no changes are expected in the plant's spent fuel storage plans to accommodate the spent MOX fuel. Eventually, the fuel would be shipped to a potential geologic repository to be developed by DOE for permanent disposal of commercial spent fuel.

4.0 ENVIRONMENTAL IMPACTS

Human health risk, waste management, land use, infrastructure requirements, accidents, air quality, water quality, and socioeconomics have been evaluated in this Synopsis. Cultural, paleontological and ecological resources, and transportation requirements are not expected to be impacted other than as discussed in the SPD Draft EIS and were not evaluated in this Synopsis. Although four sites are being considered by DOE for the proposed MOX facility, this Environmental Synopsis focuses primarily on environmental impacts at DOE's Savannah River Site (SRS) for the potential MOX facility because, as stated in Section 1.6 of the SPD Draft EIS, it is DOE's preferred location for the MOX facility. However, this Synopsis also discusses non-radiological impacts at other potential MOX facility sites, where appropriate. Unless otherwise noted, impacts would likely be similar at other sites.

4.1 MOX Fuel Fabrication Facility

4.1.1 Human Health Risk

The annual radiological dose from normal operations to the general population residing within 50 miles of the proposed MOX facility at the preferred site, SRS, was calculated based on radiological emissions estimated by the offeror. The major contributor to this dose would be attributable to the offeror's estimated annual release of 0.25 mg of plutonium.[7] In contrast to the "atmospheric release only" assumption presented in the SPD Draft EIS, the MOX facility data provided by the offeror includes both liquid and airborne releases because the proposed process includes some aqueous processing. Table 3 shows the projected radiological dose that would be received by the general population as a result of normal operations of the MOX facility proposed by the offeror.

The average individual living within 50 miles of the SRS site would be expected to receive an annual dose of $2.3\text{x}10^{-4}$ mrem/yr from normal operation of the MOX facility. The maximally exposed individual (MEI) would be expected to receive an annual dose of $3.7\text{x}10^{-3}$ mrem/yr from operation of the MOX facility at SRS. This dose is well below regulatory limits, which require doses resulting from DOE operations to be below 10 mrem/yr from airborne pathways, 4 mrem/yr from drinking water pathways, and 100 mrem/yr from all pathways combined. The additional dose to the general population would also be small in comparison with the average dose received from other SRS activities. For example, in 1997, the average individual living within 50 miles of SRS received a dose of $1.4\text{x}10^{-2}$ mrem/yr from site activities. (SPD Draft EIS, pg. 3-141)

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[7] The isotopic distribution of the potential plutonium releases were modeled based on the isotopic distribution developed by Los Alamos National Laboratory for use in the SPD Draft EIS.

Table 3. Estimated Radiological Impacts on the Public from Operations of the MOX Facility at SRS

	Maximally Exposed Ind. (mrem/yr)	Latent Fatal Cancer Risk from 10 Year Operating Life	Est. Dose to Pop. within 50 mi. radius (person-rem/yr)	Latent Fatal Cancers from 10 Year Operating Life	Avg. Dose to Ind. within 50 mi. radius (mrem/yr)	Latent Fatal Cancer Risk from 10 Year Operating Life
Offeror	$3.7x10^{-3}$	$1.9x10^{-8}$	0.181	$9.1x10^{-4}$	$2.3x10^{-4}$	$1.2x10^{-9}$
SPD Draft EIS*	$3.1x10^{-4}$	$1.6x10^{-9}$	0.029	$1.5x10^{-4}$	$3.7x10^{-5}$	$1.9x10^{-10}$
SRS Base**	0.2	$1.0x10^{-6}$	8.6	$4.3x10^{-2}$	$1.4x10^{-2}$	$7.0x10^{-8}$

* Includes contributions from polishing process discussed in Appendix N in addition to those shown in Chapter 4.
** SPD Draft EIS pg. 3-141

Table 4 shows the potential radiological impacts on involved workers at the proposed MOX facility conservatively calculated from 1997 data from the offeror's European operating facility. As shown in Table 4, the average radiation worker at the offeror's proposed MOX facility would receive an annual dose of 65 mrem/yr from normal operations. The offeror has stated that in 1997 the maximum dose to an individual worker at the offeror's MOX facility was 885 mrem, well below the DOE administrative control level of 2,000 mrem/yr and the Federal regulatory limit of 5,000 mrem/yr. The offeror also estimates that fewer radiation workers would be needed to operate the MOX facility than indicated in the SPD Draft EIS. The offeror estimates that approximately 330 radiation workers would be required, rather than the 410 estimated in the SPD Draft EIS.[8]

Table 4. Potential Radiological Impacts on Involved Workers from Operations of the MOX Facility

	No. of Radiation Workers	Average Worker Dose (mrem/yr)	Latent Fatal Cancer Risk from 10 Years of Operation	Total Dose to Workers (person-rem/yr)	Latent Fatal Cancers from 10 Years of Operations
Offeror	330	65	$2.6x10^{-4}$	22	0.088
SPD Draft EIS*	410	500	$2.0x10^{-3}$	205	0.82
SRS Base**	12,500	19	$7.6x10^{-5}$	237	0.95

* Includes contributions from polishing process discussed in Appendix N in addition to the doses shown in Chapter 4.
** SPD Draft EIS pg. 3-142.

4.1.2 Accidents

Design-basis and beyond-design-basis accidents were evaluated in the SPD Draft EIS for the MOX facility and the aqueous plutonium polishing process. Accidents evaluated for the MOX facility included a criticality, fires, and earthquakes. A spill, an uncontrolled reaction resulting in an explosion, a criticality, and an earthquake were evaluated for the plutonium polishing process. Any of these accidents could occur

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[8] Although it is estimated that about 385 personnel would be required to operate the facility, only about 330 of the 385 would be considered radiation workers.

in the proposed MOX facility since it would use similar processes.

Including the plutonium polishing process in the MOX facility as proposed by the offeror would make a criticality the bounding design-basis accident for the facility. As shown in Table 5, no major radiological impacts to the general population would be expected from design-basis accidents at the proposed MOX facility. The frequency of this accident, a criticality in solution, is estimated to be between 1 in 10,000 and 1 in 1,000,000 per year.

The bounding beyond-design-basis accident would be an earthquake of sufficient magnitude to collapse the MOX facility. An earthquake of this magnitude would be expected to result in major radiological impacts. However, an earthquake of this magnitude would also be expected to result in widespread damage across the site and throughout the surrounding area. The frequency of an earthquake of this magnitude is estimated to be between 1 in 100,000 and 1 in 10,000,000 per year. Table 5 shows the impact of this accident on SRS. At the other candidate sites, the estimated dose to the general population from this accident would range from $2.0H10^{3}$ to $5.7H10^{4}$ with the corresponding number of LCFs expected to range from 1.0 to 28 LCFs. The maximum dose to a person at the site boundary at the time of the accident would be expected to range from 16 to 25 rem with a corresponding risk of latent cancer fatality of $8.0H10^{-3}$ to $1.2H10^{-2}$. A noninvolved worker would be exposed to a dose in the range of $2.2H10^{2}$ to $6.4H10^{2}$ rem with a corresponding risk of latent cancer fatality of $8.8H10^{-2}$ to $2.3H10^{-1}$.

