Office of
Fissile Materials Disposition

United States Department of Energy

Surplus Plutonium Disposition Final Environmental Impact Statement

Volume I - Part B

November 1999

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DOE/EIS-0283

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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}

Chapter 4
Environmental Consequences

4.1 INTRODUCTION

In this U.S. Department of Energy (DOE) *Surplus Plutonium Disposition Final Environmental Impact Statement* (SPD EIS), each of the major disposition alternatives, including the No Action Alternative, is discussed separately in Sections 4.2 through 4.25. To focus the impact analyses on those areas where the greatest potential exists for effects on the environment, the following areas are discussed in detail: air quality and noise, waste management, socioeconomics, human health risk, facility accidents, transportation, and environmental justice. The remaining resource areas (i.e., geology and soils, water resources, ecological resources, cultural and paleontological resources, land use and visual resources, and infrastructure) are likely to have minimal or no impacts at the candidate sites regardless of the disposition action alternative being considered. Therefore, impacts on these resources were evaluated in terms of the alternative that would have the greatest impact on the resource.[1] The alternative analyzed is generally that which would locate the largest number of surplus plutonium disposition facilities at a given site. For example, the maximum impact on these resource areas at Pantex would be Alternative 9 or 10, all of which consider building both a pit conversion facility and a mixed oxide (MOX) facility on the site. In another example, at Savannah River Site (SRS), the alternative having the greatest impact would be Alternative 3. [Text deleted.]

This chapter also discusses the potential impacts related to implementation of lead assembly fabrication at five candidate sites and postirradiation examination at two candidate sites. To provide an overview of the impacts associated with full implementation of the MOX fuel approach to disposition, this chapter presents an integrated assessment of the potential impacts of the MOX facility, lead assembly fabrication, postirradiation examination, and use of the MOX fuel in domestic, commercial reactors. To facilitate the evaluation of proposed immobilization technologies, this chapter discusses the impacts associated with the can-in-canister immobilization technology with the homogenous technologies described in the *Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement (Storage and Disposition PEIS)* for the ceramic immobilization and vitrification alternatives.

Environmental justice and transportation impacts of constructing facilities for surplus plutonium disposition are not discussed. Construction would not involve the release of any appreciable quantities of radionuclides or other hazardous constituents, and therefore would not be expected to cause adverse impacts on the offsite areas that are the focus of the environmental justice analysis. Likewise, construction would not involve the offsite transport of radioactive materials, and therefore would not appreciably contribute to adverse transportation impacts.

The environmental consequences of alternatives for surplus plutonium disposition were generally estimated by comparing facility characteristics and requirements from Chapter 2 and Appendix E with affected environment information from Chapter 3. The two sets of information were analyzed following the impact assessment methods described in Appendix F. The results of the assessment of environmental consequences are presented in this chapter. For some of the resource areas, more detailed descriptions of the development of the impacts are presented in Appendixes G through M as follows:

- Appendix G, Air Quality
- Appendix H, Waste Management
- Appendix I, Socioeconomics

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[1] During the conduct of the cultural resources impacts analysis, it was determined that construction of surplus plutonium disposition facilities at SRS could produce impacts on archaeological resources requiring mitigation (see Section 4.26.4.4.1). DOE plans to avoid these sites, and it will not be necessary to disturb these areas.

- Appendix J, Human Health Risks
- Appendix K, Facility Accidents
- Appendix L, Transportation
- Appendix M, Environmental Justice

Portions of some alternatives are equivalent. For example, under Alternatives 4A and 4B, the pit conversion facility is located in Zone 4 West at Pantex. Therefore, the activities at Pantex are the same for these two alternatives. The organization of Chapter 4 takes advantage of these equivalencies. When the impacts at a site have already been described under a previous alternative, the later impacts discussion provides a reference to the previous location rather than repeating the information.

DOE revised the SPD Draft EIS and its *Supplement* in response to comments received from other Federal agencies; tribal, State, and local governments; nongovernmental organizations; the general public; and DOE reviews. The text was changed to provide additional environmental baseline information, reflect new technical data, make editorial corrections, respond to comments, and clarify text. Some of these changes involved recalculations of the impacts discussed. In addition, DOE updated information due to events or decisions made since the SPD Draft EIS and *Supplement* were provided for public comment. Sidebars are used throughout this SPD Final EIS to indicate where changes have been made.

4.2 ALTERNATIVE 1: NO ACTION

The No Action Alternative for this SPD EIS includes implementation of the storage decisions made in the Record of Decision (ROD) (DOE 1997a) and amended ROD (DOE 1998a) for the *Storage and Disposition PEIS* (DOE 1996a). Therefore, under the No Action Alternative in this SPD EIS, surplus weapons-usable plutonium materials in storage at various DOE sites would remain at those locations. The vast majority of pits would continue to be stored at Pantex, and the remaining plutonium in various forms would continue to be stored at the Hanford Site (Hanford), Idaho National Engineering and Environmental Laboratory (INEEL), Los Alamos National Laboratory (LANL), and SRS. At Hanford, nonpit plutonium materials would continue to be stored at the Plutonium Finishing Plant (PFP). At INEEL, nonpit plutonium materials would continue to be stored in the Zero Power Physics Reactor (ZPPR) and Fuel Manufacturing Facility (FMF) at Argonne National Laboratory–West (ANL–W). At LLNL, surplus plutonium materials would continue to be stored in Building 332 of the Superblock complex. At LANL, surplus plutonium materials would continue to be stored in the Nuclear Materials Storage Facility (NMSF) in Technical Area 55 (TA–55). At Pantex, surplus plutonium pits would be stored in Zone 12.[2] At the Rocky Flats Environmental Technology Site (RFETS), DOE would continue to reduce plutonium inventories in order to support the accelerated cleanup and closure of that site.[3] At SRS, surplus nonpit plutonium would continue to be stored at various locations until the Actinide Packaging and Storage Facility (APSF), if built, is completed.

[2] DOE is considering leaving the repackaged surplus pits in Zone 4 at Pantex for long-term storage. An appropriate environmental review will be conducted when the specific proposal for this change has been determined (e.g., whether additional magazines need to be air-conditioned). The analysis in this document assumes that the surplus pits are stored in Zone 12 in accordance with the ROD for the *Storage and Disposition PEIS*.

[3] The removal of all plutonium pits from RFETS was completed in June 1999. Should the No Action Alternative be chosen, the ROD pursuant to this SPD EIS would also address the movement of the remaining surplus nonpit plutonium from RFETS in support of its planned closure in 2006.

4.2.1 Air Quality and Noise

4.2.1.1 Hanford

Activities associated with the No Action Alternative at Hanford would generate criteria, hazardous, and toxic air pollutants. The sources of air pollutants associated with operations include natural gas–fired package boilers, diesel generators that are periodically tested and operated, tank farm emissions, various process emissions, and vehicle emissions. No Action activities would include the conversion to natural gas and electricity for heating and process steam (DOE 1996a:4-34). To evaluate the air quality impacts, criteria, hazardous, and toxic pollutant concentrations from the No Action Alternative were compared with the applicable Federal and State standards and guidelines. This comparison is presented as Table 4–1.

Table 4–1. Evaluation of Hanford Air Pollutant Concentrations Associated With Alternative 1: No Action; Continued Storage of Plutonium at the Site

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m^3)[a]	No Action Concentration (Fg/m^3)[b]	Percent of Standard or Guideline
Criteria pollutants				
Carbon monoxide	8 hours	10,000	34.1	0.34
	1 hour	40,000	48.3	0.12
Nitrogen dioxide	Annual	100	0.25	0.25
PM_{10}	Annual	50	0.0179	0.036
	24 hours	150	0.77	0.51
Sulfur dioxide	Annual	50	1.63	3.1
	24 hours	260	8.91	3.4
	3 hours	1,300	29.6	2.3
	1 hour	660	32.9[c]	5.0
Other regulated pollutants				
Total suspended particulates	Annual	60	0.0179	0.03
	24 hours	150	0.77	0.51
Hazardous and other toxic compounds				
[Text deleted.]				
Benzene	Annual	0.12	0.000006	0.01

[a] The more stringent of the Federal and State standards is presented if both exist for the averaging period.
[b] Total site contribution, including plutonium storage operations and other approved facilities projected to be in operation in 2005.
[c] Estimated from 3-hr concentration.
Source: EPA 1997a; WDEC 1994.

Maximum air pollutant concentrations from operations at Hanford are well under the applicable standards and guidelines for pollutants of concern. Natural pollutant sources should continue to produce occasional exceedances of the standards for particulate matter with an aerodynamic diameter less than or equal to 10 microns (Fm) (PM_{10}) and total suspended particulates. Vehicle emissions associated with No Action activities at Hanford would likely decrease somewhat because of a decrease in overall site employment during this timeframe. Site employment at Hanford is expected to increase significantly over the period 2005–2010 to support construction of the tank waste remediation system. After this construction is completed, site employment is expected to drop again.

Impacts of operational noise would be similar to those described for existing conditions in Section 3.2.1.2. Noise from traffic associated with operation of facilities at Hanford is expected to decrease until 2005, when it could again increase owing to a projected increase in employment unrelated to surplus plutonium disposition activities. Given the distance to the site boundary (about 7.1 km [4.4 mi]), noise emissions from operational activities would not be expected to annoy the public. Nontraffic noise sources are far enough away from offsite areas that the contribution to offsite noise levels would continue to be small.

4.2.1.2 INEEL

Activities associated with the No Action Alternative at INEEL would generate criteria, hazardous, and toxic air pollutants. The sources of air pollutants associated with operations include calcination of high-level radioactive liquid waste, coal-fired boilers, diesel generators that are periodically tested and operated, various process emissions, waste burial activities, and vehicle emissions. To evaluate the air quality impacts, criteria, hazardous, and toxic pollutant concentrations under the No Action Alternative were compared with the applicable Federal and State standards and guidelines. This comparison is presented as Table 4–2.

Table 4–2. Evaluation of INEEL Air Pollutant Concentrations Associated With Alternative 1: No Action; Continued Storage of Plutonium at the Site

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m^3)[a]	No Action Concentration (Fg/m^3)[b]	Percent of Standard or Guideline
Criteria pollutants				
Carbon monoxide	8 hours	10,000	302	3.0
	1 hour	40,000	1,220	3.1
Nitrogen dioxide	Annual	100	11	11
PM_{10}	Annual	50	3	6
	24 hours	150	39	26
Sulfur dioxide	Annual	80	6	7.5
	24 hours	365	137	38
	3 hours	1,300	591	45
Hazardous and other toxic compounds				
[Text deleted.]				
Benzene	Annual	0.12	0.029	24

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

[b] Total site contribution, including current plutonium storage operations and other approved facilities projected to be in operation in 2005.

[Text deleted.]

Source: EPA 1997a; ID DHW 1995.

Maximum air pollutant concentrations from operations at INEEL would be in compliance with the applicable standards and guidelines for these pollutants of concern. Vehicle emissions associated with No Action activities at INEEL would likely decrease somewhat because of a decrease in overall site employment during this timeframe.

Impacts of operational noise would be similar to those described for existing conditions in Section 3.3.1.2. Noise from traffic associated with the operation of facilities at INEEL would likely decrease as site employment decreases. Given the distance to the site boundary (about 12 km [7.5 mi]), noise emissions from operational activities would not be expected to annoy the public. Nontraffic noise sources are far enough away from offsite areas that the contribution to offsite noise levels would continue to be small.

4.2.1.3 Pantex

Activities associated with the No Action Alternative at Pantex would generate criteria, hazardous, and toxic air pollutants. The types of sources associated with operations include steam boilers, diesel generators that are periodically tested and operated, explosives burning, high-explosive synthesis, and vehicle emissions. To evaluate the air quality impacts, criteria, hazardous, and toxic pollutant concentrations from the No Action Alternative were compared with the applicable Federal and State standards and guidelines. This comparison is presented as Table 4–3.

Table 4–3. Evaluation of Pantex Air Pollutant Concentrations Associated With Alternative 1: No Action; Continued Storage of Plutonium at the Site

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m^3)[a]	No Action Concentration (Fg/m^3)[b]	Percent of Standard or Guideline
Criteria pollutants				
Carbon monoxide	8 hours	10,000	620	6.2
	1 hour	40,000	2,990	7.5
Nitrogen dioxide	Annual	100	1.94	1.9
PM_{10}	Annual	50	8.79	18
	24 hours	150	89.4	60
Sulfur dioxide	Annual	80	0	0
	24 hours	365	0.00002	<0.001
	3 hours	1,300	0.00008	<0.001
	30 minutes	1,048	0.00016	<0.001
Other regulated pollutants				
Total suspended particulates	3 hours	200	(c)	0
	1 hour	400	(c)	0
Hazardous and other toxic compounds				
[Text deleted.]				
Benzene	Annual	3[d]	0.0547	1.8
	1 hour	75[d]	19.4	26

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

[b] Total site contribution, including current plutonium storage operations and other approved facilities projected to be in operation in 2005.

[c] Three- and 1-hr concentrations for total suspended particulates are not listed in the source documents (see Table G–43).

[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 1997a; TNRCC 1997a, 1997b.

Maximum air pollutant concentrations from operations at Pantex would likely continue to be in compliance with the applicable standards of the pollutants of concern, but natural pollutant sources could continue to produce occasional exceedances of the PM_{10} standard. The maximum 1-hr air pollutant concentration and the annual concentration for benzene are below the Texas Natural Resource Conservation Commission's (TNRCC's) effects-screening levels. [Text deleted.] Vehicle emissions associated with No Action activities at Pantex would likely decrease somewhat because of a decrease in overall site employment during this timeframe.

Impacts of operational noise would be similar to those described for existing conditions in Section 3.4.1.2. Noise from traffic associated with the operation of facilities at Pantex would likely decrease as site employment decreases. Given the distance to the site boundary (about 1.6 km [1.0 mi]), noise emissions from operational activities would not be expected to annoy the public. Most nontraffic noise sources are far enough away from offsite areas that the contribution to offsite noise levels would continue to be small. Noise from explosives detonation and small arms firing would continue to be heard off the site.

4.2.1.4 SRS

Activities associated with the No Action Alternative at SRS would generate criteria, hazardous, and toxic air pollutants. The sources of air pollutants associated with operations include coal-fired boilers, diesel generators that are periodically tested and operated, various process emissions, groundwater air strippers, the consolidated incineration facility, and vehicle emissions. To evaluate the air quality impacts, criteria, hazardous, and toxic pollutant concentrations from the No Action Alternative were compared with the applicable Federal and State standards and guidelines. This comparison is presented as Table 4–4.

Table 4–4. Evaluation of SRS Air Pollutant Concentrations Associated With Alternative 1: No Action; Continued Storage of Plutonium at the Site

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m^3)[a]	No Action Concentration (Fg/m^3)[b]	Percent of Standard or Guideline
Criteria pollutants				
Carbon monoxide	8 hours	10,000	671	6.7
	1 hour	40,000	5,100	13
Nitrogen dioxide	Annual	100	11.4	11
PM_{10}	Annual	50	4.94	9.9
	24 hours	150	85.7	57
Sulfur dioxide	Annual	80	16.7	21
	24 hours	365	222	61
	3 hours	1,300	725	56
Other regulated pollutants				
Total suspended particulates	Annual	75	45.4	61
Hazardous and other toxic compounds				
[Text deleted.]				
Benzene	24 hours	150	20.7	14

[a] The more stringent of the Federal and State standards is presented if both exist for the averaging period.
[b] Total site contribution, including current plutonium storage operations and other approved facilities projected to be in operation in 2005.
Source: EPA 1997a; SCDHEC 1996a.

Maximum air pollutant concentrations from operations at SRS are in compliance with the applicable standards and guidelines for these pollutants of concern. Vehicle emissions associated with No Action activities at SRS would likely decrease somewhat from current emissions because of a decrease in overall site employment during this timeframe.