Table 5. Bounding Accidents for the Proposed MOX Facility

	Noninvolved Worker (rem)	Probability of Cancer Fatality per Accident	Estimated Dose at Site Boundary (rem)	Probability of Cancer Fatality per Accident	Estimated Dose to Pop. Within 50 mi. radius (person-rem)	Latent Cancer Fatalities per Accident
Criticality at SRS*	$3.0x10^{-1}$	$1.2x10^{-4}$	$1.6x10^{-2}$	$8.0x10^{-6}$	$1.6x10^{1}$	$8.0x10^{-3}$
Beyond-design-basis earthquake**	$2.2x10^{2}$	$8.8x10^{-2}$	8.9	$4.5x10^{-3}$	$2.1x10^{4}$	10.6

*SPD Draft EIS pg. N-15
**SPD Draft EIS pgs. K-50 and N-15

No major consequences for the maximally exposed involved worker would be expected from leaks, spills, and smaller fires. These accidents are such that involved workers would be able to evacuate immediately or would not be affected by the events. However, explosions could result in immediate injuries from flying debris, as well as the uptake of plutonium and uranium particulates through inhalation. If a criticality were to occur, workers within tens of meters could receive very high to fatal radiation exposures from the initial neutron burst. The dose would strongly depend on the magnitude of the criticality (number of fissions), the distance from the criticality, and the amount of shielding provided by the structures and equipment between the workers and the criticality. Earthquakes could also result in substantial consequences to workers, ranging from workers being killed by collapsing equipment and structures to high radiation exposures and uptakes of radionuclides. For all but the most severe accidents, immediate emergency response actions should reduce the magnitude of the consequences to workers near the accident.

4.1.3 Waste Management

The MOX facility would be expected to produce TRU waste, low-level radioactive waste (LLW), mixed LLW, hazardous waste and sanitary waste in the course of its normal operations. As shown in Table 6, the offeror's estimated generation rates for radioactive wastes are consistent with those estimated in the SPD Draft EIS. None of these estimates is expected to impact the proposed sites in terms of their ability to handle these wastes. The ability to store, treat, and/or dispose of radioactive waste is limited at Pantex. If Pantex were chosen as the site for the MOX facility, the wastes would presumably be handled as discussed in the SPD Draft EIS. TRU waste would have to be stored in the MOX facility until it could be shipped to the Waste Isolation Pilot Plant (WIPP) for permanent disposal. Mixed LLW would be handled in the same manner as current mixed waste that is shipped offsite for treatment and disposal. LLW would be treated and stored onsite until shipped to the Nevada Test Site or a commercial facility for disposal.[9]

Table 6. Estimated Annual Waste Generation Rates

	TRU Waste	Mixed LLW	LLW	Hazardous Waste	Sanitary Waste
Offeror					
Liquid (l/yr)	500	0	300	1,200	11 million
Solid (m^3/yr)	~67	3	94	0.1	150
SPD Draft EIS*					
Liquid (l/yr)	0.5	0.1 l	0.3	1,740	18 million
Solid (m^3/yr)	~67	3	94	1.2	440
SRS Generation Rate**					
Liquid (l/yr)	na	na	na	Na	416 million
Solid (m^3/yr)	431	1,135	10,043	74	6,670

na – not available

*Includes contributions from the polishing process discussed in Appendix N of the SPD Draft EIS, in addition to the wastes shown in Chapter 4.

**SPD Draft EIS pg. 3-130.

4.1.4 Land Use

It is estimated that a total of 6.2 hectares (15.3 acres) would be needed for the MOX facility. This estimate includes 1.0 hectares (2.5 acres) for the process building, 0.2 hectares (0.58 acres) for support facilities, and 5 hectares (12.4 acres) for parking and a security buffer. This is very close to the 6.0 hectares (14.9 acres) estimated in the SPD Draft EIS (pg. E-10). As indicated in the SPD Draft EIS, there is sufficient space available to accommodate the proposed MOX facility at any of the candidate sites.

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[9] DOE would ensure that any such disposal would be consistent with the RODs for the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste*, DOE/EIS-0200F, May 1997.

4.1.5 Infrastructure Requirements

The proposed MOX facility would use electricity, natural gas, water, and fuel oil. As shown in Table 7, the offeror's proposed facility would use more of these materials than estimated in the SPD Draft EIS.

Table 7. Estimated MOX Facility Infrastructure Requirements

	Electricity (MWh/yr)	Natural Gas (m^3/yr)	Water (10^6 l/yr)	Fuel Oil (l/yr)
Offeror	30,000	1,070,000	68	63,000
SPD Draft EIS*	17,520	920,000	44	43,000
SRS F-Area Available Capacity**	482,700	na***	1,216	na****

*Includes contributions from the polishing process as discussed in Appendix N in addition to the infrastructure requirements shown in Chapter 4.
**SPD Draft EIS pg. 3-165.
***Heat in F-Area provided by steam.
****Fuel oil trucked in as needed and stored at MOX facility.

4.1.5 Air Quality

Operation of the proposed MOX facility would result in the release of a small amount of nonradiological air pollutants that would be expected to slightly increase the ambient air pollutant concentrations at the selected site. The majority of these pollutants would be associated with routine maintenance and testing runs of the facility's emergency diesel generator and emissions from facility heating. Table 8 shows the estimated increases in ambient air pollutant concentrations for the proposed facility and the national standards for these pollutants. The projected emissions are a very small fraction of the national standards. Although some small radionuclide discharges are expected from the proposed MOX facility, these discharges are not expected to have a major impact on air quality. As explained in Section 4.1.1, these discharges would result in a very small dose to the general public.

Table 8. Estimated Nonradiological Ambient Air Pollutant Concentrations from the Proposed MOX Facility

	Carbon Monoxide 8 hour 1 hour	Nitrogen Dioxide Annual	PM_{10} Annual 24 hour	Sulfur Dioxide Annual 24 hour 3 hour
National Ambient Air Quality Standards (µg/m^3)	10,000 40,000	100	50 150	80 365 1,300
Offeror (µg/m^3)	0.123 0.371	0.011	0.001 0.011	0.039 0.531 1.39
SPD Draft EIS* (µg/m^3)	0.109 0.345	0.011	0.001 0.010	0.031 0.420 1.11
SRS Base** (µg/m^3)	64 279	9.3	4.14 56.4	15.1 219 962

*Includes contributions from the polishing process discussed in Appendix N in addition to the pollutant concentrations shown in Chapter 4.
**SPD Draft EIS pg. 4-6

4.1.6 Water Quality

Table 9 shows a comparison of water resources information described in the SPD Draft EIS to that provided by the offeror. Although the proposed water use is higher than that analyzed in the SPD Draft EIS, the amount of water needed is estimated to be from 0.9 to 6.0 percent of the site's estimated annual water requirements. Therefore, the additional water use is not expected to have a major impact on water resources. Although some small radionuclide discharges are expected from the proposed MOX facility, these discharges are not expected to have a major impact on water quality. As explained in Section 4.1.1, these discharges would result in a very small dose to the general public.

Table 9. Comparison of Water Resources Information for the MOX Facility

	Water Use (10^6 liters/yr)	Sanitary Wastewater Discharged (10^6 liters/yr)	Radionuclide Emissions to Water (Ci)
SPD Draft EIS	44	18	0
Offeror	68	11	0.0025

4.1.7 Socioeconomics

The proposed MOX facility would employ about 385 workers, somewhat fewer than the 435 workers estimated in the SPD Draft EIS. An increase of 385 workers would not be expected to have a major impact on any of the candidate sites. At three of the four candidate sites (i.e., INEEL, Pantex, and SRS), the workforce is projected to be falling at the same time the proposed MOX facility would begin operations. The additional MOX facility workers would help mitigate the negative socioeconomic impacts associated with such reductions. The SPD Draft EIS concluded that, at Hanford, although the increase in workforce requirements for proposed surplus plutonium disposition facilities (including MOX) would coincide with an increase in the site's overall workforce (as a result of the planned tank waste remediation system), the projected changes would not have a major impact on the level of community services currently offered in the region of influence. (SPD Draft EIS pg. 4-37)

4.2 Proposed Reactor Sites

The offeror is proposing to use a partial MOX core (up to approximately 40 percent of the fuel in the core at equilibrium) in each of the proposed reactors. The S&D PEIS analyzed a full MOX core at a generic reactor site.

4.2.1 Human Health Risk

Risk to human health was assessed for the proposed reactor sites based on information provided by the offeror and compared to the generic reactor information in the S&D PEIS. The offeror stated that there would be no difference in dose to the general public from normal operations based on the use of MOX fuel versus LEU fuel in the proposed reactors. This is consistent with findings in the S&D PEIS that showed a very small range in the expected difference ($-1.1\text{x}10^{-2}$ to $2\text{x}10^{-2}$ person-rem, S&D PEIS pg. 4-729). The doses shown in this section reflect the projected dose in the year 2015.

The annual radiological dose from normal operations to the general population residing within 50 miles of the proposed reactor sites was estimated based on radiological emissions estimated by the offeror. As shown in Table 10, the average individual living within 50 miles of one of the proposed reactor sites could expect to receive an annual dose of between $2.7\text{x}10^{-3}$ to $9.9\text{x}10^{-3}$ mrem/yr from normal operation of these reactors regardless of whether the reactors were using MOX fuel or LEU fuel.

Table 10. Estimated Dose to the General Population from Normal Operations of the Proposed Reactors in the Year 2015 (Partial MOX or LEU Core)

	Maximally Exposed Individual (mrem/yr)	Latent Fatal Cancer Risk	Est. Dose to Pop. within 50 mi. radius (person-rem/yr)	Annual Number of Latent Cancer Fatalities	Avg. Dose to Ind. within 50 mi. radius (mrem/yr)
Catawba[a]	0.73	$3.7\text{x}10^{-7}$	6.1	$3.1\text{x}10^{-3}$	$2.7\text{x}10^{-3}$
McGuire[b]	0.31	$1.6\text{x}10^{-7}$	10.7	$5.4\text{x}10^{-3}$	$4.2\text{x}10^{-3}$
North Anna[c]	0.37	$1.9\text{x}10^{-7}$	20.3	$1.0\text{x}10^{-2}$	$9.9\text{x}10^{-3}$
S&D PEIS (high)*	0.17	$8.5\text{x}10^{-8}$	2.0	$1.0\text{x}10^{-3}$	$7.8\text{x}10^{-4}$

*S&D PEIS pg. 4-729

[a] The population for the year 2015 is estimated to be 2,265,000.

[b] The population for the year 2015 is estimated to be 2,575,000.

[c] The population for the year 2015 is estimated to be 2,042,000.

The offeror also stated that the workers at the proposed reactor sites would be expected to receive about the same amount of radiation dose as a result of their job activities regardless of the plant's decision to use

MOX fuel. As shown in Table 11, the average radiation worker at the proposed reactor sites could expect to receive an annual dose of between 46 and 123 mrem/yr from normal operations. This is lower than the worker dose range estimated in the S&D PEIS (281 to 543 mrem/yr). The offeror’s statement that the use of MOX fuel would not change the estimated worker dose is consistent with data presented in the S&D PEIS that showed an incremental increase in worker dose of less than 0.1 percent due to the use of MOX fuel. (S&D PEIS pg. 4-730)

Table 11. Estimated Dose to Workers from Normal Operations of the Proposed Reactors with MOX Fuel

	No. of Radiation Workers*	Total Dose to Workers (person-rem/ year)	Annual Number of Latent Cancer Fatalities	Average Worker Dose (mrem/yr)	Annual Latent Fatal Cancer Risk
Catawba	3,400	265	0.11	78	$3.1x10^{-5}$
McGuire	4,000	492	0.20	123	$4.9x10^{-5}$
North Anna	2,240	103	0.041	46	$1.8x10^{-5}$
S&D PEIS (high)**	2,220	1,204	0.48	543	$2.2x10^{-4}$

*The number of radiation workers at the proposed reactor sites was estimated based on the total dose to workers given by the offeror divided by the average worker dose, also supplied by the offeror.

**S&D PEIS pg. 4-730; adjusted to reflect a two reactor site for comparison to the proposed reactor sites.

4.2.2 Accidents

Two design-basis accidents, a large break loss-of-coolant accident (LOCA) and a fuel handling accident (FHA), were evaluated for the Environmental Critique and are reflected in this Synopsis. These accidents were chosen because they are the limiting reactor and non-reactor design-basis accidents at the proposed facilities. As shown in Tables 12 through 14, only small increases in the estimated impacts would be expected from a LOCA at the proposed reactor sites due to the use of MOX fuel. In a FHA, the consequences (defined as latent cancer fatalities) would decrease as a result of using MOX fuel rather than LEU fuel. This is because the end-of-cycle krypton inventory is less in MOX fuel than in LEU fuel and krypton is one of the greatest contributors to radiation dose from a FHA.

Beyond-design-basis accidents, if they were to occur, would be expected to result in major impacts to workers, the surrounding communities, and the environment regardless of whether the reactor was using a LEU or a partial MOX core. As shown in Tables 15 through 17, the probability of a beyond-design-basis accident happening and the risk to an individual living within 50 miles of the proposed reactors is very low.

The largest estimated risk of a latent cancer fatality for the maximally exposed individual (MEI) at any of the proposed reactors is estimated to be $2.86H10^{-5}$ for a steam generator tube rupture at one of the North Anna reactors when using a partial MOX core. If this same accident were to happen at the reactor when it was using a LEU core, the estimated risk would be $2.46H10^{-5}$. In either case, the risk of a latent cancer fatality is estimated to be less than 3 in 100,000 over the 16 year period the reactors would be using MOX fuel.