Impacts of operational noise would be similar to those described for existing conditions in Section 3.5.1.2. Noise from traffic associated with the operation of facilities at SRS is expected to decrease as site employment decreases. Given the distance to the site boundary (about 8.7 km [5.4 mi]), noise emissions from operational activities would not be expected to annoy the public. Nontraffic noise sources are far enough away from offsite areas that the contribution to offsite noise levels would continue to be small.

4.2.1.5 LLNL

Activities associated with the No Action Alternative at LLNL would generate criteria, hazardous, and toxic air pollutants. The types of sources associated with operations include boilers, diesel generators that are periodically tested and operated, various processes, and vehicle emissions. No Action activities would include the continuation of plutonium storage within administrative limits established in the *Supplement Analysis for Continued Operation of LLNL and SNL* (DOE 1999a:vol. I). To evaluate air quality impacts, estimated criteria, hazardous, and toxic pollutant concentrations were compared with the applicable Federal and State standards and guidelines. This comparison is presented as Table 4–5. Maximum air pollutant concentrations from operations at LLNL are in compliance with the applicable guidelines and regulations for the pollutants of concern. Vehicle emissions associated with the No Action activities at LLNL would likely be unchanged.

Table 4–5. Evaluation of LLNL Air Pollutant Concentrations Associated with Altnerative 1: No Action; Continued Storage at the Site

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a] (Fg/m³)	No Action Concentration[b] (Fg/m³)	Percent of Standard or Guideline
Carbon monoxide	8 hours	10,000	69.69	0.70
	1 hour	23,000	235.50	1.0
Nitrogen dioxide	Annual	100	6.08	6.1
	1 hour	470	1,205.75	257
PM_{10}	Annual	30	0.83	2.8
	24 hours	50	16.18	32
Sulfur dioxide	Annual	80	0.08	0.10
	24 hours	105	1.59	1.5
	3 hours	1,300	10.44	0.80
	1 hour	655	16.01	2.4

[a] California Standard as stated in the *Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management* (DOE 1996b:vol. I).

[b] Based on the total pollutant concentrations presented for the Combined Program Impacts in the *Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management* (DOE 1996b:vol. I, 4-366).

Key: LLNL, Lawrence Livermore National Laboratory.

The continuing operations at LLNL would result in no appreciable change from current levels of traffic noise and onsite operational noise. Nontraffic noise sources are far enough away from offsite areas that the contribution to offsite noise levels would continue to be small, and noise operations would not be expected to cause annoyance to the public. However, some noise sources could be close enough to onsite noise-sensitive areas to result in impacts, such as the disturbance of wildlife.

4.2.1.6 LANL

Activities associated with the No Action Alternative at LANL would generate criteria, hazardous, and toxic air pollutants. The types of sources associated with operations include boilers, diesel generators that are periodically tested and operated, various processes, and vehicle emissions. No Action activities would include the continuation of plutonium storage, as discussed in the *Storage and Disposition PEIS* (DOE 1996a:4-366). To evaluate the air quality impacts, criteria, hazardous, and toxic pollutant concentrations from the No Action

Alternative were compared with the applicable Federal and State standards and guidelines. This comparison is presented as Table 4–6. Maximum air pollutant concentrations from operations at LANL are in compliance

Table 4–6. Evaluation of LANL Air Pollutant Concentrations Associated With Alternative 1: No Action; Continued Storage of Plutonium at the Site

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m³)[a]	No Action Concentration (Fg/m³)[b]	Percent of Standard or Guideline
Criteria pollutants				
Carbon monoxide	8 hours	7,800	3,000	38
	1 hour	11,750	5,060	43
Nitrogen dioxide	Annual	74	24	32
	24 hour	147	119	81
PM_{10}	Annual	50	11	22
	24 hours	150	39	26
Sulfur dioxide	Annual	41	26	63
	24 hours	205	171	83
	3 hours	1,025	459	45
Other regulated pollutants				
[Text deleted.]				
Total suspended particulates	Annual	60	14	23
	24 hours	150	48	32

[a] New Mexico Ambient Air Quality Standard as stated in the *Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory* (DOE 1999b).

[b] Based on the total pollutant concentrations presented for the Expanded Operations Alternative in the *Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory* (DOE 1999b).

[Text deleted.]

Key: LANL, Los Alamos National Laboratory.

Source: DOE 1999b.

with the applicable guidelines and regulations for the pollutants of concern. Vehicle emissions associated with No Action activities at LANL would likely be unchanged.

The continuing operations at LANL would result in no appreciable change from current levels of traffic noise and onsite operational noise. Nontraffic noise sources are far enough away from offsite areas that the contribution to offsite noise levels would continue to be small. Given the size of the site, noise emissions from operational activities would not be expected to cause annoyance to the public. However, some noise sources could be close enough to onsite noise-sensitive areas to result in impacts, such as the disturbance of wildlife.

4.2.1.7 RFETS

Activities associated with the No Action Alternative at RFETS would generate criteria, hazardous, and toxic, air pollutants. The types of sources associated with operations include boilers, diesel generators that are periodically tested and operated, various processes, and vehicle emissions. No Action activities would include the continuation of plutonium storage, as discussed in the *Storage and Disposition PEIS* (DOE 1996a:4-346). To evaluate the air quality impacts, criteria, hazardous, and toxic pollutant concentrations from the No Action Alternative were compared with the applicable Federal and State standards and guidelines. This comparison is presented as Table 4–7. During dry and windy conditions, increased PM_{10} and total suspended particulate concentrations could be expected from ongoing construction associated with activities outside the scope of this SPD EIS. Nevertheless, the site should remain in compliance with applicable Federal and State regulations for the air pollutants of concern.

Table 4–7. Evaluation of RFETS Air Pollutant Concentrations Associated With Alternative 1: No Action; Continued Storage of Plutonium at the Site

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m^3)[a]	No Action Concentration (Fg/m^3)[b]	Percent of Standard or Guideline
Criteria pollutants				
Carbon monoxide	8 hours	10,000	145	1.5
	1 hour	40,000	534	1.3
Nitrogen dioxide	Annual	100	4.14	4.1
PM_{10}	Annual	50	0.235	0.5
	24 hours	150	17.4	12.0
Sulfur dioxide	Annual	80	0.295	0.37
	24 hours	365	21.8	6.0
	3 hours	700	64.6	9.2
Other regulated pollutants				
Hydrogen sulfide	1 hour	142	<0.01	0.007
Total suspended particulates	Annual	75	0.284	0.38
	24 hours	150	21.0	14.0

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

[b] Total site contribution, including plutonium storage operations and other approved facilities projected to be in operation in 2005.

Key: RFETS, Rocky Flats Environmental Technology Site.

Source: Adapted from DOE 1996a; EPA 1997a.

Vehicle emissions associated with No Action activities at RFETS would likely be unchanged.

The continuing operations at RFETS would result in no appreciable change from current levels of traffic noise and onsite operational noise. Nontraffic noise sources are far enough away from offsite areas that the contribution to offsite noise levels would continue to be small. Given the size of the site, noise emissions from operational activities would not be expected to annoy the public. However, some noise sources could be close enough to onsite noise-sensitive areas to result in impacts, such as the disturbance of wildlife.

Section 176(c) of the 1990 Clean Air Act (CAA) amendments requires that all Federal actions conform with the applicable State implementation plan. EPA has implemented rules governing determination of the conformity of all Federal actions in nonattainment and maintenance areas. Because the RFETS area is considered a nonattainment area for ozone, PM_{10}, and carbon monoxide, proposed actions at this site must be evaluated for applicability of the conformity regulations. The No Action Alternative would effect no change in direct or indirect emissions from RFETS. Accordingly, there is no need for a RFETS conformity determination relative to this alternative.

4.2.2 Waste Management

4.2.2.1 Hanford

Wastes generated by activities associated with storage of surplus plutonium at Hanford are a portion of the existing site waste generation rates presented in Section 3.2.2.1. Because the rates of waste generation from continued storage of surplus plutonium at Hanford should not appreciably change from current rates, impacts on waste management facilities would not change from those currently experienced. Because the current waste generation rates from the storage of surplus plutonium at Hanford are part of the planning basis for Hanford, continued storage should not have a major impact on waste management activities at the site.

Depending in part on decisions in the RODs for the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (WM PEIS), wastes could be treated and disposed of on the site or at other DOE sites or commercial facilities. According to the ROD for transuranic (TRU) waste issued on January 20, 1998, TRU and mixed TRU waste would be certified on the site to current Waste Isolation Pilot Plant (WIPP) waste acceptance criteria and shipped to WIPP for disposal. Shipment of TRU waste from Hanford to WIPP is expected to begin in 2000 (Aragon 1999). 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 low-level waste (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 1997b).

4.2.2.2 INEEL

Wastes generated by activities associated with the storage of surplus plutonium at INEEL are a portion of the existing site waste generation rates presented in Section 3.3.2.1. Because the rates of waste generation from continued storage of surplus plutonium at INEEL should not appreciably change from current rates, impacts on waste management facilities would not change from those currently experienced. Because the current waste generation rates from the storage of surplus plutonium at INEEL are part of the planning basis for INEEL, continued storage should not have a major impact on waste management activities at the site.

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. According to 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. The first shipment of TRU waste from INEEL to WIPP was made in April 1999. 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 INEEL are described in the *DOE Programmatic Spent Nuclear Fuel Management and INEL Environmental Restoration and Waste Management Programs Final EIS* (DOE 1995a).

4.2.2.3 Pantex

Wastes generated by activities associated with the storage of surplus plutonium pits at Pantex are a portion of the existing site waste generation rates presented in Section 3.4.2.1. Because the rates of waste generation from continued storage of surplus plutonium at Pantex should not appreciably change from current rates, impacts on waste management facilities would not change from those currently experienced. Because the current waste generation rates from the storage of surplus plutonium at Pantex are part of the planning basis for Pantex, continued storage should not have a major impact on waste management activities at the site.

Depending in part on decisions in the RODs for the WM PEIS, wastes could be treated on the site, or treated and disposed of off the site in DOE or commercial facilities. 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 assumes that LLW, mixed LLW, and nonhazardous waste would be treated, stored, and disposed of in accordance with current site practices. TRU waste would not be routinely generated. Impacts of treatment and storage of radioactive, hazardous, mixed, and nonhazardous wastes at Pantex are described in the *Final EIS for the Continued Operation of Pantex and Associated Storage of Nuclear Weapon Components* (DOE 1996c). LLW from Pantex is currently shipped to the Nevada Test Site (NTS) for disposal. 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 1996d).

4.2.2.4 SRS

The No Action Alternative at SRS involves the continued storage of surplus plutonium in existing facilities, with materials moved to APSF, if built. Impacts on the waste management infrastructure associated with construction and operation of APSF are described in the *Final EIS Interim Management of Nuclear Materials* (DOE 1995b:2-60). That EIS indicates that there would be no major impacts on SRS waste management systems from the storage of plutonium at APSF, if built.

Wastes generated by activities associated with the storage of surplus plutonium at SRS are a portion of the existing site waste generation rates presented in Section 3.5.2.1. Because the rates of waste generation from continued storage of surplus plutonium at SRS should not appreciably change from current rates, impacts on waste management facilities would not change from those currently experienced. Because the current waste generation rates from the storage of surplus plutonium at SRS are part of the planning basis for SRS, continued storage should not have a major impact on waste management activities at the site.

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. According to 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. Shipment of TRU waste from SRS to WIPP is expected to begin in 2000 (Aragon 1999). 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 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 1995c).

4.2.2.5 LLNL

Waste generated by activities associated with the storage of surplus plutonium at LLNL would not be expected to increase existing site waste generation rates. Because the current waste generation rates from the storage of surplus plutonium at LLNL are part of the planning basis for LLNL, continued storage would not be expected to have a major impact on waste management activities at the site.

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. According to 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, nonhazardous 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 waste at LLNL are described in the *Supplement Analysis for Continued Operation of LLNL and SNL* (DOE 1999a:vol. I).

4.2.2.6 LANL

Waste generated by activities associated with the storage of surplus plutonium at LANL are a portion of the existing site waste generation rates presented in Section 3.6.4.2 of Chapter 3. Because the rates of waste generation from continued storage of surplus plutonium at LANL are not expected to appreciably change from current rates, impacts on waste management facilities would not change from those currently experienced. Because the current waste generation rates from the storage of surplus plutonium at LANL are part of the planning basis for LANL, continued storage would not be expected to have a major impact on waste management activities at the site.

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. According to 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. The first shipment of TRU waste from LANL to WIPP was made in March 1999 (Richardson 1999). Per the ROD for hazardous waste issued on August 5, 1998, nonhazardous 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 waste at LANL are described in the *Site-Wide EIS for the Continued Operation of Los Alamos National Laboratory* (DOE 1999b).

4.2.2.7 RFETS

Waste generated by activities associated with the storage of surplus nonpit plutonium at RFETS are a portion of the existing site waste generation rates. Because the rates of waste generation from continued storage of surplus nonpit plutonium at RFETS are not expected to appreciably change from current rates, impacts on waste management facilities would not change from those currently experienced. Because the current waste generation rates from the storage of surplus nonpit plutonium at RFETS are part of the planning basis for RFETS, continued storage would not be expected to have a major impact on waste management activities at the site. RFETS has stored plutonium since 1956 and is adequately equipped to manage the wastes from the storage mission using the existing waste management infrastructure (DOE 1996a:4-359).

The nuclear weapons mission of the RFETS was terminated in 1994. The only remaining mission of the site is cleanup and remediation. The Rocky Flats Cleanup Agreement establishes a legally binding relationship between DOE, EPA, and the Colorado Department of Public Health and Environment that governs cleanup of the site (DOE 1998b:48). Waste generated by cleanup activities is expected to be much greater than wastes generated from continued storage of surplus nonpit plutonium. The impacts of the wastes generated by site cleanup activities would be addressed in individual remedial action feasibility studies (DOE 1996a:4-359).

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. According to 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. The first shipment of TRU waste from RFETS to WIPP was made in June 1999. 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.

4.2.3 Socioeconomics

Under the No Action Alternative, the existing storage facilities at the candidate sites would remain operational. No new employment or in-migration of workers would be required. Thus, there would be no additional impacts on the socioeconomic conditions near the sites.

4.2.4 Human Health Risk

4.2.4.1 Hanford

Radiological Impacts. Table 4–8 presents the dose to the population within 80 km (50 mi) from storage in the year 2030 and the projected number of fatal cancers in this population from 50 years of storage as shown in the *Storage and Disposition PEIS.* Included in the table are the calculated annual doses to the maximally exposed member of the public and the average exposed member of the public from the continued storage of plutonium, and a projection of the fatal cancer risk to these individuals from 50 years of storage. An annual dose of 0.047 person-rem would be incurred by the population of 621,000. The corresponding number of fatal cancers in this population from 50 years of storage would be 1.2×10^{-3}. An annual dose of 4.1×10^{-4} mrem has been calculated for the maximally exposed individual (MEI). From 50 years of storage, the corresponding risk of fatal cancer to this individual would be 1.0×10^{-8}. To put these doses into perspective, comparisons with natural background radiation doses are also provided in the table. The storage doses are much lower than those from total site operations.

Table 4–8. Potential Radiological Impacts on the Public of Alternative 1: No Action; Continued Storage of Plutonium at Hanford

Population dose within 80 km for year 2030	
Atmospheric release pathway (person-rem)	0.047
Liquid release pathway (person-rem)	0
Atmospheric and liquid release pathways combined (person-rem)	0.047
Percent of natural background[a]	2.5×10^{-5}
50-year fatal cancers	1.2×10^{-3}
Annual dose to the maximally exposed individual	
Atmospheric release pathway (mrem)	4.1×10^{-4}
Total liquid release pathway (mrem)	0
Atmospheric and liquid release pathways combined (mrem)	4.1×10^{-4}
Percent of natural background[a]	1.4×10^{-4}
50-year fatal cancer risk	1.0×10^{-8}
Annual dose to the average exposed individual within 80 km[b]	
Atmospheric and liquid release pathways combined (mrem)	7.6×10^{-5}
50-year fatal cancer risk	1.9×10^{-9}

[a] The annual natural background radiation level at Hanford is 300 mrem for the average individual; the population within 80 km (50 mi) in 2030 would receive 186,300 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 2030 (621,000).

Source: DOE 1996a.

Under the No Action Alternative, the annual average dose to a worker involved in storage operations and the annual dose to the total storage workforce would be 250 mrem and 46 person-rem, respectively, as shown in Table 4–9. The risk of fatal cancer to the average worker from 50 years of storage operations would be 5.0×10^{-3}, and the projected number of fatal cancers in the total storage workforce from 50 years of operation would be 0.92.

Table 4–9. Potential Radiological Impacts on Workers of Alternative 1: No Action; Continued Storage of Plutonium at Hanford

Total dose (person-rem/yr)	46
50-year fatal cancers	0.92
Average worker dose (mrem/yr)	250
50-year fatal cancer risk	5.0×10^{-3}

Note: Under the No Action Alternative, 225 in-plant workers (including 185 monitored for radiation exposure) would be required to operate the storage facility. The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995d). However, the maximum dose to a worker involved in storage operations would be kept below 500 mrem/yr. Based on a review of worker doses associated with similar operations, an average worker dose of 250 mrem/yr has been conservatively assumed. An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.
Source: DOE 1996a.

Hazardous Chemical Impacts. Hazardous chemical impacts of the No Action Alternative would be the same as those of current site operations. The Hazard Index for the MEI from normal operations at Hanford would be 6×10^{-5}, which indicates that adverse, noncancer health effects should not occur; the cancer risk is expected to be zero. The Hazard Index for the onsite worker would be 4×10^{-3}, which also suggests that noncancer effects are not expected; the cancer risk is expected to be zero (DOE 1996a:4-62).

4.2.4.2 INEEL

Radiological Impacts. Table 4–10 presents the dose to the population within 80 km (50 mi) from storage in the year 2030 and the projected number of fatal cancers in this population from 50 years of storage as shown in the *Storage and Disposition PEIS*. Included in the table are the calculated annual doses to the maximally exposed member of the public and the average exposed member of the public from the continued storage of plutonium, and a projection of the fatal cancer risk to these individuals from 50 years of storage.

An annual dose of 7.6×10^{-5} person-rem would be incurred by the population of 269,000. The corresponding number of fatal cancers in this population from 50 years of storage would be 1.9×10^{-6}. An annual dose of 1.4×10^{-5} mrem has been calculated for the MEI. From 50 years of storage, the corresponding risk of fatal cancer to this individual would be 3.5×10^{-10}. To put these doses into perspective, comparisons with natural background radiation doses are also provided in the table. The storage doses are much lower than those from total site operations.

Under the No Action Alternative, the annual average dose to a worker involved in storage operations and the annual dose to the total storage workforce would be 26 mrem and 1.5 person-rem, respectively, as shown in Table 4–11. The associated risk of fatal cancer to the average worker from 50 years of storage operations would be 5.1×10^{-4}, and the projected number of fatal cancers in the total storage workforce from 50 years of operation would be 0.029.

Hazardous Chemical Impacts. Hazardous chemical impacts of the No Action Alternative would be the same as those of current site operations. Thus, the Hazard Index for the MEI at INEEL from normal operations would be 2×10^{-2}, which indicates that adverse, noncancer health effects should not occur; the cancer risk is expected to be 3.6×10^{-6}. The Hazard Index for the onsite worker would be 0.2, which also suggests that noncancer effects are not expected; the cancer risk is expected to be 8×10^{-4} (DOE 1996a:4-163).

Table 4–10. Potential Radiological Impacts on the Public of Alternative 1: No Action; Continued Storage of Plutonium at INEEL

Population dose within 80 km for year 2030	
Atmospheric release pathway (person-rem)	7.6×10^{-5}
Liquid release pathway (person-rem)	0
Atmospheric and liquid release pathways combined (person-rem)	7.6×10^{-5}
Percent of natural background[a]	7.8×10^{-8}
50-year fatal cancers	1.9×10^{-6}
Annual dose to the maximally exposed individual	
Atmospheric release pathway (mrem)	1.4×10^{-5}
Total liquid release pathway (mrem)	0
Atmospheric and liquid release pathways combined (mrem)	1.4×10^{-5}
Percent of natural background[a]	3.9×10^{-6}
50-year fatal cancer risk	3.5×10^{-10}
Annual dose to the average exposed individual within 80 km[b]	
Atmospheric and liquid release pathways combined (mrem)	2.8×10^{-7}
50-year fatal cancer risk	7.1×10^{-12}

[a] The annual natural background radiation level at INEEL is 361 mrem for the average individual; the population within 80 km (50 mi) in 2030 would receive 97,100 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 2030 (269,000).

Source: DOE 1996a; Mitchell et al. 1997.

Table 4–11. Potential Radiological Impacts on Workers of Alternative 1: No Action; Continued Storage of Plutonium at INEEL

Total dose (person-rem/yr)	1.5
50-year fatal cancers	0.029
Average worker dose (mrem/yr)	26
50-year fatal cancer risk	5.1×10^{-4}

Note: No Action Alternative storage worker doses are based on an average of the 1994 to 1996 measured doses for 57 workers totaling 1.5 person-rem/yr deep dose (assumed whole body). The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995d). However, the maximum dose to a worker involved in storage operations would be kept below 500 mrem/yr. Based on a review of worker doses associated with similar operations, an average worker dose of 26 mrem/yr has been conservatively assumed. An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1996a.

4.2.4.3 Pantex

Radiological Impacts. Table 4–12 presents the dose to the population within 80 km (50 mi) from storage in the year 2030 and the projected number of fatal cancers in this population from 50 years of storage. To support this analysis, it was assumed that the gasket on the AL–R8 sealed insert (SI) storage container would need to be replaced after 30 years. This activity is not expected to result in any additional dose to the public, but would result in an additional dose to those workers involved with the gasket replacement activity. Included in the table are the calculated annual doses to the maximally exposed member of the public and the average exposed member of the public from the continued storage of plutonium, and a projection of the fatal cancer risks to these individuals from 50 years of storage. An annual dose of 6.3×10^{-6} person-rem would be incurred by the

Table 4–12. Potential Radiological Impacts on the Public of Alternative 1: No Action; Continued Storage of Plutonium at Pantex

Population dose within 80 km for year 2030	
Atmospheric release pathway (person-rem)	(a)
Liquid release pathway (person-rem)	0
Atmospheric and liquid release pathways combined (person-rem)	6.3×10^{-6}
Percent of natural background[b]	5.4×10^{-9}
50-year fatal cancers	1.6×10^{-7}
Annual dose to the maximally exposed individual	
Atmospheric release pathway (mrem)	(a)
Total liquid release pathway (mrem)	0
Atmospheric and liquid release pathways combined (mrem)	1.8×10^{-8}
Percent of natural background[b]	5.4×10^{-9}
50-year fatal cancer risk	4.5×10^{-13}
Annual dose to the average exposed individual within 80 km[c]	
Atmospheric and liquid release pathways combined (mrem)	1.8×10^{-8}
50-year fatal cancer risk	4.5×10^{-13}

[a] The atmospheric releases for the No Action Alternative would not be measurable above background radiation. The atmospheric and liquid release pathways combined was calculated with measured data from direct doses outside the facility.

[b] The annual natural background radiation level at Pantex is 332 mrem for the average individual; the population within 80 km (50 mi) in 2030 would receive 116,200 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 2030 (350,000).

Key: RFETS, Rocky Flats Environmental Technology Site.

Note: The quantity of plutonium pits at Pantex to be stored in upgraded facilities in Zone 12 would be slightly increased by the addition of pits from RFETS. The overall effect of moving Pantex and RFETS pits from Zone 4 to upgraded Zone 12 storage facilities would result in lower potential releases of radioactive materials (and hence, impacts) to the public. All values shown in the above table are associated with Zone 4 releases only; therefore, they serve as upper bounding estimates for potential impacts incurred from Zone 12 releases (i.e., potential impacts from Zone 12 releases would not exceed the values presented above). However, DOE is considering leaving the repackaged surplus pits in Zone 4 at Pantex for long-term storage. An appropriate environmental review will be conducted when the specific proposal for this change has been determined (e.g., whether additional magazines need to be air-conditioned). The analysis in this document assumes that the surplus pits are stored in Zone 12 in accordance with the ROD for the *Storage and Disposition PEIS*.

Source: DOE 1996a.

population of 350,000. The corresponding number of fatal cancers in this population from 50 years of storage would be 1.6×10^{-7}. An annual dose of 1.8×10^{-8} mrem has been calculated for the MEI. From 50 years of storage, the corresponding risk of fatal cancer to this individual would be 4.5×10^{-13}. To put these doses into perspective, comparisons with natural background radiation doses are also provided in the table. The storage doses are much lower than those from total site operations.

Under the No Action Alternative, the annual average dose to a worker involved in storage operations and the annual dose to the total storage workforce would be 116 mrem and 3 person-rem, respectively. In addition, gasket replacement activities (replacing up to 20,000 gaskets) would result in an additional dose of 160 person-rem to the workforce. Assuming that 2,000 storage containers were redone each year for 10 years, these workers would receive an average dose of 320 mrem/yr. The projected number of fatal cancers in the packaging workforce from 10 years of gasket replacements would be 0.064. As shown in Table 4–13, the associated risk of fatal cancer to the average worker from 50 years of storage operations would be 2.3×10^{-3}, and the projected number of fatal cancers in the total storage workforce from 50 years of operation would be 0.06.

Table 4–13. Potential Radiological Impacts on Workers of Alternative 1: No Action; Continued Storage of Plutonium at Pantex

Impact	Storage Worker	Packaging Worker
Total dose (person-rem/yr)	3	16
50-year fatal cancers	0.060	NA
10-year fatal cancers	NA	0.064
Average worker dose (mrem/yr)	116	320
50-year fatal cancer risk	2.3×10^{-3}	NA
10-year fatal cancer risk	NA	1.3×10^{-3}

Key: RFETS, Rocky Flats Environmental Technology Site; NA, not applicable.

Note: Under the No Action Alternative (with pits from RFETS), 25 in-plant workers monitored for radiation exposure would be required to operate the storage facility. Over a 10-year period, an additional 50 workers per year would be required to replace gaskets in all the AL–R8 sealed inserts to be used for the entire storage period. The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995d). However, the maximum dose to a worker involved in storage operations would be kept below 500 mrem/yr. An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Hazardous Chemical Impacts. Modification of Zone 12[4] for continued storage would slightly reduce the hazardous chemical impacts of normal operations. The Hazard Index for the MEI would be 6×10^{-3}, which indicates that adverse, noncancer effects should not occur; the cancer risk is expected to be 1×10^{-8}. The Hazard Index for the onsite worker would be 6×10^{-3}, which also suggests that noncancer effects are not expected; the cancer risk is expected to be 5×10^{-7} (DOE 1996a:4-220).

4.2.4.4 SRS

[4] DOE is considering leaving the repackaged surplus pits in Zone 4 at Pantex for long-term storage. An appropriate environmental review will be conducted when the specific proposal for this change has been determined (e.g., whether additional magazines need to be air-conditioned). The analysis in this document assumes that the surplus pits are stored in Zone 12 in accordance with the ROD for the *Storage and Disposition PEIS*.

Radiological Impacts. Table 4–14 presents the dose to the population within 80 km (50 mi) from storage in the year 2030 and the projected number of fatal cancers in this population from 50 years of storage as shown in the *Storage and Disposition PEIS*. Included in the table are the calculated annual doses to the maximally exposed member of the public and the average exposed member of the public from the continued storage of plutonium, and a projection of the fatal cancer risks to these individuals from 50 years of storage. An annual dose of 2.9×10^{-4} person-rem would be incurred by the population of 893,000. The corresponding number of fatal cancers in this population from 50 years of storage would be 7.2×10^{-6}. An annual dose of 6.8×10^{-6} mrem has been calculated for the MEI. From 50 years of storage, the corresponding risk of fatal cancer to this individual would be 1.7×10^{-10}. To put these doses into perspective, comparisons with natural background radiation doses are also provided in the table.

Under the No Action Alternative, the annual average dose to a worker involved in storage operations and the annual dose to the total storage workforce would be 250 mrem and 7.5 person-rem, respectively, as shown in Table 4–15. The associated risk of fatal cancer to the average worker from 50 years of storage operations would be 5.0×10^{-3}, and the projected number of fatal cancers in the total storage workforce from 50 years of operation would be 0.15.

Table 4–14. Potential Radiological Impacts on the Public of Alternative 1: No Action; Continued Storage of Plutonium at SRS

Population dose within 80 km for year 2030	
Atmospheric release pathway (person-rem)	2.8×10^{-4}
Total liquid release pathway (person-rem)[a]	1.0×10^{-5}
Atmospheric and liquid release pathways combined (person-rem)	2.9×10^{-4}
Percent of natural background[b]	1.1×10^{-7}
50-year fatal cancers	7.2×10^{-6}
Annual dose to the maximally exposed individual	
Atmospheric release pathway (mrem)	6.2×10^{-6}
Total liquid release pathway (mrem)[a]	6.1×10^{-7}
Atmospheric and liquid release pathways combined (mrem)	6.8×10^{-6}
Percent of natural background[b]	2.3×10^{-6}
50-year fatal cancer risk	1.7×10^{-10}
Annual dose to the average exposed individual within 80 km[c]	
Atmospheric and liquid release pathways combined (mrem)	3.2×10^{-7}
50-year fatal cancer risk	8.0×10^{-12}

[a] Includes the drinking water pathway.

[b] The annual natural background radiation level at SRS is 295 mrem for the average individual; the population within 80 km (50 mi) in 2030 would receive 263,000 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 2030 (893,000).

Source: DOE 1996a.

Table 4–15. Potential Radiological Impacts on Workers of Alternative 1: No Action; ContinuedStorage of Plutonium at SRS

Total dose (person-rem/yr)	7.5
50-year fatal cancers	0.15
Average worker dose (mrem/yr)	250
50-year fatal cancer risk	5.0×10^{-3}

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995d). However, the maximum dose to a worker involved in storage operations would be kept below 500 mrem/yr. Based on a review of worker doses associated with similar operations, an average worker dose of 250 mrem/yr has been conservatively assumed. An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.
Source: DOE 1996a.

Hazardous Chemical Impacts. Hazardous chemical impacts of the No Action Alternative would be the same as those for current site operations. The Hazard Index for the MEI at SRS would be 5×10^{-3}, which indicates that adverse, noncancer health effects should not occur; the cancer risk is expected to be 1×10^{-7}. The Hazard Index for the onsite worker would be 1.2, which suggests that onsite workers may experience adverse health effects as a result of the exposures; the cancer risk is expected to be 2×10^{-4} (DOE 1996a:4-324).

4.2.4.5 LLNL

Radiological Impacts. Table 4–16 presents the dose to the population within 80 km (50 mi) from storage in the year 2030 and the projected number of fatal cancers in this population from 50 years of storage. The table also includes the calculated annual doses to the maximally exposed member of the public and the average

Table 4–16. Potential Radiological Impacts on the Public of Alternative 1: No Action; Continued Storage of Plutonium at LLNL[a]

Population dose within 80 km for year 2030	
Atmospheric release pathway (person-rem)	0.0067
Total liquid release pathway (person-rem)[a]	0
Atmospheric and liquid release pathways combined (person-rem)	0.0067
Percent of natural background[b]	2.2×10^{-7}
50-year fatal cancers	1.7×10^{-4}
Annual dose to the maximally exposed individual	
Atmospheric release pathway (mrem)	3.1×10^{-4}
Total liquid release pathway (mrem)[a]	0
Atmospheric and liquid release pathways combined (mrem)	3.1×10^{-4}
Percent of natural background[b]	1.0×10^{-4}
50-year fatal cancer risk	7.8×10^{-9}
Annual dose to the average exposed individual within 80 km[c]	
Atmospheric and liquid release pathways combined (mrem)	6.6×10^{-7}
50-year fatal cancer risk	1.7×10^{-11}

[a] To conservatively estimate "no action" impacts at LLNL, "Upgraded Pu Storage Facility" releases were extracted from DOE 1996a:M-15.