For beyond-design-basis accidents, the scenarios that lead to containment bypass or failure were evaluated because these are the accidents with the greatest potential consequences. The public and environmental consequences would be significantly less for accident scenarios that do not lead to containment bypass or failure. A steam generator tube rupture, early containment failure, late containment failure, and an interfacing systems loss-of-coolant accident (ISLOCA) were chosen as the representative set of beyond-design-basis accidents.

Commercial reactors, licensed by the NRC are required to complete Individual Plant Examinations (IPE) to assess plant vulnerabilities to severe accidents. An acceptable method of completing the IPEs is to perform a probabilistic risk assessment (PRA). A PRA analysis evaluates, in full detail (quantitatively), the consequences of all potential events caused by the operating disturbances (known as internal initiating events) within each plant. The PRA uses realistic criteria and assumptions in evaluating the accident progression and the systems required to mitigate each accident. The PRAs for the proposed reactors provided the required data to evaluate beyond-design-basis accidents.

As shown in Table 18, the difference in accident consequences for reactors using MOX fuel versus LEU fuel is generally very small. For beyond-design-basis accidents, the consequences would be expected to be slightly higher, with the largest increase associated with an ISLOCA. This is because the MOX fuel will release a higher actinide inventory in a severe accident. The impacts of an ISLOCA are estimated to be about 10 to 15 percent (an average of about 13 percent) greater to the general population living within 50 miles of the reactor operating with a partial MOX core instead of a LEU core. It should be noted that this accident has a very low estimated frequency of occurrence, an average of 1 in 3.2 million per year of reactor operation for the reactors being proposed.

Table 12. Design-Basis Accident Impacts for Catawba with LEU and Mixed Oxide Fuels

			Noninvolved Worker			Maximally Exposed Offsite Individual			Population		
Accident Release Scenario	Accident Scenario Frequency (per year)	LEU or MOX Core	Dose (rem)	Probability of Latent Cancer Fatality Given Dose to Noninvolved Worker[1]	Risk of Latent Cancer Fatality (over campaign)[2]	Dose (rem)	Probability of Latent Cancer Fatality Given Dose at Site Boundary[1]	Risk of Latent Cancer Fatality (over campaign)[2]	Dose (person-rem)	Number of Latent Cancer Fatalities in the Population within 80 km[3]	Risk of Latent Cancer Fatalities (over campaign)[4]
Loss-of-Coolant Accident	$7.50x10^{-6}$	LEU	3.78	1.51×10^{-3}	1.81×10^{-7}	1.44	7.20×10^{-4}	8.64×10^{-8}	$3.64\times10^{+3}$	1.82	2.19×10^{-4}
		MOX	3.85	1.54×10^{-3}	1.86×10^{-7}	1.48	7.40×10^{-4}	8.88×10^{-8}	$3.75\times10^{+3}$	1.88	2.26×10^{-4}
Spent Fuel Handling Accident[5]	$1.00x10^{-4}$	LEU	0.275	1.10×10^{-4}	1.78×10^{-7}	0.138	6.90×10^{-5}	1.10×10^{-7}	$1.12\times10^{+2}$	5.61×10^{-2}	8.98×10^{-5}
		MOX	0.262	1.05×10^{-4}	1.68×10^{-7}	0.131	6.55×10^{-5}	1.05×10^{-7}	$1.10\times10^{+2}$	5.48×10^{-2}	8.77×10^{-5}

[1] Increased likelihood (probability) of cancer fatality to a hypothetical individual - a noninvolved worker at a distance of 640 meters or the maximally exposed offsite individual located at the site boundary (762 m) - if exposed to the indicated dose.

[2] Increased likelihood (probability) of cancer fatality over the estimated 16 year campaign (frequency weighted) to a hypothetical individual - a noninvolved worker at a distance of 640 meters or the maximally exposed offsite individual located at the site boundary (762 m).

[3] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 kilometers (50 miles) if exposed to the indicated dose.

[4] Estimated number of cancer fatalities over the estimated 16 year campaign (frequency weighted) in the entire offsite population out to a distance of 80 kilometers (50 miles).

[5] Accident scenario frequency estimated in lieu of plant specific data.

Table 13. Design-Basis Accident Impacts for McGuire with LEU and Mixed Oxide Fuels

			Noninvolved Worker			Maximally Exposed Offsite Individual			Population		
Accident Release Scenario	Accident Scenario Frequency (per year)	LEU or MOX Core	Dose (rem)	Probability of Latent Cancer Fatality Given Dose to Noninvolved Worker[1]	Risk of Latent Cancer Fatality (over campaign)[2]	Dose (rem)	Probability of Latent Cancer Fatality Given Dose at Site Boundary[1]	Risk of Latent Cancer Fatality (over campaign)[2]	Dose (person-rem)	Number of Latent Cancer Fatalities in the Population within 80 km[3]	Risk of Latent Cancer Fatalities (over campaign)[4]
Loss-of-Coolant Accident	$1.50x10^{-5}$	LEU	5.31	2.12×10^{-3}	5.10×10^{-7}	2.28	1.14×10^{-3}	2.74×10^{-7}	$3.37\times10^{+3}$	1.68	4.03×10^{-4}
		MOX	5.46	2.18×10^{-3}	5.25×10^{-7}	2.34	1.17×10^{-3}	2.82×10^{-7}	$3.47\times10^{+3}$	1.73	4.16×10^{-4}
Spent Fuel Handling Accident[5]	$1.00x10^{-4}$	LEU	0.392	1.57×10^{-4}	2.51×10^{-7}	0.212	1.06×10^{-4}	1.70×10^{-7}	99.1	4.96×10^{-2}	7.94×10^{-5}
		MOX	0.373	1.49×10^{-4}	2.38×10^{-7}	0.201	1.01×10^{-4}	1.62×10^{-7}	97.3	4.87×10^{-2}	7.79×10^{-5}

[1] Increased likelihood (probability) of cancer fatality to a hypothetical individual **-** a noninvolved worker at a distance of 640 meters or the maximally exposed offsite individual located at the site boundary (762 m) **-** if exposed to the indicated dose.

[2] Increased likelihood (probability) of cancer fatality over the estimated 16 year campaign (frequency weighted) to a hypothetical individual **-** a noninvolved worker at a distance of 640 meters or the maximally exposed offsite individual located at the site boundary (762 m).

[3] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 kilometers (50 miles) if exposed to the indicated dose.

[4] Estimated number of cancer fatalities over the estimated 16 year campaign (frequency weighted) in the entire offsite population out to a distance of 80 kilometers (50 miles).

[5] Accident scenario frequency estimated in lieu of plant specific data.

Table 14. Design-Basis Accident Impacts for North Anna with LEU and Mixed Oxide Fuels

			Noninvolved Worker			Maximally Exposed Offsite Individual			Population		
Accident Release Scenario	Accident Scenario Frequency (per year)	LEU or MOX Core	Dose (rem)	Probability of Latent Cancer Fatality Given Dose to Noninvolved Worker[1]	Risk of Latent Cancer Fatality (over campaign)[2]	Dose (rem)	Probability of Latent Cancer Fatality Given Dose at Site Boundary[1]	Risk of Latent Cancer Fatality (over campaign)[2]	Dose (person-rem)	Number of Latent Cancer Fatalities in the Population within 80 km[3]	Risk of Latent Cancer Fatalities (over campaign)[4]
Loss-of-Coolant Accident	$2.10\text{x}10^{-5}$	LEU	0.114	4.56×10^{-5}	1.53×10^{-8}	3.18×10^{-2}	1.59×10^{-5}	5.34×10^{-9}	39.4	1.97×10^{-2}	6.62×10^{-6}
		MOX	0.115	4.60×10^{-5}	1.55×10^{-8}	3.20×10^{-2}	1.60×10^{-5}	5.38×10^{-9}	40.3	2.02×10^{-2}	6.78×10^{-6}
Spent Fuel Handling Accident[5]	$1.00\text{x}10^{-4}$	LEU	0.261	1.04×10^{-4}	1.66×10^{-7}	9.54×10^{-2}	4.77×10^{-5}	7.63×10^{-8}	29.4	1.47×10^{-2}	2.35×10^{-5}
		MOX	0.239	9.56×10^{-5}	1.53×10^{-7}	8.61×10^{-2}	4.31×10^{-5}	6.90×10^{-8}	27.5	1.38×10^{-2}	2.21×10^{-5}

[1] Increased likelihood (probability) of cancer fatality to a hypothetical individual - a noninvolved worker at a distance of 640 meters or the maximally exposed offsite individual located at the site boundary (1349 m) - if exposed to the indicated dose.

[2] Increased likelihood (probability) of cancer fatality over the estimated 16 year campaign (frequency weighted) to a hypothetical individual - a noninvolved worker at a distance of 640 meters or the maximally exposed offsite individual located at the site boundary (1349 m).

[3] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 kilometers (50 miles) if exposed to the indicated dose.

[4] Estimated number of cancer fatalities over the estimated 16 year campaign (frequency weighted) in the entire offsite population out to a distance of 80 kilometers (50 miles).

[5] Accident scenario frequency estimated in lieu of plant specific data.

Table 15. Beyond-Design-Basis Accident Impacts for Catawba with LEU and Mixed Oxide Fuels

			Maximally Exposed Offsite Individual			Population		
Accident Release Scenario	Accident Scenario Frequency (per year)	LEU or MOX Core	Dose (rem)	Probability of Latent Cancer Fatality Given Dose at Site Boundary[1]	Risk of Latent Cancer Fatality (over campaign)[2]	Dose (person-rem)	Number of Latent Cancer Fatalities in the Population within 80 km[3]	Risk of Latent Cancer Fatalities (over campaign)[4]
Steam Generator Tube Rupture[5]	6.31×10^{-10}	LEU	$3.46\times10^{+2}$	0.346	3.49×10^{-9}	$5.71\times10^{+6}$	$2.86\times10^{+3}$	2.88×10^{-5}
		MOX	$3.67\times10^{+2}$	0.367	3.71×10^{-9}	$5.93\times10^{+6}$	$2.96\times10^{+3}$	2.99×10^{-5}
Early Containment Failure	3.42×10^{-8}	LEU	5.97	2.99×10^{-3}	1.63×10^{-9}	$7.70\times10^{+5}$	$3.85\times10^{+2}$	2.11×10^{-4}
		MOX	6.01	3.01×10^{-3}	1.65×10^{-9}	$8.07\times10^{+5}$	$4.04\times10^{+2}$	2.21×10^{-4}
Late Containment Failure	1.21×10^{-5}	LEU	3.25	1.63×10^{-3}	3.15×10^{-7}	$3.93\times10^{+5}$	$1.96\times10^{+2}$	3.79×10^{-2}
		MOX	3.48	1.74×10^{-3}	3.38×10^{-7}	$3.78\times10^{+5}$	$1.89\times10^{+2}$	3.66×10^{-2}
Interfacing System Loss of Cooling Accident	6.90×10^{-8}	LEU	$1.40\times10^{+4}$	1	1.10×10^{-6}	$2.64\times10^{+7}$	$1.32\times10^{+4}$	1.46×10^{-2}
		MOX	$1.60\times10^{+4}$	1	1.10×10^{-6}	$2.96\times10^{+7}$	$1.48\times10^{+4}$	1.63×10^{-2}

[1] Increased likelihood (probability) of cancer fatality to the maximally exposed offsite individual located at the site boundary (762 m) - if exposed to the indicated dose.

[2] Increased likelihood (probability) of cancer fatality over the estimated 16 year campaign (frequency weighted) to a hypothetical individual - a noninvolved worker at a distance of 640 meters or the maximally exposed offsite individual located at the site boundary (762 m).

[3] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 kilometers (50 miles) if exposed to the indicated dose.

[4] Estimated number of cancer fatalities over the estimated 16 year campaign (frequency weighted) in the entire offsite population out to a distance of 80 kilometers (50 miles).

[5] McGuire timing and release fractions were used to compare like scenarios.

Table 16. Beyond-Design-Basis Accident Impacts for McGuire with LEU and Mixed Oxide Fuels

			Maximally Exposed Offsite Individual			Population		
Accident Release Scenario	Accident Scenario Frequency (per year)	LEU or MOX Core	Dose (rem)	Probability of Latent Cancer Fatality Given Dose at Site Boundary[1]	Risk of Latent Cancer Fatality (over campaign)[2]	Dose (person-rem)	Number of Latent Cancer Fatalities in the Population within 80 km[3]	Risk of Latent Cancer Fatalities (over campaign)[4]
Steam Generator Tube Rupture	5.81×10^{-9}	LEU	$6.10\times10^{+2}$	0.610	5.66×10^{-8}	$5.08\times10^{+6}$	$2.54\times10^{+3}$	2.37×10^{-4}
		MOX	$6.47\times10^{+2}$	0.647	6.02×10^{-8}	$5.28\times10^{+6}$	$2.64\times10^{+3}$	2.45×10^{-4}
Early Containment Failure	9.89×10^{-8}	LEU	12.2	6.10×10^{-3}	9.65×10^{-9}	$7.90\times10^{+5}$	$3.95\times10^{+2}$	6.26×10^{-4}
		MOX	12.6	6.30×10^{-3}	9.97×10^{-9}	$8.04\times10^{+5}$	$4.02\times10^{+2}$	6.37×10^{-4}
Late Containment Failure	7.21×10^{-6}	LEU	2.18	1.09×10^{-3}	1.26×10^{-7}	$3.04\times10^{+5}$	$1.52\times10^{+2}$	1.76×10^{-2}
		MOX	2.21	1.11×10^{-3}	1.28×10^{-7}	$2.96\times10^{+5}$	$1.48\times10^{+2}$	1.71×10^{-2}
Interfacing System Loss of Cooling Accident	6.35×10^{-7}	LEU	$1.95\times10^{+4}$	1	1.02×10^{-5}	$1.79\times10^{+7}$	$8.93\times10^{+3}$	0.091
		MOX	$2.19\times10^{+4}$	1	1.02×10^{-5}	$1.97\times10^{+7}$	$9.85\times10^{+3}$	0.10

[1] Increased likelihood (probability) of cancer fatality to the maximally exposed offsite individual located at the site boundary (762 m) - if exposed to the indicated dose.