[b] The annual natural background radiation level at LLNL is 300 mrem for the average individual; the population within 80 km (50 mi) in 2030 would receive 3,040,500 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 2030 (10,135,000).

Key: LLNL, Lawrence Livermore National Laboratory.

Source: DOE 1996a:M-15.

exposed member of the public from continued storage of plutonium, and projects the fatal cancer risk to these individuals from 50 years of storage. An annual dose of 0.0067 person-rem would be incurred by the population of 10,135,000. The corresponding number of fatal cancers in this population from 50 years of storage would be 1.7×10^{-4}. An annual dose of 3.1×10^{-4} mrem is calculated for the MEI. From 50 years of storage, the corresponding risk of fatal cancer to this individual would be 7.8×10^{-9}. To put these doses into perspective, comparisons with natural background radiation doses are included in the table.

Under the No Action Alternative, the annual average dose to a worker involved with storage operations and the annual dose to the total storage workforce would be 250 mrem and 25 person-rem, respectively, as shown in Table 4–17. The risk of fatal cancer to the average worker from 50 years of storage operations would be 5.0×10^{-3}, and the projected number of fatal cancers in the total storage workforce from 50 years of operation would be 0.50.

Hazardous Chemical Impacts. The hazardous chemical impacts of the No Action Alternative would be the same as those of current site operations. The Hazard Index for the MEI from normal operations at LLNL would be 1.13, which suggests that the maximally exposed member of the public may experience adverse health effects as a result of exposures; the cancer risk is expected to be 5×10^{-7}. The Hazard Index for the onsite worker would be 2.4, which suggests that onsite workers may also experience adverse health effects as a result of the exposures; the cancer risk is expected to be 5×10^{-6} (DOE 1996b:4-392).

4.2.4.6 LANL

Radiological Impacts. Table 4–18 presents the dose to the population within 80 km (50 mi) from storage in the year 2030 and the projected number of fatal cancers in this population from 50 years of storage as shown

Table 4–17. Potential Radiological Impacts on Workers of Alternative 1: No Action; Continued Storage of Plutonium at LLNL

Total dose (person-rem/yr)	25
50-year fatal cancers	0.50
Average worker dose (mrem/yr)	250
50-year fatal cancer risk	5.0×10^{-3}

Key: LLNL, Lawrence Livermore National Laboratory.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995d). However, the maximum dose to a worker involved in storage operations would be kept below 500 mrem/yr. Based on a review of worker doses associated with similar operations, an average worker dose of 250 mrem/yr has been conservatively assumed. An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1996a:M-16.

Table 4–18. Potential Radiological Impacts on the Public of Alternative 1: No Action; Continued Storage of Plutonium at LANL

Population dose within 80 km for year 2030	
Atmospheric release pathway (person-rem)	2.7
Liquid release pathway (person-rem)	~0
Atmospheric and liquid release pathways combined (person-rem)	2.7
Percent of natural background[a]	2.8×10^{-3}
50-year fatal cancers	0.068
Annual dose to the maximally exposed individual[b]	
Atmospheric release pathway (mrem)	5.7
Total liquid release pathway (mrem)	0.80
Atmospheric and liquid release pathways combined (mrem)	6.5
Percent of natural background[a]	1.9
50-year fatal cancer risk	1.6×10^{-4}
Annual dose to the average exposed individual within 80 km[c]	
Atmospheric release pathway (mrem)	9.7×10^{-3}
50-year fatal cancer risk	2.4×10^{-7}

[a] The annual natural background radiation level at LANL is 342 mrem for the average individual; the population within 80 km (50 mi) in 2030 would receive 95,000 person-rem.

[b] Although the maximally exposed individual receives a dose, no population groups are exposed to any liquid pathways.

[c] Obtained by dividing the population dose by the number of people projected to live within 80 km (50 mi) of the site in 2030 (278,000).

Key: LANL, Los Alamos National Laboratory.

Source: DOE 1996a:4-376.

in the *Storage and Disposition PEIS*. The table also includes the calculated annual doses to the maximally exposed member of the public and the average exposed member of the public from continued storage of plutonium, and projects the fatal cancer risk to these individuals from 50 years of storage. An annual dose of

2.7 person-rem would be incurred by the population of 278,000. The corresponding number of fatal cancers in this population from 50 years of storage would be 0.068. An annual dose of 6.5 mrem is calculated for the MEI. From 50 years of storage, the corresponding risk of fatal cancer to this individual would be 1.6×10^{-4}.

To put these doses into perspective, comparisons with natural background radiation doses are included in the table.

Under the No Action Alternative, the annual average dose to a worker involved with storage operations and the annual dose to the total storage workforce would be 250 mrem and 12.5 person-rem, respectively, as shown in Table 4–19. The risk of fatal cancer to the average worker from 50 years of storage operations would be 5.0×10^{-3}, and the projected number of fatal cancers in the total storage workforce from 50 years of operation would be 0.25.

Table 4–19. Potential Radiological Impacts on Workers of Alternative 1: No Action; Continued Storage of Plutonium at LANL

Total dose (person-rem/yr)	12.5
50-year fatal cancers	0.25
Average worker dose (mrem/yr)	250
50-year fatal cancer risk	5.0×10^{-3}

Key: LANL, Los Alamos National Laboratory.
Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995d). It is assumed that there are 50 workers badged with dosimeters to monitor radiation exposure, with a conservatively estimated average dose of 250 mrem/yr per worker. An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.
Source: DOE 1996a:4-377.

Hazardous Chemical Impacts. The hazardous chemical impacts of the No Action Alternative would be the same as those of current site operations. The Hazard Index for the MEI from normal operations at LANL would be 3×10^{-2}, which indicates that adverse, noncancer health effects should not occur; the cancer risk is expected to be 5×10^{-6}. The Hazard Index for the onsite worker would be 5×10^{-2}, which also suggests that noncancer effects are not expected; the cancer risk is expected to be 2×10^{-4} (DOE 1996a:4-377).

4.2.4.7 RFETS

Radiological Impacts. Table 4–20 presents the dose to the population within 80 km (50 mi) from storage in the year 2030 and the projected number of fatal cancers in this population from 50 years of storage as shown in the *Storage and Disposition PEIS*. The table also includes the calculated annual doses to the maximally exposed member of the public and the average exposed member of the public from continued storage of plutonium, and projects the fatal cancer risk to these individuals from 50 years of storage. An annual dose of 0.10 person-rem would be incurred by the population of 3,116,000. The corresponding number of fatal cancers in this population from 50 years of storage would be 2.5×10^{-3}. An annual dose of 0.48 mrem is calculated for the MEI. From 50 years of storage, the corresponding risk of fatal cancer to this individual would be 1.2×10^{-5}. To put these doses into perspective, comparisons with natural background radiation doses are included in the table.

Under the No Action Alternative, the annual average dose to a worker involved with storage operations and the annual dose to the total storage workforce would be 250 mrem and 25 person-rem, respectively, as shown in

Table 4–21. The risk of fatal cancer to the average worker from 50 years of storage operations would be 5.0×10^{-3}, and the projected number of fatal cancers in the total storage workforce from 50 years of operation would be 0.50.

Table 4–20. Potential Radiological Impacts on the Public of Alternative 1: No Action; Continued Storage of Plutonium at RFETS

Population dose within 80 km for year 2030	
Atmospheric release pathway (person-rem)	0.10
Liquid release pathway (person-rem)	0
Atmospheric and liquid release pathways combined (person-rem)	0.10
Percent of natural background[a]	9.1×10^{-6}
50-year fatal cancers	2.5×10^{-3}
Annual dose to the maximally exposed individual	
Atmospheric release pathway (mrem)	0.13
Total liquid release pathway (mrem)	0.35
Atmospheric and liquid release pathways combined (mrem)	0.48
Percent of natural background[a]	0.14
50-year fatal cancer risk	1.2×10^{-5}
Annual dose to the average exposed individual within 80 km[b]	
Atmospheric release pathway (mrem)	3.2×10^{-5}
50-year fatal cancer risk	8.0×10^{-10}

[a] The annual natural background radiation level at RFETS is 353 mrem for the average individual; the population within 80 km (50 mi) in 2030 would receive 1,100,000 person-rem.

[b] Obtained by dividing the population dose by the number of people projected to live within 80 km (50 mi) of the site in 2030 (3,116,000).

Key: RFETS, Rocky Flats Environmental Technology Site.

Source: DOE 1996a:4-356.

Table 4–21. Potential Radiological Impacts on Workers of Alternative 1: No Action; Continued Storage of Plutonium at RFETS

Total dose (person-rem/yr)	25
50-year fatal cancers	0.50
Average worker dose (mrem/yr)	250
50-year fatal cancer risk	5.0×10^{-3}

Key: RFETS, Rocky Flats Environmental Technology Site.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995d). It is assumed that there are 100 workers badged with dosimeters to monitor radiation exposure, with a conservatively estimated average dose of 250 mrem/yr per worker. An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1996a:4-357.

Hazardous Chemical Impacts. The hazardous chemical impacts of the No Action Alternative would be the same as those of current site operations. The Hazard Index for the MEI from normal operations at RFETS would be 1×10^{-3}, which indicates that adverse, noncancer health effects should not occur; the cancer risk is expected to be 2×10^{-8}. The Hazard Index for the onsite worker would be 1×10^{-2}, which also suggests that noncancer effects are not expected; the cancer risk is expected to be 2×10^{-6} (DOE 1996a:4-357).

4.2.5 Facility Accidents

The facilities involved in plutonium storage under the No Action Alternative are operated in accordance with DOE orders, which ensure that the risk to the public of prompt fatalities due to accidents, or cancer fatalities due to operations are minimized. The safety of workers and the public from accidents at existing facilities is also controlled by Technical Safety Requirements specified in detail in a Safety Analysis Report (SAR) or a Basis for Interim Operations (BIO) document prepared and maintained specifically for a facility or a process within a facility. Under these controls, any change in approved operations or facilities could curtail operations until it can be established that worker and public safety has not been compromised.

4.2.5.1 Hanford

As discussed in the *Storage and Disposition PEIS* (DOE 1996a:4-62–4-63), the *Plutonium Finishing Plant Safety Analysis Report* (WHC-SD-CP-SAR-021) analyzes a wide spectrum of accidents that are primarily associated with processing rather than vault storage. This is because a release from a vault would require more severe accident conditions than are normally analyzed in a SAR. The accidents in the SAR consist of potential process accidents such as fires, explosions, and criticality as well as an externally initiated aircraft crash and earthquake. An estimate of the effects of potential accidents in the existing storage vault at Hanford can be derived from similar storage accidents that have been postulated for an upgraded storage facility. A severe-consequence, low-frequency accident for storage under the No Action Alternative would be a beyond-design-basis earthquake. If this accident were to occur, there would be an estimated 0.12 LCF in the offsite population within 80 km (50 mi). The estimated frequency of the earthquake with sufficient damage to cause a release is 1.0×10^{-7} per year. Consistent with the treatment of beyond-design-basis earthquake in this SPD EIS, this corresponds to a frequency in the range from extremely unlikely to beyond extremely unlikely. For the MEI and noninvolved worker, there would be latent cancer fatality (LCF) probabilities of 1.7×10^{-5} and 2.2×10^{-3}, respectively. [Text deleted.]

4.2.5.2 INEEL

As discussed in the *Storage and Disposition PEIS* (DOE 1996a:4-163), the *Final Safety Analysis Report for the Fuel Manufacturing Facility, Building 704* (ANL-IFR-57) and the *Final Safety Analysis Report of the Zero Power Plutonium Reactor Facility* (ANL-7471) at ANL–W analyzed a wide spectrum of design basis accidents. These studies indicate that these facilities are low hazard based on the effects of design basis accidents. However, these studies do not normally analyze the effects of severe accidents. An estimate of the effects of potential severe accidents in the existing storage vault at INEEL can be derived from similar storage accidents that have been postulated for an upgraded storage facility. A severe-consequence, low-frequency accident for storage under the No Action Alternative would be a beyond-design-basis earthquake. If this accident were to occur, there would be an estimated 0.33 LCF in the offsite population within 80 km (50 mi). The estimated frequency of the earthquake with sufficient damage to cause a release is 1.0×10^{-7} per year. Consistent with the treatment of beyond-design-basis earthquake in this SPD EIS, this corresponds to a frequency in the range from extremely unlikely to beyond extremely unlikely. For the MEI and noninvolved worker, there would be LCF probabilities of 9.8×10^{-4} and 2.0×10^{-2}, respectively. [Text deleted.]

4.2.5.3 Pantex

Under the No Action Alternative, surplus plutonium pits would be stored at Pantex in upgraded facilities in Zone 12 South.[5] The *Storage and Disposition PEIS* (DOE 1996a:4-221–4-222), postulates a set of accidents involving upgraded storage of surplus plutonium pits that could result in releases of plutonium impacting noninvolved workers and the offsite population. For that set of accidents, the maximum consequences would be from a beyond-design-basis earthquake (estimated probability of occurrence: 1.0×10^{-7} per year), which would cause an estimated 0.26 LCF in the population within 80 km (50 mi) of the Pantex site. In terms of the treatment of beyond-design-basis earthquakes in this SPD EIS, that figure corresponds to a frequency in the range of extremely unlikely to beyond extremely unlikely. For the MEI and the noninvolved worker, the LCF probabilities would be 1.7×10^{-3} and 4.7×10^{-3}, respectively. [Text deleted.] As described in the *Pantex Sitewide EIS* (DOE 199c:4-272-4-291), an aircraft crash into Zone 12 could result in plutonium dispersal due to either explosion or fire. The frequencies of an aircraft crash resulting in either of these plutonium dispersal events are beyond extremely unlikely. The LCF probabilities for the MEI would be 3.0×10^{-2} and 1.7×10^{-2} for explosive release and fire release, respectively. The noninvolved worker may not survive the impact event. If the individual did survive, the LCF probability would be 1.6×10^{-2} for explosive release, and would approach 1.0 for fire release.

4.2.5.4 SRS

Under the No Action Alternative, plutonium at SRS would be stored in APSF, if built. If APSF were not built, plutonium would continue to be stored in current storage locations.[6] Design modifications of the storage facility would ensure that the continued storage of plutonium is in accordance with contemporary DOE orders and applicable regulations, and that the risks to the public of prompt fatalities due to accidents and of LCFs due to operations are minimized.

The *Storage and Disposition PEIS* (DOE 1996a:4-327), postulates a set of accidents involving storage of plutonium pits that could result in releases of plutonium impacting noninvolved workers and the offsite population. For that set of accidents, the maximum consequences would be from a beyond-design-basis earthquake (estimated probability of occurrence: 1.0×10^{-7} per year), which would cause an estimated 0.098 LCF in the population within 80 km (50 mi) of SRS. In terms of the treatment of beyond-design-basis earthquakes in this SPD EIS, that figure corresponds to a frequency in the range from extremely unlikely to beyond extremely unlikely. For the MEI and the noninvolved worker, the LCF probabilities would be 2.0×10^{-5} and 9.8×10^{-4}, respectively. [Text deleted.]

4.2.5.5 LLNL

Under the No Action Alternative, plutonium would continue to be stored at the site in exisiting facilities. [Text deleted.]

4.2.5.6 LANL

Under the No Action Alternative, plutonium would continue to be stored at the site in existing facilities. [Text deleted.]

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[5] DOE is considering leaving the repackaged surplus pits in Zone 4 at Pantex for long-term storage. An appropriate environmental review will be conducted when the specific proposal for this change has been determined (e.g., whether additional magazines need to be air-conditioned). The analysis in this document assumes that the surplus pits are stored in Zone 12 in accordance with the ROD for the *Storage and Disposition PEIS.*

[6] DOE would prepare a supplement analysis, and a supplement to and an amended ROD for, the *Storage and Disposition PEIS,* if required to address continued storage of surplus plutonium at current locations.