[2] Increased likelihood (probability) of cancer fatality over the estimated 16 year campaign (frequency weighted) to a hypothetical individual - a noninvolved worker at a distance of 640 meters or the maximally exposed offsite individual located at the site boundary (762 m).

[3] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 kilometers (50 miles) if exposed to the indicated dose.

[4] Estimated number of cancer fatalities over the estimated 16 year campaign (frequency weighted) in the entire offsite population out to a distance of 80 kilometers (50 miles).

Table 17. Beyond-Design-Basis Accident Impacts for North Anna with LEU and Mixed Oxide Fuels

			Maximally Exposed Offsite Individual			Population		
Accident Release Scenario	Accident Scenario Frequency (per year)	LEU or MOX Core	Dose (rem)	Probability of Latent Cancer Fatality Given Dose at Site Boundary[1]	Risk of Latent Cancer Fatality (over campaign)[2]	Dose (person-rem)	Number of Latent Cancer Fatalities in the Population within 80 km[3]	Risk of Latent Cancer Fatalities (over campaign)[4]
Steam Generator Tube Rupture[5]	7.38×10^{-6}	LEU	$2.09\times10^{+2}$	0.209	2.46×10^{-5}	$1.73\times10^{+6}$	$8.63\times10^{+2}$	0.102
		MOX	$2.43\times10^{+2}$	0.243	2.86×10^{-5}	$1.84\times10^{+6}$	$9.20\times10^{+2}$	0.109
Early Containment Failure[5]	1.60×10^{-7}	LEU	19.6	1.96×10^{-2}	5.02×10^{-8}	$8.33\times10^{+5}$	$4.17\times10^{+2}$	1.07×10^{-3}
		MOX	21.6	2.16×10^{-2}	5.54×10^{-8}	$8.42\times10^{+5}$	$4.21\times10^{+2}$	1.08×10^{-3}
Late Containment Failure[5]	2.46×10^{-6}	LEU	1.12	5.60×10^{-4}	2.21×10^{-8}	$4.04\times10^{+4}$	20.2	7.95×10^{-4}
		MOX	1.15	5.75×10^{-4}	2.26×10^{-8}	$4.43\times10^{+4}$	22.1	8.70×10^{-4}
Interfacing System Loss of Cooling Accident[5]	2.40×10^{-7}	LEU	$1.00\times10^{+4}$	1	3.84×10^{-6}	$4.68\times10^{+6}$	$2.34\times10^{+3}$	8.99×10^{-3}
		MOX	$1.22\times10^{+4}$	1	3.84×10^{-6}	$5.41\times10^{+6}$	$2.70\times10^{+3}$	1.04×10^{-2}

[1] Increased likelihood (probability) of cancer fatality to the maximally exposed offsite individual located at the site boundary (1349 m) - if exposed to the indicated dose.

[2] Increased likelihood (probability) of cancer fatality over the estimated 16 year campaign (frequency weighted) to a hypothetical individual - a noninvolved worker at a distance of 640 meters or the maximally exposed offsite individual located at the site boundary (1349 m).

[3] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 kilometers (50 miles) if exposed to the indicated dose.

[4] Estimated number of cancer fatalities over the estimated 16 year campaign (frequency weighted) in the entire offsite population out to a distance of 80 kilometers (50 miles).

[5] McGuire release durations and warning times were used in lieu of site specific data.

Table 18. Ratio of Accident Impacts for Mixed Oxide Fueled and Uranium Fueled Reactors (Mixed Oxide Impacts/LEU Impacts)

	Catawba		McGuire		North Anna		S&D PEIS	
Accident Scenario	MEI	Population	MEI	Population	MEI	Population	MEI	Population
Design-Basis Accidents								
Loss-of-Coolant Accident	1.03	1.03	1.01	1.03	1.03	1.03	NA	NA
Fuel Handling Accident	0.95	0.98	0.90	0.94	0.95	0.98	NA	NA
Beyond-Design-Basis Accidents								
Steam Generator Tube Rupture	1.06	1.04	1.16	1.07	1.06	1.04	0.94	0.94
Early Containment Failure	1.01	1.05	1.10	1.01	1.03	1.02	0.96	0.97
Late Containment Failure	1.07	0.96	1.03	1.09	1.01	0.97	1.07	1.08
Interfacing System Loss of Cooling Accident	1.14	1.12	1.22	1.15	1.12	1.10	0.92	0.93

Key: MEI – Maximally Exposed Individual; NA – not available

Note: The number 1 represents the consequences equal to the accident occurring in the proposed reactors with an LEU core

Table 19 shows the number of prompt fatalities estimated from a postulated ISLOCA and a beyond-design-basis steam generator tube rupture. As shown in this table, the differences due to the use of MOX fuel rather than LEU are small. None of the other accidents evaluated in this Synopsis are expected to result in prompt fatalities.

Table 19. Estimated Prompt Fatalities from Beyond-Design-Basis Reactor Accidents

Reactor Site	LEU Core	MOX Core
Steam Generator Tube Rupture		
Catawba	1	1
McGuire	1	1
North Anna	0	0
Interfacing System Loss of Cooling Accident		
Catawba	815	843
McGuire	398	421
North Anna	54	60

4.2.3 Waste Management

The proposed reactors would be expected to continue to produce mixed LLW, LLW, hazardous waste, and nonhazardous waste as part of their normal operations. According to the offeror, the volume of waste generated is not expected to increase as a result of the reactors using MOX fuel. This is consistent with information presented in the S&D PEIS that stated the use of MOX fuel is not expected to increase the amount or change the content of the waste being generated. (S&D PEIS, pg. 4-734) Table 20 shows the annual waste volume that would be generated during operation of the proposed reactors.

Table 20. Estimated Waste Generation Rates

Reactor Site	Mixed LLW (m^3/yr)	LLW (m^3/yr)	Hazardous Waste (m^3/yr)	Nonhazardous Waste Solid (m^3/yr)
Catawba (per unit)	0.3	25	15	455
McGuire (per unit)	0.1	21	14	568
North Anna (per unit)	0.0	118	6	5,200
S&D PEIS*	na	178	na	na

na - not available.
*S&D PEIS pg. 4-734.

As shown in Table 20, the estimated LLW generation for each of the proposed reactors is less than the amount estimated in the S&D PEIS. None of these waste estimates are expected to impact the proposed reactor sites in terms of their ability to handle these wastes. The wastes would continue to be handled in the same manner as they are today with no change required due to the use of MOX fuel at the reactors.

4.2.4 Spent Fuel

As shown in Table 21, it is likely that some additional spent fuel would be generated by using a partial MOX core in the proposed reactors. The amount of additional spent nuclear fuel generated is estimated to range from approximately 2 to 16 percent of the total amount of spent fuel that would be generated by the proposed reactors during the time period MOX fuel would be used. The offeror intends to manage the spent MOX fuel the same as its spent LEU fuel, by storing it in the reactor's spent fuel pool or in dry storage. According to the offeror, the amount of additional spent fuel is not expected to impact spent fuel management at the reactor sites.

Table 21. Total Additional Spent Fuel Assemblies Generated for the MOX Fuel Option

	Number of Spent Fuel Assemblies Generated with no MOX Fuel	Number of Additional Spent Fuel Assemblies with MOX Fuel	Percent Increase
S&D PEIS (based on a shorter fuel cycle)			
Typical PWR*	48/yr	32/yr	66.7%
Offeror's Reactors			
Total Over MOX Campaign	3,732	199	5.3%

*S&D PEIS pg. 4-734

For the four units at Catawba and McGuire, all of the additional spent nuclear fuel assemblies would be generated during the transition cycles from LEU to MOX fuel. Additional assemblies help to maintain peaking below design and regulatory limits, and compensate for the greater end-of-cycle reactivity. Once equilibrium is reached in the partial MOX core, additional fuel assemblies would not be required.

Like Catawba and McGuire, the North Anna units are expected to require additional LEU assemblies during the first transition cores. However, additional assemblies will also be required during equilibrium cycles because the smaller North Anna cores (157 fuel assemblies compared to 193 each for the McGuire and Catawba units) are more prone to neutron leakage and provide less flexibility with respect to meeting power peaking limits.

As designs are finalized and optimized for MOX fuel it may be possible to reduce MOX fuel assembly peaking and thereby reduce the number of additional assemblies required (and spent fuel generated) at the proposed reactors. As it currently stands, the North Anna site could generate approximately 16 percent more spent fuel by using MOX fuel than if the plants continued to use LEU fuel. The total amount of additional spent fuel generated by all six proposed reactors is estimated to be approximately 92 metric tons heavy metal. However, such MOX spent fuel is included in the inventory for the potential Nuclear Waste Policy Act geologic repository being studied by DOE. DOE is in the process of completing an environmental impact statement for a geologic repository.

4.2.5 Land Use

The offeror has stated that the proposed reactor sites would not require any additional land to support the use of MOX fuel in their reactors. This statement is consistent with information presented in the S&D PEIS. (S&D PEIS, pg. 4-720)

4.2.6 Infrastructure Requirements

The offeror has stated that the proposed reactor sites would not require any additional infrastructure to support the use of MOX fuel in their reactors. This statement is consistent with information presented in the S&D PEIS. (S&D PEIS, pg. 4-721)

4.2.7 Air Quality

Continued operation of the proposed reactor sites would result in a small amount of nonradiological air pollutants being released to the atmosphere, mainly due to the requirement to periodically test emergency diesel generators. The estimated air pollutants resulting from operation of the proposed reactors would not be expected to increase due to the use of MOX fuel in these reactors. Table 22 shows the estimated air pollutant concentrations and the national standards for these pollutants at the proposed sites. The impact of radiological releases is included in Section 4.2.1.

Table 22. Nonradiological Ambient Air Pollutant Concentrations with or without MOX Fuel from the Continued Operation of the Proposed Reactors

	Carbon Monoxide 8 hour 1 hour	Nitrogen Dioxide Annual	PM_{10} Annual 24 hour	Sulfur Dioxide Annual 24 hour 3 hour
National Ambient Air Quality Standards (µg/m^3)	10,000 40,000	100	50 150	80 365 1,300
Catawba (µg/m^3)	978 1400	3.26	0.102 65.4	0.0418 26.9 60.4
McGuire (µg/m^3)	1060 1510	2.6	0.08 71.2	0.03 29.9 67.4
North Anna (µg/m^3)	416 594	0.01	0.004 15.4	0.02 63 142

4.2.8 Water Quality

The offeror stated that there would be no change in water usage or discharge of nonradiological pollutants resulting from use of MOX fuel in the proposed reactors. Each of the reactor sites discharges nonradiological wastewater in accordance with a National Pollutant Discharge Elimination System

(NPDES) Permit, or an analogous state-issued permit. Permitted outfalls discharge conventional and priority pollutants from the reactor and ancillary processes that are similar to discharges from most reactor sites. Discharge Monitoring Reports (DMRs) for North Anna (May 1994 through April 1998) and Catawba (calendar years 1995 through 1997) showed that for the most part, there were only occasional noncompliances with permit limitations, only one of which occurred at an outfall receiving reactor process discharges. (The offeror did not provide DMRs for McGuire.) During the period reviewed, Catawba experienced four noncompliances, two in 1995 and two in early 1996. North Anna has exceeded the chlorine limitation at its sewage treatment facility, but this would neither affect nor be affected by, the use of MOX fuel. The impact of radiological releases is included in Section 4.2.1.

4.2.9 Socioeconomics

The offeror has stated that the proposed reactor sites would not need to employ any additional workers to support the use of MOX fuel in their reactors so there would not be any expected socioeconomic impacts. This statement is consistent with information presented in the S&D PEIS which concluded that the use of MOX fuel could result in small increases in the worker population at the reactor sites (between 40 and 105), but that any increase would be filled from the area's existing workforce. Therefore, there would be little impact on the local economy and communities (S&D PEIS, pgs. 4-727).

5.0 REQUIRED PERMITS AND LICENSES

Both the MOX fabrication facility and the selected reactors will require permitting and licensing activities to support the proposed fabrication and use of MOX fuel. The MOX fabrication facility will be constructed and operated at an existing DOE-owned site, but will be licensed by the NRC. The selected reactors are all U.S. operating, commercial PWRs, licensed by the NRC. The MOX facility, in particular, has special licensing considerations apart from most facilities that are built and operated in the United States today. This section discusses the particular licensing and permitting requirements of both facilities.

Both DOE and NRC have their origins in the Atomic Energy Act (AEA). The AEA first established their predecessor agency, the Atomic Energy Commission (AEC) to promote and regulate the use of atomic energy in the United States. The AEC was subsequently split into two organizations that have since become DOE and NRC. DOE was authorized to manage defense-related nuclear activities, while NRC was given the responsibility of regulating civilian uses of nuclear materials. Both DOE and NRC publish their regulations in Title 10 of the *Code of Federal Regulations* (10 CFR), with NRC publishing in Parts 0–199, and DOE, Parts 200–1099. DOE supplements its regulations with a series of Orders, while NRC uses Regulatory Guides to further establish specific methods of implementation of its regulations. The proposed actions that are the subject of this Synopsis are unique in that DOE and NRC each have regulatory responsibility for certain parts of the activities.