4.2.5.7 RFETS

Under the No Action Alternative, plutonium pits would no longer be stored at the site, but other nonpit plutonium material would continue to be stored in existing facilities. [Text deleted.]

4.2.6 Transportation

As the No Action Alternative would involve no intersite transportation of radioactive materials between any of the candidate sites, no transportation impacts would be expected if this alternative were implemented.

4.2.7 Environmental Justice

4.2.7.1 Hanford

As discussed in other parts of Section 4.2, routine operations conducted under the No Action Alternative would pose no significant health or other environmental risks to the public. The likelihood of an LCF for the MEI over 50 years of storage would be approximately 1 in 100 million, and the expected number of LCFs among the general population residing in the potentially affected area would be 1.2×10^{-3} (see Table 4–8). Radiological and nonradiological risks posed by implementation of the No Action Alternative would be small regardless of the racial and ethnic composition of the population, and independent of the economic status of individuals comprising the population. Operation of storage facilities at Hanford under the No Action Alternative would have no disproportionately high and adverse effects on minority or low-income populations.

4.2.7.2 INEEL

As discussed in other parts of Section 4.2, routine operations conducted at INEEL under the No Action Alternative would pose no significant health or other environmental risks to the public. The likelihood of an LCF for the MEI over 50 years of storage would be essentially zero, and the expected number of LCFs among the general population residing in the potentially affected area would be 1.9×10^{-6} (see Table 4–10). Radiological and nonradiological risks posed by implementation of the No Action Alternative would be small regardless of the racial and ethnic composition of the population, and independent of the economic status of individuals comprising the population. Operation of storage facilities at INEEL under the No Action Alternative would have no disproportionately high and adverse effects on minority or low-income populations.

4.2.7.3 Pantex

As discussed in other parts of Section 4.2, routine operations conducted at Pantex under the No Action Alternative would pose no significant health or other environmental risks to the public. The likelihood of an LCF for the MEI over 50 years of storage would be essentially zero, and the expected number of LCFs among the general population residing in the potentially affected area would be 1.6×10^{-7} (see Table 4–12). Radiological and nonradiological risks posed by implementation of the No Action Alternative would be small regardless of the racial and ethnic composition of the population, and independent of the economic status of individuals comprising the population. Operation of storage facilities at Pantex under the No Action Alternative would have no disproportionately high and adverse effects on minority or low-income populations.

4.2.7.4 SRS

As discussed in other parts of Section 4.2, routine operations conducted at SRS under the No Action Alternative would pose no significant health or other environmental risks to the public. The likelihood of an LCF for the MEI over 50 years of storage would be essentially zero, and the expected number of LCFs among the general population residing in the potentially affected area would be 7.2×10^{-6} (see Table 4–14). Radiological and nonradiological risks posed by implementation of the No Action Alternative would be small regardless of the racial and ethnic composition of the population, and independent of the economic status of individuals comprising the population. Operation of storage facilities at SRS under the No Action Alternative would have no disproportionately high and adverse effects on minority or low-income populations.

4.2.7.5 LLNL

As discussed in other parts of Section 4.2, routine operations conducted under the No Action Alternative would pose no significant health or other environmental risks to the public. The likelihood of an LCF for the MEI over 50 years of storage would be approximately 7.8×10^{-9}, and the expected number of LCFs among the general population residing in the potentially affected area would be 1.7×10^{-4} (see Table 4–16). Radiological and nonradiological risks posed by implementation of the No Action Alternative would be small independent of the racial and ethnic composition of the population, and independent of the economic status of individuals comprising the population. Operation of storage facilities at LLNL under the No Action Alternative would have no disproportionately high and adverse effects on minority or low-income populations.

4.2.7.6 LANL

As discussed in other parts of Section 4.2, routine operations conducted under the No Action Alternative would pose no significant health or other environmental risks to the public. The likelihood of an LCF for the MEI would be approximately 1.6×10^{-4}, and the expected number of LCFs among the general population residing in the potentially affected area would be 6.8×10^{-2} (see Table 4–18). Radiological and nonradiological risks posed by implementation of the No Action Alternative would be small independent of the racial and ethnic composition of the population, and independent of the economic status of individuals comprising the population. Operation of storage facilities at LANL under the No Action Alternative would have no disproportionately high and adverse effects on minority or low-income populations.

4.2.7.7 RFETS

As discussed in other parts of Section 4.2, routine operations conducted under the No Action Alternative would pose no significant health or other environmental risks to the public. The likelihood of an LCF for the MEI over 50 years of storage would be approximately 1.2×10^{-5}, and the expected number of LCFs among the general population residing in the potentially affected area would be 2.5×10^{-3} (see Table 4–20). Radiological and nonradiological risks posed by implementation of the No Action Alternative would be small independent of the racial and ethnic composition of the population, and independent of the economic status of individuals comprising the population. Operation of storage facilities at RFETS under the No Action Alternative would have no disproportionately high and adverse effects on minority or low-income populations.

4.2.8 Geology and Soils

4.2.8.1 Hanford

Continued storage of surplus plutonium, or the No Action Alternative, at Hanford would have no additional impacts on the geologic or soil resources. In the *Storage and Disposition PEIS*, hazards from the large-scale geologic conditions were analyzed in detail: the analysis indicated that these hazards present an acceptable risk to long-term storage facilities. More detailed descriptions of the impacts of the potential geologic hazards at Hanford are included in the *Storage and Disposition PEIS* (DOE 1996a:4-45–4-47). Potential effects of accidents initiated by natural phenomena such as earthquakes are discussed in Section 4.2.5.1.

Because no ground-disturbing activities would be needed for the No Action Alternative at Hanford, the soil attributes at current facility locations are inconsequential. Continued storage of surplus plutonium would not impact available geologic resources. Other than crushed rock, sand, and gravel, no economically viable geologic resources have been identified at Hanford. No soils at Hanford are currently classified as prime farmland.

4.2.8.2 INEEL

Continued storage of surplus plutonium, or the No Action Alternative, at INEEL would have no additional impacts on the geologic or soil resources. In the *Storage and Disposition PEIS*, hazards from the large-scale geologic conditions were analyzed in detail: the analysis indicated that these hazards present an acceptable risk to long-term storage facilities. More detailed descriptions of the impacts of the potential geologic hazards at INEEL are included in the *Storage and Disposition PEIS* (DOE 1996a:4-148–4-150). Potential effects of accidents initiated by natural phenomena such as earthquakes are discussed in Section 4.2.5.2.

Because no ground-disturbing activities would be needed for the No Action Alternative at INEEL, the soil attributes at current facility locations are inconsequential. Continued storage of surplus plutonium would not impact available geologic resources. Other than sand, gravel, and pumice, no economically viable geologic resources have been identified at INEEL. No soils at INEEL are currently classified as prime farmland.

4.2.8.3 Pantex

Continued storage of surplus plutonium, or the No Action Alternative, at Pantex would have no additional impacts on the geologic or soil resources. In the *Storage and Disposition PEIS*, hazards from the large-scale geologic conditions were analyzed in detail: the analysis indicated that these hazards present an acceptable risk to long-term storage facilities. More detailed descriptions of the impacts of the potential geologic hazards at Pantex are included in the *Storage and Disposition PEIS* (DOE 1996a:4-204–4-206). Potential effects of accidents initiated by natural phenomena such as earthquakes are discussed in Section 4.2.5.3.

Modifying Zone 12 facilities to provide for continued plutonium storage was determined to have no direct or indirect effects on geologic resources (DOE 1996a:4-204, 4-205).[7] No economically viable geologic resources have been identified at Pantex. Pantex is underlain by soils of the Pullman-Randall association. The Pullman soil is classified as prime farmland. Pantex is exempt from the Farmland Protection Policy Act (FPPA) under Section 1540(c)(4) (7 USC Section 4201) because the acquisition of Pantex property occurred prior to the FPPA effective date of June 22, 1982 (DOE 1996c:4-22).

4.2.8.4 SRS

Continued storage of surplus plutonium, or the No Action Alternative, at SRS would have no additional impacts on the geologic or soil resources. In the *Storage and Disposition PEIS*, hazards from the large-scale geologic conditions were analyzed in detail. The analysis indicated that these hazards present an acceptable risk to long-term storage facilities. More detailed descriptions of the impacts of the potential geologic hazards at SRS are included in the *Storage and Disposition PEIS* (DOE 1996a:4-309–4-311). Potential effects of accidents initiated by natural phenomena such as earthquakes are discussed in Section 4.2.5.4.

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[7] DOE is considering leaving the repackaged surplus pits in Zone 4 at Pantex for long-term storage. An appropriate environmental review will be conducted when the specific proposal for this change has been determined (e.g., whether additional magazines need to be air-conditioned). The analysis in this document assumes that the surplus pits are stored in Zone 12 in accordance with the ROD for the *Storage and Disposition PEIS.*

Because no ground-disturbing activities beyond those analyzed in the *Storage and Disposition PEIS* would be needed for the No Action Alternative at SRS, the soil attributes at current facility locations are inconsequential. Continued storage of surplus plutonium would not impact available geological resources. No economically viable geologic resources have been identified at SRS. No soils at SRS are currently classified as prime farmland.

4.2.8.5 LLNL

Continued storage of surplus plutonium, or the No Action Alternative, at LLNL would not impact available geologic resources. Detailed descriptions of the impacts of the potential geologic hazards at LLNL are included in the *Supplement Analysis for Continued Operation of LLNL and SNL* (DOE 1999a). Potential effects of accidents initiated by natural phenomena such as earthquakes are discussed in Section 4.2.5.5. Because no ground-disturbing activities would be needed for the No Action Alternative at LLNL, the soil attributes at current facility locations are inconsequential. A significant portion of the site is classified as undeveloped and industrial uses occupy a substantial amount of land. No soils at LLNL are currently classified as prime farmland.

4.2.8.6 LANL

Continued storage of surplus plutonium, or the No Action Alternative, at LANL would have no additional impacts on the geologic or soil resources. In the *Storage and Disposition PEIS*, hazards from the large-scale geologic conditions were analyzed in detail. The analysis indicated that these hazards present an acceptable risk to long-term storage facilities. More detailed descriptions of the impacts of the potential geological hazards at LANL are included in the *Storage and Disposition PEIS* (DOE 1996a:4-371). Potential effects of accidents initiated by natural phenomena such as earthquakes are discussed in Section 4.2.5.6.

Because no ground-disturbing activities would be needed for the No Action Alternative at LANL, the soil attributes at current facility locations are inconsequential. Continued storage of surplus plutonium would not impact available geologic resources. No economically viable geologic resources have been identified at LANL. No soils at LANL are currently classified as prime farmland.

4.2.8.7 RFETS

Continued storage of surplus plutonium, or the No Action Alternative, at RFETS would have no additional impacts on the geologic or soil resources. In the *Storage and Disposition PEIS*, hazards from the large-scale geologic conditions were analyzed in detail. The analysis indicated that these hazards present an acceptable risk to long-term storage facilities. More detailed descriptions of the impacts of the potential geological hazards at RFETS are included in the *Storage and Disposition PEIS* (DOE 1996a:4-350). Potential effects of accidents initiated by natural phenomena such as earthquakes are discussed in Section 4.2.5.7.

Because no ground-disturbing activities associated with this program would be needed for the No Action Alternative at RFETS, the soil attributes at current facility locations are inconsequential. Continued storage of surplus plutonium would not impact available geologic resources. No economically viable geologic resources have been identified at RFETS. No soils at RFETS are currently classified as prime farmland.

4.2.9 Water Resources

4.2.9.1 Hanford

The *Storage and Disposition PEIS* found that surface water withdrawals from the Columbia River are not expected to increase from the current usage of 13.5 billion l/yr (3.6 billion gal/yr). Restoration programs would continue, and water quality should improve. No additional impacts on groundwater are anticipated (DOE 1996a:4-39).

4.2.9.2 INEEL

The *Storage and Disposition PEIS* found that continued operation of long-term storage facilities at INEEL would not affect water resources. No surface water would be used for construction and normal operation of these facilities. No additional impacts on groundwater are anticipated. Current groundwater use should decrease, and existing tritium plumes in groundwater, including perched groundwater, should continue to migrate southwest. Studies show that water withdrawals could change the existing plumes' direction to the east (DOE 1996a:4-143).

4.2.9.3 Pantex

The *Storage and Disposition PEIS* found that no demands on surface waters would occur. Because surface water is not used, there would be no impact on surface water availability or quality (DOE 1996a:4-198). The analysis also found that as baseline conditions and operations continued, groundwater usage would decrease from 836 million l/yr (221 million gal/yr) to 249 million l/yr (65.7 million gal/yr) by 2005. Groundwater would continue to be withdrawn from the Ogallala aquifer from wells on the Pantex property. Groundwater restoration activities would continue, including pump, treatment, and reinjection activities (DOE 1996a:4-198).

4.2.9.4 SRS

The *Storage and Disposition PEIS* found that surface water withdrawals from the Savannah River will decrease from 140.4 billion l/yr (37.1 billion gal/yr) to 127 billion l/yr (33.6 billion gal/yr) by 2005. As a result of reduced discharges to streams, the analysis further concluded surface water quality would improve. The analysis also found that additional withdrawals to support long-term storage facilities at SRS would have minimal impacts on regional groundwater levels. Water requirements to support these facilities were expected to represent much less than 1 percent of projected annual withdrawals (DOE 1996a:4-303–4-306).

4.2.9.5 LLNL

The *Supplement Analysis for Continued Operation of LLNL and SNL* (DOE 1999a:vol. I) found that the continued operation of plutonium storage facilities at LLNL within administrative limits would not affect water resources. Projected water demand of 1 billion l/yr (265 million gal/yr) represents only a small fraction of the water available to LLNL from its municipal suppliers (DOE 1999a).

4.2.9.6 LANL

The *Storage and Disposition PEIS* found that continued operation of long-term storage facilities at LANL would not affect water resources. No surface water would be used for construction and normal operation of these facilities. No additional impacts on groundwater are expected (DOE 1996a:4-369–370).

4.2.9.7 RFETS

The *Storage and Disposition PEIS* found that continued operation of long-term storage facilities at RFETS would not affect water resources. No surface water would be used for construction and normal operation of these facilities. No additional impacts on groundwater are expected (DOE 1996a:4-348–349).

4.2.10 Ecological Resources

4.2.10.1 Hanford

Under the No Action Alternative, there would not be any construction or demolition of buildings, and any modifications required to ensure safe storage would not result in any appreciable change to current conditions. Because no new construction would occur, the No Action Alternative would have no impact on ecological resources, including terrestrial and aquatic resources, wetlands, and threatened and endangered species.

4.2.10.2 INEEL

Under the No Action Alternative, there would not be any construction or demolition of buildings, and any modifications required to ensure safe storage would not result in any appreciable change to current conditions. Because no new construction would occur, the No Action Alternative would have no impact on ecological resources, including terrestrial and aquatic resources, wetlands, and threatened and endangered species.

4.2.10.3 Pantex

Under the No Action Alternative, Zone 12 facilities would be upgraded to provide for continued storage of surplus plutonium materials.[8] The *Storage and Disposition PEIS* (DOE 1996a:4-207) determined that upgrading these facilities would cause minimal disturbance of biological resources. The baseline resources described in Chapter 3 are the existing biotic conditions.

4.2.10.4 SRS

In accordance with the ROD (December 12, 1995) for the *Final EIS, Interim Management of Nuclear Materials*, DOE was planning to construct a new APSF in F-Area. This facility, if built, would enable SRS to stabilize and package plutonium metals and oxides to meet storage criteria and to provide space for storage of all plutonium and special actinide materials. Environmental consequences from this action are documented in the associated EIS (DOE 1995b). If APSF were not built, plutonium would continue to be stored in current storage locations, and DOE would prepare a supplement analysis, and a supplement to and an amended ROD for, the *Storage and Disposition PEIS*, if required to address continued storage of surplus plutonium at current locations.

4.2.10.5 LLNL

Under the No Action Alternative, there would not be any construction or demolition of buildings, and any modifications required to ensure safe storage would not result in any appreciable change to current conditions. Because no new construction would occur, the No Action Alternative would have no impact on ecological resources, including terrestrial and aquatic resources, wetlands, and threatened and endangered species.