The AEA authorizes DOE to establish standards to protect health or minimize dangers to life or property for activities under DOE's jurisdiction. Through a series of DOE orders and regulations, an extensive system of standards and requirements has been established to ensure safe operation of facilities. The DOE orders have been revised and reorganized to reduce duplication and eliminate obsolete provisions (though some older orders remain in effect during the transition). For DOE orders, the new organization is by Series and is generally intended to include all DOE policies, manuals, requirements documents, notices, guides, and orders. For proposed actions involving fuel qualification, relevant DOE regulations include 10 CFR 820, Procedural Rules for DOE Nuclear Activities; 10 CFR 830, Nuclear Safety Management; 10 CFR.834, Radiation Protection of the Public and the Environment (Draft); 10 CFR 835, Occupational Radiation Protection; 10 CFR 1021, Compliance with the National Environmental Policy Act; and 10 CFR 1022, Compliance with Floodplains/Wetlands Environmental Review Requirements. DOE orders include those in new Series 400, which deals with Work Process; and within this Series, DOE Order 420.1 addresses Facility Safety; 425.1 addresses Startup and Restart of Nuclear Facilities; 452.1A addresses Nuclear Explosive and Weapons Surety Programs; 452.2A addresses the Safety of Nuclear Explosives Operations; 452.4 addresses the Security and Control of Nuclear Explosives; 460.1A addresses Packaging and Transportation Safety; 470.1 addresses the Safeguards and Security Program; and 474.1 addresses the Control and Accountability of Nuclear Materials. In addition, DOE (older number) Series 5400 addresses environmental, safety, and health programs for DOE operations. Not all of these DOE regulations and orders would apply to operation of the proposed MOX fuel fabrication facility, and most would not apply to use of the proposed reactors.

There are a number of Federal environmental statutes dealing with environmental protection, compliance, or consultation. In addition, certain environmental requirements have been delegated to state authorities for enforcement and implementation. Certain statutes and regulations require DOE to consult with Federal, State, and local agencies and federally recognized Native American groups. Most of these consultations are related to biotic resources, cultural resources, and Native American resources. Biotic resources consultations generally pertain to the potential for activities to disturb sensitive species or habitats. Cultural resources consultations relate to the potential for disruption of important cultural resources and archaeological sites. Finally, Native American consultations are concerned with the potential for disturbance of Native American sites and resources. DOE has conducted appropriate consultations at the candidate sites and will report the results of these consultations in the SPD Final EIS.

It is DOE policy to conduct its operations in an environmentally safe manner in compliance with all applicable statutes, regulations, and standards. Although this chapter does not address pending or future regulations, DOE recognizes that the regulatory environment is subject to change, and that the construction, operation, and decommissioning of any surplus plutonium disposition facility must be conducted in compliance with all applicable regulations and standards.

5.1 Regulatory Activities

It is likely that new or modified permits will be needed before the proposed surplus plutonium disposition facilities may be constructed or operated. Permits regulate many aspects of facility construction and operations, including the quality of construction, treatment and storage of hazardous waste, and discharges of effluents to the environment. These permits will be obtained from appropriate Federal, state, and local agencies. NRC issues operating licenses for major facilities such as commercial nuclear power reactors and fuel fabrication facilities, although the regulations under which these two facilities would be licensed are different.

5.1.1 The MOX Facility

The MOX facility would be licensed to operate by NRC under its regulations at 10 CFR 70, *Domestic Licensing of Special Nuclear Materials*. Because the facility would be located at a DOE site, however, certain DOE requirements affecting site interfaces and infrastructure will also be applicable. In addition, as would be the case regardless of where the facility were built, Federal or state regulations implementing certain provisions of the Clean Water Act, Clean Air Act, and Resource Conservation and Recovery Act would be applicable. These regulations are implemented through permits. Evaluation would be required to determine whether MOX facility emissions and activities would necessitate modification of any of these permits. Analyses in the SPD Draft EIS have shown that there would be minimal impact from construction and operation of the MOX facility.

MOX facility design and operating parameters will be imposed by requirements of 10 CFR 70. Facility robustness, worker health and safety, and material and personnel security are all specified by 10 CFR 70. This regulation incorporates and refers the licensee to provisions of other NRC regulations such as those found at 10 CFR 20, *Radiation Protection Standards.* Safety and environmental analyses will be required to support the license application for the MOX facility.

Integral to the NEPA process is consideration of how the proposed action might affect biotic, cultural, and Native American resources, and the need for mitigation of any potential impacts. Required consultations with agencies and recognized Native American groups have been conducted.

5.1.2 Reactors

Nuclear power reactors undergo a lengthy licensing process under 10 CFR 50, *Domestic Licensing of Production and Utilization Facilities*, beginning before facility construction commences. This process includes preparation of safety analysis and environmental reports. The safety analysis report remains a living document that serves as the licensing basis for the plant, and is updated throughout the life of the plant. Public hearings before a licensing board are conducted prior to a license being issued. Once issued, operating licenses may be amended only with proper evaluation, review and approval as specified in 10 CFR 50.90. This prescriptive process requires demonstration that a proposed change does not involve an unreviewed environmental or safety question and provides for public notice and opportunity to comment prior to issuance of the license amendment. Minor license amendments can be processed fairly expeditiously, but more involved amendments can require multiple submittals before the NRC is assured that the proposed action will not reduce the margin of safety of the plant. All submittals, except portions that contain proprietary information, are available to the public.

The regulatory process for requesting reactor license amendments to use MOX fuel will be the same as for any 10 CFR 50 Operating License amendment request. The reactor licensee submitting an operating license amendment request in accordance with 10 CFR 50.90 initiates this process. Safety and environmental analyses commensurate with the level of potential impact are submitted in support, and as part, of the amendment request. NRC reviews the submitted information and denies or approves the request. The review process can involve submittal of additional information and face-to-face meetings between the licensee and NRC, and can result in modified license amendment requests. NRC provides notice in the *Federal Register* for certain steps in the process. The notice for the amendment request initially appears in the *Federal Register* with a Notice of Opportunity for Public Hearing. *Federal Register* notices are also required for the Proposed No Significant Hazards Determination, associated environmental documents, Consideration of Issuance of the License Amendment, and issuance of the final amendment. Certain of these notices allow for the opportunity to provide written comments, and for potentially affected parties to petition to intervene or request public hearings.

The six reactors proposed to use MOX fuel have been operating for a number of years. Revisions to each of their operating licenses will be required prior to MOX fuel being brought to the reactor sites and loaded into the reactors. The license amendment request will need to include a discussion of all potential impacts and changes in reactor operation that could be important to safety or the environment. This will include fresh and spent fuel handling, security and operational changes, as well as complete core load analysis and safety analyses, including potential changes to the severe accident analyses. Because the offeror has indicated that no new construction would be required to accommodate the use of MOX fuel, it is unlikely that any biotic, cultural or Native American resources would be impacted by the proposed action. The analyses performed for the Environmental Critique have demonstrated very little difference between the impacts from using a partial MOX core over a LEU core.

The need for modifications to site permits will be evaluated by the individual plants as part of their licensing activities. The offeror has indicated, and the analyses and reviews performed for the Environmental Critique, support the assertion, that there would be minimal or no change in effluents, emissions, and wastes (both radiological and nonradiological). Therefore, it is expected that few, if any, environmental permits or agreements will require modification for use of MOX fuel.

6.0 CONCLUSION

No major impacts to the environment surrounding the proposed MOX facility or reactor sites are expected to result from normal operation of these facilities. Environmental impacts from operation of the proposed reactors are not expected to change appreciably due to the use of MOX fuel. Impacts from construction and operation of the MOX facility are expected to be generally consistent with those presented in the SPD Draft EIS, and impacts at the reactor sites are expected to be generally consistent with those in the S&D PEIS.