4.2.10.6 LANL

Under the No Action Alternative, there would not be any construction or demolition of buildings, and any modifications required to ensure safe storage would not result in any appreciable change to current conditions.

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[8] DOE is considering leaving the repackaged surplus pits in Zone 4 at Pantex for long-term storage. An appropriate environmental review will be conducted when the specific proposal for this change has been determined (e.g., whether additional magazines need to be air-conditioned). The analysis in this document assumes that the surplus pits are stored in Zone 12 in accordance with the ROD for the *Storage and Disposition PEIS*.

Because no new construction would occur, the No Action Alternative would have no impact on ecological resources, including terrestrial and aquatic resources, wetlands, and threatened and endangered species.

4.2.10.7 RFETS

Under the No Action Alternative, there would not be any construction or demolition of buildings, and any modifications required to ensure safe storage would not result in any appreciable change to current conditions. Because no new construction would occur, the No Action Alternative would have no impact on ecological resources, including terrestrial and aquatic resources, wetlands, and threatened and endangered species.

4.2.11 Cultural and Paleontological Resources

4.2.11.1 Hanford

Under the No Action Alternative, DOE would continue storage of plutonium material in the Plutonium Finishing Plant (PFP) in stabilized forms pursuant to Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 94–1. Therefore, no impacts on cultural or paleontological resources from the continued storage mission under the No Action Alternative would be expected.

4.2.11.2 INEEL

Under the No Action Alternative, DOE would continue storage of plutonium material at ANL–W ZPPR and FMF vaults in stabilized forms pursuant to DNFSB Recommendation 94–1. Therefore, no impacts on cultural or paleontological resources from the continued storage mission under the No Action Alternative would be expected.

4.2.11.3 Pantex

Under the No Action Alternative, Zone 12 facilities would be upgraded to provide for continued storage of surplus plutonium materials.[9] Impacts on cultural or paleontological resources should be minimal. Therefore, no impacts on cultural or paleontological resources from the continued storage mission under the No Action Alternative would be expected.

4.2.11.4 SRS

Under the No Action Alternative, DOE would continue storage of plutonium material in F-Area in stabilized forms pursuant to DNFSB Recommendation 94–1. Therefore, no impacts on cultural or paleontological resources from the continued storage mission under the No Action Alternative would be expected.

4.2.11.5 LLNL

Under the No Action Alternative, DOE would continue storage of plutonium material in Building 332 in stabilized forms pursuant to DNFSB Recommendation 94–1. Therefore, no impacts on cultural or paleontological resources from the continued storage mission under the No Action Alternative would be expected.

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[9] DOE is considering leaving the repackaged surplus pits in Zone 4 at Pantex for long-term storage. An appropriate environmental review will be conducted when the specific proposal for this change has been determined (e.g., whether additional magazines need to be air-conditioned). The analysis in this document assumes that the surplus pits are stored in Zone 12 in accordance with the ROD for the *Storage and Disposition PEIS*.

4.2.11.6 LANL

Under the No Action Alternative, DOE would continue storage of plutonium material in NMSF in stabilized form pursuant to DNFSB Recommendation 94–1. Therefore, no impacts on cultural or paleontological resources from the continued storage mission under the No Action Alternative would be expected.

4.2.11.7 RFETS

Under the No Action Alternative, DOE would continue storage of plutonium material in a existing facilities in stabilized form pursuant to DNFSB Recommendation 94–1. Therefore, no impacts on cultural or paleontological resources from the continued storage mission under the No Action Alternative would be expected.

4.2.12 Land Use and Visual Resources

With the exception of Pantex, where either Zone 4 or Zone 12 facilities would be upgraded to provide for continued storage of surplus plutonium materials, there would not be a change in existing land use at any of the sites. This construction would take place on previously disturbed land, and therefore would not cause a major change in any existing land-use plans at the site. Upgrades at Pantex would not result in any impacts to visual resources.

4.2.13 Infrastructure

4.2.13.1 Hanford

The current infrastructure at Hanford is capable of supporting all anticipated missions and functions associated with the No Action Alternative. However, certain actions under that alternative could result in changes to the site infrastructure, but they are not expected to result in any major impact. For instance, upgrades of PFP and support services and utilities could be required to complete stabilization and packaging activities for the current inventory of weapons-usable plutonium. Further detailed discussion on Hanford infrastructure can be found in the *Storage and Disposition PEIS* (DOE 1996a:4-29).

4.2.13.2 INEEL

The INEEL infrastructure would, without major modifications, be capable of supporting all anticipated missions and functions associated with the No Action Alternative. No major site infrastructure changes would be required. Detailed data on INEEL infrastructure are presented in the *Storage and Disposition PEIS* (DOE 1996a:4-134, 4-135).

4.2.13.3 Pantex

The Pantex infrastructure would be capable of supporting all anticipated missions and functions associated with the No Action Alternative. No major site infrastructure changes are required. Detailed data on Pantex infrastructure are presented in the *Storage and Disposition PEIS* (DOE 1996a:4-295, 4-296).

4.2.13.4 SRS

The SRS infrastructure would be capable of supporting all anticipated missions and functions associated with the No Action Alternative. No major site infrastructure changes are required. Detailed data on SRS infrastructure are presented in the *Storage and Disposition PEIS* (DOE 1996a:4-186, 4-187).

4.2.13.5 LLNL

The LLNL infrastructure would be capable of supporting all anticipated missions and functions associated with the No Action Alternative. No major infrastructure changes are required. Detailed data on LLNL infrastructure are presented in the *Supplement Analysis for Continued Operation of LLNL and SNL* (DOE 1999a).

4.2.13.6 LANL

The LANL infrastructure would be capable of supporting all anticipated missions and functions associated with the No Action Alternative. No major infrastructure changes are required. Detailed data on LANL infrastructure are presented in the *Storage and Disposition PEIS* (DOE 1996a:4-365).

4.2.13.7 RFETS

The RFETS infrastructure would be capable of supporting all anticipated missions and functions associated with the No Action Alternative. No major infrastructure changes are required. Detailed data on RFETS infrastructure are presented in the *Storage and Disposition PEIS* (DOE 1996a:4-345).

4.3 ALTERNATIVE 2

Alternative 2 would involve constructing and operating all three facilities for surplus plutonium disposition at Hanford. The pit conversion and immobilization facilities would be located in the existing Fuels and Materials Examination Facility (FMEF) building, and the MOX facility, in a new building near FMEF in the 400 Area.

4.3.1 Construction

4.3.1.1 Air Quality and Noise

Sources of potential air quality impacts of construction under Alternative 2 at Hanford include emissions from fuel-burning construction equipment, soil disturbance by construction equipment and other vehicles, the operation of a concrete batch plant, trucks moving materials and wastes, and employee vehicles. Emissions from these sources are summarized in Appendix G.

A comparison of maximum air pollutant concentrations, including the contribution from Hanford construction activities, with standards and guidelines is presented as Table 4–22. Concentrations of air pollutants, especially PM_{10} and total suspended particulates, would likely increase at the site boundary, but should not exceed the Federal or State ambient air quality standards as a result of Hanford activities. Occasional exceedances of the PM_{10} and total suspended particulates standards attributable to natural sources would be expected to continue. Air pollution impacts during construction would be mitigated by applying, as appropriate, standard dust control practices such as watering or sweeping of roads and watering of exposed areas.

Total vehicle emissions associated with activities at Hanford would likely decrease somewhat from current emissions during the planned construction period because of an expected decrease in overall site employment.

The location of these facilities relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during construction would include heavy construction equipment, employee vehicles, and truck traffic. Traffic noise associated with construction of these facilities would occur on the site and along offsite local and regional transportation routes used to bring construction materials and workers to the site. Given the distance to the site boundary (about 7.1 km [4.4 mi]), noise emissions from construction equipment would not likely annoy the public. These noise sources would be far enough away from offsite areas that the contribution to offsite noise levels would be small. Some noise sources could result in onsite impacts, such as the disturbance of wildlife. However, noise would be unlikely to affect federally listed threatened or endangered species or their critical habitats, as none are known to occur on or in the immediate vicinity of the proposed site location (see Section 4.26). Traffic associated with construction of these facilities would likely produce less than a 1-dB increase in noise levels along roads used to access the site, and thus would not result in any increased annoyance of the public.

Construction workers could be exposed to noise levels higher than the acceptable limits specified by the Occupational Safety and Health Administration (OSHA) in its noise regulations (OSHA 1997). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of standard silencing packages on construction equipment, administrative controls, engineering controls, and personal hearing protection equipment.

Table 4–22. Evaluation of Air Pollutant Concentrations Associated With Construction Under Alternative 2: Pit Conversion in FMEF, Immobilization in FMEF and HLWVF, and MOX in New Construction at Hanford

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m^3)[a]	SPD Increment (Fg/m^3)	Total Site Concentration (Fg/m^3)	Site as a Percent of Standard or Guideline
Criteria pollutants					
Carbon monoxide	8 hours	10,000	2.18	36.3	0.36
	1 hour	40,000	14.9	63.2	0.16
Nitrogen dioxide	Annual	100	0.169	0.419	0.42
PM_{10}	Annual	50	0.169	0.186	0.37
	24 hours	150	6.55	7.32	4.9
Sulfur dioxide	Annual	50	0.0164	1.65	3.2
	24 hours	260	0.183	9.09	3.5
	3 hours	1,300	1.24	30.9	2.4
	1 hour	660	3.72	36.6	5.5
Other regulated pollutants					
Total suspended particulates	Annual	60	0.327	0.344	0.57
	24 hours	150	12.3	13.1	8.7
Hazardous and other toxic compounds					
Other toxics[b]	Annual	0.12	0.000008	0.000014	0.012

[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: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility; SPD, surplus plutonium disposition.

Source: EPA 1997a; WDEC 1994.

4.3.1.2 Waste Management

Table 4–23 compares the wastes generated during the construction of surplus plutonium disposition facilities at Hanford with the existing treatment, storage, and disposal capacity for the various waste types. It is anticipated that no TRU waste, LLW, or mixed LLW would be generated during construction. Nonradioactive wastes generated during construction would be the responsibility of the construction contractor and would be managed in accordance with existing procedures largely at offsite facilities. In addition, no soil contaminated with hazardous or radioactive constituents should be generated during construction. However, if any were generated, the waste would be managed in accordance with site practice and applicable Federal and State regulations. Construction waste generation would be the same for the ceramic and glass immobilization technologies because the same size facility would be built under either scenario.

Hazardous wastes generated during the construction of surplus plutonium disposition facilities would be typical of those generated during the construction of an industrial facility. Any hazardous wastes generated during construction would be packaged in containers approved by the U.S. Department of Transportation (DOT) and shipped off the site to permitted commercial recycling, treatment, and disposal facilities. The additional waste load generated during construction should not have a major impact on the Hanford hazardous waste management system.

Table 4–23. Potential Waste Management Impacts of Construction Under Alternative 2: Pit Conversion in FMEF, Immobilization in FMEF and HLWVF, and MOX in New Construction at Hanford

Waste Type[a]	Estimated Additional Waste Generation (m^3/yr)	Estimated Additional Waste Generation as a Percent of[b]		
		Characterization or Treatment Capacity	Storage Capacity	Disposal Capacity
Hazardous	50	NA	NA	NA
Nonhazardous				
Liquid	30,000	13[c]	NA	13[d]
Solid	9,600	NA	NA	NA

[a] See definitions in Appendix F.8.
[b] Treatment capacities, and the disposal capacity for nonhazardous liquid waste, are compared with estimated additional annual waste generation. All other storage and disposal capacities are compared with total estimated additional waste generation assuming a 3-year construction period.
[c] Percent of capacity of the 400 Area sanitary sewer.
[d] Percent of capacity of the Energy Northwest (formerly Washington Public Power Supply System) Sewage Treatment Facility.

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility; NA, not applicable (i.e., it is assumed that the majority of the hazardous waste and nonhazardous solid waste would be treated and disposed of off the site by the construction contractor).

Nonhazardous solid wastes generated during the construction of surplus plutonium disposition facilities would be packaged in conformance with standard industrial practice, for recycling or disposal largely at offsite facilities. The additional waste load generated during construction should not have a major impact on the nonhazardous solid waste management system at Hanford.

To be conservative, it was assumed that all nonhazardous liquid wastes generated during the construction of surplus plutonium disposition facilities would be managed at the Energy Northwest (formerly Washington Public Power Supply System [WPPSS]) Sewage Treatment Facility, even though it is likely that much of this waste would be collected in portable toilets and would be managed at offsite facilities. Nonhazardous liquid waste generated during the construction of these facilities is estimated to be 13 percent of the 235,000-m^3/yr (307,000-yd^3/yr) capacity of the 400 Area sanitary sewer, 13 percent of the 235,000-m^3/yr (307,000-yd^3/yr) capacity of the Energy Northwest Sewage Treatment Facility, and within the 138,000-m^3/yr (181,000-yd^3/yr) excess capacity of the Energy Northwest Sewage Treatment Facility (Mecca 1997). Therefore, management of these wastes at Hanford should not have a major impact on the nonhazardous liquid waste treatment system during construction.

4.3.1.3 Socioeconomics

Construction-related employment requirements under Alternative 2 would be as indicated in Table 4–24.

At its peak in 2003, construction of the three new surplus plutonium disposition facilities at Hanford under this alternative would require 1,235 construction workers and should generate another 1,268 indirect jobs in the region. As this total increase of 2,503 direct and indirect jobs represents 0.6 percent of the projected regional economic area (REA) workforce, it should have no major impact on the REA. Moreover, it should have little effect on the community services currently offered in the region of influence (ROI). In fact, it should help offset the 15 percent reduction in Hanford's total workforce (i.e., from 12,882 to 11,000 workers) projected for the years 1997–2005.

Table 4–24. Construction Employment Requirements for Alternative 2: Pit Conversion in FMEF, Immobilization in FMEF and HLWVF, and MOX in New Construction at Hanford

Year	Pit Conversion	Immobilization	MOX	Total
2001	76	0	0	76
2002	116	277	441	834
2003	72	391	772	1,235
2004	0	343	508	851
2005	0	228	221	449
2006	0	0	208	208

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility.
Source: DOE 1999c; UC 1998a, UC 1999a, UC 1999b.

4.3.1.4 Human Health Risk

Radiological Impacts. No radiological risk would be incurred by members of the public from construction activities. According to the results of 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.

Hazardous Chemical Impacts. The probability of excess latent cancer incidence associated with exposure to benzene released as a result of construction activities at Hanford under this alternative has been estimated to be much less than 1 chance in 1 million over the lifetime of the maximally exposed member of the public.

4.3.1.5 Facility Accidents

Surplus plutonium disposition construction activities at Hanford could result in worker injuries and fatalities. DOE-required industrial safety programs would be in place to reduce the risks. Given the estimated 3,653 person-years of construction labor and standard industrial accident rates, approximately 360 cases of nonfatal occupational injury or illness and 0.51 fatality could be expected (DOL 1997a, 1997b). As all construction would be in nonradiological areas, no radiological accidents should occur.

4.3.1.6 Environmental Justice

As discussed in other parts of Section 4.3.1, construction under Alternative 2 would pose no significant health risks to the public. The risks would be negligible regardless of the racial or ethnic composition or the economic status of the population. Therefore, construction activities at Hanford under Alternative 2 would have no significant impacts on minority or low-income populations.

4.3.2 Operations

4.3.2.1 Air Quality and Noise

Potential air quality impacts of the operation of facilities under Alternative 2 at Hanford were analyzed using the Industrial Source Computer Short-Term Model Version 3 (ISCST3). Operational impacts would result from process emissions, emergency diesel generator testing, trucks moving materials and wastes, and employee vehicles. Emissions from these sources are summarized in Appendix G.

A comparison of maximum air pollutant concentrations, including the contribution from surplus plutonium disposition facilities, with standards and guidelines is presented as Table 4–25. Concentrations for immobilization in the ceramic and glass forms are the same. Concentrations of air pollutants would likely increase at the site boundary, but would not exceed the Federal or State ambient air quality standards. Occasional exceedances of the PM_{10} and total suspended particulates standards attributable to natural sources would be expected to continue. Air pollution impacts during operation would be mitigated; for example, high-efficiency particulate air (HEPA) filtration has been included in the design of these facilities.

Table 4–25. Evaluation of Air Pollutant Concentrations Associated With Operations Under Alternative 2: Pit Conversion in FMEF, Immobilization in FMEF and HLWVF, and MOX in New Construction at Hanford

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m³)[a]	SPD Increment (Fg/m³)	Total Site Concentration (Fg/m³)	Site as a Percent of Standard or Guideline
Criteria pollutants					
Carbon monoxide	8 hours	10,000	0.651	34.7	0.35
	1 hour	40,000	4.43	52.7	0.13
Nitrogen dioxide	Annual	100	0.0873	0.337	0.34
PM_{10}	Annual	50	0.00541	0.023	0.047
	24 hours	150	0.0601	0.83	0.55
Sulfur dioxide	Annual	50	0.00496	1.64	3.1
	24 hours	260	0.0551	8.97	3.4
	3 hours	1,300	0.375	30	2.3
	1 hour	660	1.12	34	5.2
Other regulated pollutants					
Total suspended particulates	Annual	60	0.00541	0.023	0.039
	24 hours	150	0.0601	0.83	0.55
[Text deleted.]					

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

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility; SPD, surplus plutonium disposition.

Note: No nonradiological hazardous or other toxic compounds would be emitted from these processes.

Source: EPA 1997a; WDEC 1994.

For a discussion of how the operation of these facilities would affect the site's ability to continue to meet limits of the National Emission Standards for Hazardous Air Pollutants (NESHAPs) regarding airborne radiological emissions, see Section 4.32.1.4. There are no other NESHAPs limits applicable to operation of these facilities. The increased concentrations of nitrogen dioxide, PM_{10}, and sulfur dioxide from the operation of these facilities would be a small fraction of the Prevention of Significant Deterioration (PSD) Class II area increments as summarized in Table 4–26.

Total vehicle emissions associated with activities at Hanford would likely decrease somewhat because of an expected decrease in overall site employment during this timeframe.

The combustion of fossil fuels associated with Alternative 2 would result in the emission of carbon dioxide, one of the atmospheric gases that are believed to influence the global climate. Annual carbon dioxide emissions from this alternative would represent less than 8×10^{-6} percent of the 1995 annual U.S. emissions of carbon dioxide from fossil fuel combustion and industrial processes, and therefore would not appreciably affect global concentrations of this pollutant.

Table 4–26. Evaluation of Air Pollutant Increases Associated With Operations Under Alternative 2: Pit Conversion in FMEF, Immobilization in FMEF and HLWVF, and MOX in New Construction at Hanford

Pollutant	Averaging Period	Increase in Concentration (Fg/m^3)	PSD Class II Area Allowable Increment (Fg/m^3)	Percent of Increment
Nitrogen dioxide	Annual	0.0873	25	0.35
PM_{10}	Annual	0.00541	17	0.032
	24 hours	0.0601	30	0.2
Sulfur dioxide	Annual	0.00496	20	0.025
	24 hours	0.0551	91	0.061
	3 hours	0.375	512	0.073

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility; PSD, prevention of significant deterioration.
Source: EPA 1997b.

The location of these facilities relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during operations would include new or existing sources (e.g., cooling systems, vents, motors, material-handling equipment), employee vehicles, and truck traffic. Traffic noise associated with operation of these facilities would occur on the site and along offsite local and regional transportation routes used to bring materials and workers to the site. Given the distance to the site boundary (about 7.1 km [4.4 mi]), noise emissions from equipment would not likely annoy the public. These noise sources would be far enough away from offsite areas that their contribution to offsite noise levels would be small. Some noise sources could have onsite impacts, such as the disturbance of wildlife. However, noise would be unlikely to affect federally listed threatened or endangered species or their critical habitats, as none are known to occur on or in the immediate vicinity of the proposed site location (see Section 4.26). Noise from traffic associated with operation of these facilities would likely produce less than a 1-dB increase in traffic noise levels along roads used to access the site, and thus would not result in any increased annoyance of the public.

Operations workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (OSHA 1997). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of administrative controls, engineering controls, and personal hearing protection equipment.

4.3.2.2 Waste Management

Table 4–27 compares the existing site treatment, storage, and disposal capacities with the expected waste generation rates from operating surplus plutonium disposition facilities at Hanford. Although high-level waste (HLW) would be used in the immobilization process, no HLW would be generated by surplus plutonium disposition facilities. Waste generation should be the same for the ceramic and glass immobilization technologies.

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. According to 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. 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, in order to be conservative, it is assumed the TRU waste would be stored on the site until

2016. 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.

Table 4–27. Potential Waste Management Impacts of Operations Under Alternative 2: Pit Conversion in FMEF, Immobilization in FMEF and HLWVF, and MOX in New Construction at Hanford

Waste Type[a]	Estimated Additional Waste Generation (m^3/yr)	Estimated Additional Waste Generation as a Percent of[b]		
		Characterization or Treatment Capacity	Storage Capacity	Disposal Capacity
TRU[c]	180	10	11	1 of WIPP
LLW	230	NA	NA	<1
Mixed LLW	5	<1	<1	<1
Hazardous	80	NA	NA	NA
Nonhazardous				
Liquid	110,000	48[d]	NA	48[e]
Solid	2,600	NA	NA	NA

[a] See definitions in Appendix F.8.

[b] Treatment capacities, and the disposal capacity for nonhazardous liquid waste, are compared with estimated additional annual waste generation. All other storage and disposal capacities are compared with total estimated additional waste generation assuming a 10-year operation period.

[c] Includes mixed TRU waste. Facilities are not expected to generate remotely handled TRU waste.

[d] Percent of capacity of the 400 Area sanitary sewer.

[e] Percent of capacity of the Energy Northwest (formerly Washington Public Power Supply System) Sewage Treatment Facility.

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility; LLW, low-level waste; NA, not applicable (i.e., the majority of this waste is not routinely treated, stored, or disposed of on the site); TRU, transuranic; WIPP, Waste Isolation Pilot Plant.

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 Hanford will be evaluated in the *Hanford Site Solid (Radioactive and Hazardous) Waste Program EIS* that is being prepared by the DOE Richland Operations Office (DOE 1997b).

TRU wastes would be treated, packaged, and certified to WIPP waste acceptance criteria at the new facilities. Drum-gas testing, real-time radiography, and loading the TRU Waste Package Transporter (TRUPACT) for shipment to WIPP would occur at the Waste Receiving and Processing Facility at Hanford.

TRU waste generated at surplus plutonium disposition facilities is estimated to be 10 percent of the 1,820-m^3/yr (2,380-yd^3/yr) capacity of the Waste Receiving and Processing Facility. A total of 1,800 m^3 (2,350 yd^3) of TRU waste would be generated over the 10-year operation period. If all the TRU waste were stored on the site, this would be 11 percent of the 17,000-m^3 (22,200-yd^3) storage capacity available at Hanford. Assuming that the waste were stored in 208-l (55-gal) drums that could be stacked two high, and allowing a 50 percent factor for aisle space, a storage area of about 0.26 ha (0.64 acre) would be required. Therefore, impacts of the management of additional quantities of TRU waste at Hanford should not be major. Impacts from the treatment of TRU waste to WIPP waste acceptance criteria are described in the WM PEIS (DOE 1997d).

The 1,800 m^3 (2,350 yd^3) of TRU wastes 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 1 percent of the current 168,500-m^3 (220,400-yd^3) limit for WIPP (DOE 1997e:3-3). Impacts of disposal of TRU waste at WIPP are described in the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997e).

LLW would be packaged, certified, and accumulated at the new facilities before transfer for additional treatment and disposal in existing onsite facilities. A total of 2,300 m^3 (3,000 yd^3) of LLW would be generated over the operations period. LLW generated at surplus plutonium disposition facilities is estimated to be less than 1 percent of the 1.74 million-m^3 (2.28 million-yd^3) capacity of the LLW Burial Grounds and 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 *Storage and Disposition PEIS* (DOE 1996a:E-9), 2,300 m^3 (3,000 yd^3) of waste would require 0.67 ha (1.7 acres) of disposal space at Hanford. Therefore, impacts of the management of this additional LLW at Hanford should not be major.

Mixed LLW would 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 generated at surplus plutonium disposition facilities is estimated to be less than 1 percent of the 1,820-m^3/yr (2,380-yd^3/yr) capacity of the Waste Receiving and Processing Facility, less than 1 percent of the 16,800-m^3 (22,000-yd^3) storage capacity of the Central Waste Complex, and less than 1 percent of the 14,200-m^3 (18,600-yd^3) planned disposal capacity of 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.

If all TRU waste and mixed LLW generated at surplus plutonium disposition facilities were processed in the Waste Receiving and Processing Facility, this additional waste would be 10 percent of the 1,820-m^3/yr (2,380-yd^3/yr) capacity of that facility.

Any hazardous wastes generated during operation would be packaged in DOT-approved containers and shipped off the site to permitted commercial recycling, treatment, and disposal facilities. The additional waste load generated during the operations period should not have a major impact on the Hanford hazardous waste management system.

Nonhazardous solid waste would be packaged and transported 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 for offsite disposal. It is unlikely that this additional waste load would have a major impact on the nonhazardous solid waste management system at Hanford.

Nonhazardous wastewater would be treated if necessary before being discharged to the 400 Area sanitary sewer system, which connects to the Energy Northwest (formerly WPPSS) Sewage Treatment Facility. Nonhazardous liquid waste generated at surplus plutonium disposition facilities is estimated to be 48 percent of the 235,000-m^3/yr (307,000-yd^3/yr) capacity of the 400 Area sanitary sewer, 48 percent of the 235,000-m^3/yr (307,000-yd^3/yr) capacity of the Energy Northwest Sewage Treatment Facility, and within the 138,000-m^3/yr (181,000-yd^3/yr) excess capacity of the Energy Northwest Sewage Treatment Facility (Mecca 1997). Therefore, management of nonhazardous liquid waste at Hanford should not have a major impact on the treatment system.

4.3.2.3 Socioeconomics

After construction, startup, and testing of all the surplus plutonium disposition facilities at Hanford in 2007 under Alternative 2, 1,165 additional workers would be required to operate them (DOE 1999c; UC 1998a, 1999a, 1999b). This level of employment should generate another 2,950 indirect jobs in the region. As the total employment increase of 4,115 direct and indirect jobs represents less than 1.0 percent of the projected REA workforce, it should have no major impact on the REA. Some of the new jobs created under this alternative could be filled from the ranks of the unemployed, currently 11 percent of the REA's population.

The total employment requirement could have minor impacts on community services in the ROI, as it should coincide with an increase in overall site employment at Hanford in connection with construction of the tank waste remediation system. Assuming that 91 percent of the new employees associated with this alternative would reside in the ROI, the 3,744 new jobs would increase the region's population by approximately 6,947 persons. This population increase, in conjunction with the normal population growth forecast by the State of Washington, would engender increased construction of local housing units. Given the current population-to-student ratio in the ROI, a population of this size would be expected to include 1,438 students, and local school districts would have to increase the number of classrooms to accommodate them.

Community services in the ROI would be expected to change to accommodate the population growth as follows: 90 teachers would be added to maintain the current student-to-teacher ratio of 16:1; 11 police officers would be added to maintain the current officer-to-population ratio of 1.5:1,000; 23 firefighters would be added to maintain the current firefighter-to-population ratio of 3.4:1,000; and 10 physicians would be added to maintain the current physician-to-population ratio of 1.4:1,000. Thus, an additional 133 positions would have to be created to maintain community services at current levels. Hospitals in the ROI would experience a drop from 2.1 beds to 2.0 per 1,000 persons unless additional beds were provided. Average school capacity would increase to 95.4 percent from the current 92.5 percent unless additional classrooms were built. None of these projected changes would have a major impact on the level of community services currently offered in the ROI.

4.3.2.4 Human Health Risk

During normal operations, there would be both radiological and hazardous chemical releases to the environment, and also direct in-plant exposures. The resulting doses to, and potential health effects on, the public and workers under Alternative 2 would be as follows.

Radiological Impacts. Table 4–28 reflects the potential radiological impacts on three individual receptor groups: the population living within 80 km (50 mi) of Hanford in the year 2010, the maximally exposed member of the public, and the average exposed member of the public. The table depicts the projected aggregate latent fatal cancer risk to these groups from 10 years of incident-free operation. To put operational doses into perspective, comparisons with doses from natural background radiation are also provided in the table.

Given incident-free operation of all three facilities, the total population dose in the year 2010 would be 7.2 person-rem. The corresponding number of LCFs in this population from 10 years of operation would be 0.036. The dose to the maximally exposed member of the public from annual operation of all three facilities would be 0.022 mrem. From 10 years of operation, the corresponding LCF risk to this individual would be 1.1×10^{-7}. The impacts on the average individual would be lower.

Estimated impacts resulting from "Total Site" operations are given in the Cumulative Impacts section of this SPD EIS (see Section 4.32). Within that section, projected incremental impacts associated with operation of the proposed surplus plutonium disposition facilities are added to the impacts of other past, present, and reasonably foreseeable future actions at or near the candidate sites. These impacts are then compared against applicable regulatory standards established by DOE, EPA, and NRC (such as DOE Order 5400.5, the CAA [NESHAPs], the Safe Drinking Water Act (SDWA), and 10 CFR 20).

Doses to involved workers from normal operations are given in Table 4–29; these workers are defined as those directly associated with process activities. Under this alternative, the annual average dose would be 500 mrem to pit conversion facility workers, 750 mrem to immobilization facility workers, and 65 mrem to MOX facility workers. The annual dose received by the total site workforce for each of these facilities would be an estimated 192, 274, and 22 person-rem, respectively. The risks and numbers of LCFs among the different workers from 10 years of operation are included in Table 4–29. Doses to individual workers would be kept to minimal levels

Table 4–28. Potential Radiological Impacts on the Public of Operations Under Alternative 2: Pit Conversion in FMEF, Immobilization in FMEF and HLWVF, and MOX in New Construction at Hanford

Impact	Pit Conversion	Immobilization Ceramic	Immobilization Glass	MOX[a]	Total[b]
Population within 80 km for year 2010					
Dose (person-rem)	6.9	7.8×10^{-3}	7.1×10^{-3}	0.29	7.2
Percent of natural background[c]	5.9×10^{-3}	6.7×10^{-6}	6.1×10^{-6}	2.5×10^{-4}	6.2×10^{-3}
10-year latent fatal cancers	0.034	3.9×10^{-5}	3.6×10^{-5}	1.5×10^{-3}	0.036
Maximally exposed individual					
Annual dose (mrem)	0.017	1.1×10^{-4}	9.7×10^{-5}	4.8×10^{-3}	0.022
Percent of natural background[c]	5.7×10^{-3}	3.7×10^{-5}	3.2×10^{-5}	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}	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}	7.5×10^{-4}	0.018
10-year latent fatal cancer risk	8.5×10^{-8}	1.0×10^{-10}	9.0×10^{-11}	3.8×10^{-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 are additive in all cases because the same groups or individuals would receive doses from all three facilities. The total includes the higher of the values for the ceramic and glass immobilization alternatives.

[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; HLWVF, high-level-waste vitrification facility.

Source: Appendix J.

Table 4–29. Potential Radiological Impacts on Involved Workers of Operations Under Alternative 2: Pit Conversion in FMEF, Immobilization in FMEF and HLWVF, and MOX in New Construction at Hanford

Impact	Pit Conversion	Immobilization (Ceramic or Glass)	MOX	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[a]
10-year latent fatal cancer risk	2.0×10^{-3}	3.0×10^{-3}	2.6×10^{-4}	1.8×10^{-3}

[a] Represents an average of the doses for all three facilities.

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995d and NRC 1999a). 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 1994a). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1999c; UC 1998a, 1998b, 1999a, 1999b.

by instituting badged monitoring, administrative limits, and as-low-as-is-reasonably-achievable (ALARA) programs (which would include worker rotations).

Hazardous Chemical Impacts. No hazardous chemicals would be released as a result of operations at Hanford under this alternative; thus, no cancer or adverse, noncancer health effects would occur. No carcinogenic chemicals would be released as a result of operations.

4.3.2.5 Facility Accidents

The potential consequences of postulated bounding facility accidents from operation of the pit conversion, immobilization, and MOX facilities at Hanford are presented in Tables 4–30 through 4–33. Doses reported would not be exceeded in 95 percent of weather conditions. Accident scenarios analyzed include low-frequency/high-consequence design basis operational accidents and an extremely low-frequency/high-consequence beyond-design-basis accident involving a building collapse. For the purposes of this analysis, the accident was assumed to be a catastrophic earthquake. The accidents analyzed are representative of the spectrum of potential accidents; analyses of different accidents may be available in the past, ongoing, or future National Environmental Policy Act (NEPA) reviews or SARs.

Table 4–30. Accident Impacts of Pit Conversion Under Alternative 2: Pit Conversion in FMEF, Immobilization in FMEF and HLWVF, and MOX in New Construction at Hanford

		Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	Frequency (per year)	Dose (rem)[a]	Probability of Cancer Fatality[b]	Dose (rem)[a]	Probability of Cancer Fatality[b]	Dose (person-rem)[a]	Latent Cancer Fatalities[c]
Fire	Unlikely	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	Unlikely	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	Extremely unlikely	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	Extremely unlikely	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	Extremely unlikely	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	Unlikely	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	Beyond extremely unlikely	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	Extremely unlikely to beyond extremely unlikely	2.5×10^{2}	9.9×10^{-2}	9.4	4.7×10^{-3}	2.3×10^{4}	11

[a] For 95th percentile meteorological conditions. With the exception of doses due to criticality and tritium exposure, the stated doses are from the inhalation of plutonium, and represent dose commitments that would be received over the lifetime of the impacted individual. See Appendix K.1.4.2 for a more detailed discussion of pathways.

[b] Increased likelihood (or probability) of cancer fatality for 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 for a hypothetical individual in the offsite population at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[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. The value assumes that the accident has occurred.

Key: FMEF, Fuels and Materials Examination Facility.

Source: Calculated using the source terms in Table K–3 and the MACCS2 computer code.

More details on the method of analysis and specific accident scenarios are presented in Appendix F.11, and more details on the consequences are presented in Appendix K. Each accident type (e.g., fire, explosion) considered is expected to bound the consequences of a range of similar accidents with lower consequences and risk.

Estimates of radiological consequences have been developed for the noninvolved worker and the MEI in the general population. Consequences are presented in terms of the radiological dose (in rem) and the probability

Table 4–31. Accident Impacts of Ceramic Immobilization Under Alternative 2: Pit Conversion in FMEF, Immobilization in FMEF and HLWVF, and MOX in New Construction at Hanford

		Impacts on Noninvolved Worker		Impact at Site Boundary		Impacts on Population Within 80 km	
Accident	Frequency (per year)	Dose (rem)[a]	Probability of Cancer Fatality[b]	Dose (rem)[a]	Probability of Cancer Fatality[b]	Dose (person-rem)[a]	Latent Cancer Fatalities[c]
Criticality	Extremely unlikely	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	Unlikely	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)	Extremely unlikely	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	Unlikely	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)	Extremely unlikely	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	Unlikely	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	Beyond extremely unlikely	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	Extremely unlikely to beyond extremely unlikely	1.5×10^{2}	6.2×10^{-2}	5.8	2.9×10^{-3}	1.4×10^{4}	7.1

[a] For 95th percentile meteorological conditions. With the exception of doses due to criticality, the stated doses are from the inhalation of plutonium, and represent dose commitments that would be received over the lifetime of the impacted individual. See Appendix K.1.4.2 for a more detailed discussion of pathways.
[b] Increased likelihood (or probability) of cancer fatality for 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 for a hypothetical individual in the offsite population at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.
[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. The value assumes that the accident has occurred.

Key: FMEF, Fuels and Materials Examination Facility; HYDOX, hydride oxidation.

Source: Calculated using the source terms in Table K–4 and the MACCS2 computer code.

that the dose would result in an LCF. The probability coefficients for determining the likelihood of fatal cancer, given a dose, are taken from the *1990 Recommendations of the International Commission on Radiation Protection* (ICRP 1991). For low doses or low dose rates, a probability coefficient of 4.0×10^{-4} LCF per rem is applied for workers, and 5.0×10^{-4} LCF per rem for the public. For high doses received at a high rate, probability coefficients of 8.0×10^{-4} and 1.0×10^{-3} LCF per rem are applied for workers and the public, respectively. These higher-probability coefficients apply for doses above 20 rem and dose rates above 10 rem/hr. At much higher doses, prompt fatalities rather than LCFs may be the primary concern.

The frequency listed for each accident category represents the estimated overall annual probability of occurrence for that type of accident. Because the estimated uncertainty of the accident frequencies is about a factor of 10 or more, the frequencies are characterized as anticipated, unlikely, extremely unlikely, and beyond extremely unlikely, representing estimated frequency ranges of greater than 10^{-2}, 10^{-2} to 10^{-4}, 10^{-4} to 10^{-6}, and less than 10^{-6} per year, respectively.

Public. The most severe consequences of a design basis accident for the pit conversion facility would be associated with a tritium release; the most severe for the immobilization and MOX facilities, a nuclear

Table 4–32. Accident Impacts of Glass Immobilization Under Alternative 2: Pit Conversion in FMEF, Immobilization in FMEF and HLWVF, and MOX in New Construction at Hanford

		Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	**Frequency (per year)**	**Dose (rem)[a]**	**Probability of Cancer Fatality[b]**	**Dose (rem)[a]**	**Probability of Cancer Fatality[b]**	**Dose (person-rem)[a]**	**Latent Cancer Fatalities[c]**
Criticality	Extremely unlikely	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	Unlikely	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)	Extremely unlikely	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	Unlikely	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	Unlikely	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	Unlikely	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	Unlikely	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	Beyond extremely unlikely	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	Extremely unlikely to beyond extremely unlikely	1.4×10^{2}	5.4×10^{-2}	5.1	2.6×10^{-3}	1.2×10^{4}	6.2

[a] For 95th percentile meteorological conditions. With the exception of doses due to criticality, the stated doses are from the inhalation of plutonium, and represent dose commitments that would be received over the lifetime of the impacted individual. See Appendix K.1.4.2 for a more detailed discussion of pathways.

[b] Increased likelihood (or probability) of cancer fatality for 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 for a hypothetical individual in the offsite population at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[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. The value assumes that the accident has occurred.

Key: FMEF, Fuels and Materials Examination Facility; HYDOX, hydride oxidation.

Source: Calculated using the source terms in Table K–5 and the MACCS2 computer code.

criticality. Bounding radiological consequences for the MEI are from the tritium release, which would result in a dose of 0.068 rem, corresponding to an LCF probability of 3.4×10^{-5}. A nuclear criticality of 10^{19} fissions would result in an MEI dose of 3.4×10^{-3} rem at the immobilization facility and 3.5×10^{-2} rem at the MOX facility. Consequences of the tritium release for the general population in the environs of Hanford would include an estimated 0.11 LCF. The frequency of such an accident is estimated to be between 1 in 10,000 and 1 in 1,000,000 per year.

The combined radiological effects from total collapse of all three facilities in the beyond-design-basis earthquake would be approximately 46 LCFs. It should be emphasized that a seismic event of sufficient magnitude to collapse these facilities would likely cause the collapse of other DOE facilities, and would almost certainly cause widespread failure of homes, office buildings, and other structures in the surrounding area. The overall impact of such an event must therefore be seen in the context not only of the potential radiological impacts of these other facilities, but of hundreds, possibly thousands, of immediate fatalities from falling debris. The frequency of such an earthquake is estimated to be between 1 in 100,000 and 1 in 10,000,000 per year.

Table 4–33. Accident Impacts of MOX Facility Under Alternative 2: Pit Conversion in FMEF, Immobilization in FMEF and HLWVF, and MOX in New Construction at Hanford

		Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	**Frequency (per year)**	**Dose (rem)[a]**	**Probability of Cancer Fatality[b]**	**Dose (rem)[a]**	**Probability of Cancer Fatality[b]**	**Dose (person-rem)[a]**	**Latent Cancer Fatalities[c]**
Criticality	Extremely unlikely	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	Extremely unlikely	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	Unlikely	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	Unlikely	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	Extremely unlikely	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	Unlikely	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	Beyond extremely unlikely	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	Extremely unlikely to beyond extremely unlikely	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] For 95th percentile meteorological conditions. With the exception of doses due to criticality, the stated doses are from the inhalation of plutonium, and represent dose commitments that would be received over the lifetime of the impacted individual. See Appendix K.1.4.2 for a more detailed discussion of pathways.

[b] Increased likelihood (or probability) of cancer fatality for 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 for a hypothetical individual in the offsite population at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[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. The value assumes that the accident has occurred.

Source: Calculated using the source terms in Table K–9 and the MACCS2 computer code.

Noninvolved Worker. Consistent with the analysis presented in the *Storage and Disposition PEIS*, the noninvolved worker is a hypothetical individual working on the site but not involved in the proposed action, and assumed to be 1,000 m (3,281 ft) from the location of the accident or at the site boundary, whichever is closer, and downwind from that location. A worker closer than 1,000 m (3,281 ft) from the accident would generally receive a higher dose; a worker farther away, a lower one. At some sites where the distance to the site boundary is less than 1,000 m (3,281 ft), the worker is assumed to be at the site boundary. For design basis accidents, the radiological consequences for this worker were estimated to be the highest for the criticality at the MOX facility. The consequences of such an accident would include an LCF probability of 2.5×10^{-4}.

Maximally Exposed Involved Worker. 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. Explosions could result in immediate injuries from flying debris, as well as the uptake of plutonium and uranium particulates through inhalation. If a criticality occurred, workers within tens of meters could receive very high to fatal radiation exposures from the initial 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 accident. The design basis and beyond-design-basis earthquakes would also have substantial consequences, ranging from workers being killed by debris from collapsing equipment and structures to high radiation exposures and uptakes of radionuclides. For most accidents, immediate emergency response actions should reduce the consequences to workers near the accident. As discussed in the Emergency Preparedness sections of Chapter 3, each candidate site has an established emergency management program that would be activated in the event of an accident. Based on the decisions made in the SPD EIS ROD, site emergency management programs would be modified to consider new accidents not in the current program.

Nonradiological Accidents. Surplus plutonium disposition operations at Hanford could result in worker injuries and fatalities. DOE-required industrial safety programs would be in place to reduce the risks. Given the estimated 12,030 person-years of labor and the standard DOE occupational accident rates, approximately 430 cases of nonfatal occupational injury or illness and 0.32 fatality could be expected for the duration of operations.

4.3.2.6 Transportation

Operational transportation impacts may be divided into two parts: impacts due to incident-free transportation and those due to transportation accidents. They may be further divided into nonradiological and radiological impacts. Nonradiological impacts are specifically vehicular, such as vehicular emissions and traffic accidents. Radiological impacts are those related to the dose received by transportation workers and the public during normal operations and in the case of accidents in which the radioactive materials being shipped may be released. For more detailed information on the transportation analysis performed for this SPD EIS, see Appendix L.

Under Alternative 2, transportation to and from Hanford would include the classified shipment of plutonium pits and clean plutonium metal via safe, secure trailer/SafeGuards Transport (SST/SGT) from sites throughout the DOE complex to the pit conversion facility.[10] During dismantlement of the pits, some highly enriched uranium (HEU) would be recovered. The pit conversion facility would ship HEU via SST/SGT to Oak Ridge Reservation (ORR) for storage.[11] After conversion, the plutonium in the pit conversion facility would be in the form of

[10] Work is currently under way to repackage all pits at Pantex from the AL–R8 container into the AL–R8 SI container for long-term storage. The AL–R8 is not an offsite shipping container as was the AT–400A analyzed in the SPD Draft EIS. Therefore, if the decision were made to site the pit conversion facility at a site other than Pantex, the surplus pits would have to be taken out of the AL–R8 SI and placed in a yet-to-be-developed shipping container. This operation would also require the replacement of some pit-holding fixtures to meet transportation requirements. Under such alternatives, this change would result in a total repackaging exposure of 208 person-rem to Pantex personnel. An increase in worker doses of this magnitude could result in an increase in the expected number of LCFs of 8.3×10^{-2} over the life of the program.

[11] Classified nuclear material parts would also result from pit disassembly. Although current plans are to store these parts at the pit conversion facility, this SPD EIS analyzes the possible transport of these nuclear material parts to LANL. Therefore, the transportation impacts are slightly overstated.

plutonium dioxide. This material would be transferred through a secure tunnel to the MOX facility at Hanford for fabrication into MOX fuel pellets.

MOX fuel fabrication also requires uranium dioxide. Quantifying the uranium dioxide transportation requirements for this SPD EIS involved selecting representative sites for the source of the depleted uranium hexafluoride and the conversion facility. A DOE enrichment facility near Portsmouth, Ohio, was chosen as a representative site for the source of the depleted uranium hexafluoride, and the nuclear fuel fabrication facility in Wilmington, North Carolina, as representative of a uranium conversion facility. These sites were also used as representative sites in the *Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement* (DOE 1996e). It is assumed that depleted uranium hexafluoride would be shipped via commercial truck to the uranium conversion facility, where it would be converted into uranium dioxide. After conversion, the depleted uranium dioxide would be shipped via commercial truck from the conversion facility to the MOX facility at Hanford. This material would be blended with plutonium dioxide at the MOX facility, fabricated into MOX fuel pellets, and placed in MOX fuel rods. After fabrication, the MOX fuel rods would be shipped to a domestic, commercial reactor site (Catawba, McGuire, or North Anna), where they would be placed in fuel assemblies and irradiated. Shipments of unirradiated MOX fuel rods would be made in an SST/SGT because unirradiated MOX fuel in large enough quantities is subject to the same security concerns as pure weapons-grade plutonium. For the purpose of this transportation analysis, it is assumed that all MOX fuel is shipped from the MOX facility to the most distant reactor site, North Anna.

Immobilization at Hanford under this alternative would require that surplus nonpit plutonium in various forms be shipped from current storage locations (i.e., SRS, Hanford, INEEL, LLNL, LANL, and RFETS) to the immobilization facility at Hanford. Even though these materials are not clean plutonium metal or pits, the quantity of the plutonium contained in them would require that they be treated as materials that could be used in nuclear weapons, and thus that shipments be made in SST/SGTs.

Under the preferred technology alternative for immobilization, the surplus plutonium would be immobilized in a ceramic matrix in small cans at the immobilization facility, placed in HLW canisters, and transported via specially designed trucks to the high-level-waste vitrification facility (HLWVF) in the 200 Area. This intrasite transportation—from 400 Area to 200 Area—could require the temporary shutdown of roads on the Hanford site. It would, however, provide for all the necessary security and for reduced risk to the public; SST/SGTs would not be required.

Use of the preferred ceramic (versus glass) matrix for immobilization would also require a small amount of depleted uranium dioxide (i.e., less than 10 t [11 tons] per year). It is assumed that this depleted uranium dioxide would be produced and shipped in the same manner as the depleted uranium dioxide needed by the MOX facility.

After the immobilized plutonium was encased by HLW at HLWVF, it would be shipped to a potential geologic repository for ultimate disposition. Because HLW would be displaced by the cans of immobilized plutonium suspended in the HLW canister, additional canisters—to accommodate the displaced HLW—would be required over the life of the immobilization program. According to estimates, up to 145 additional canisters of HLW would be needed to meet the demands of surplus plutonium disposition under Alternative 2. The *Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (*Yucca Mountain Draft EIS)* (DOE 1999d) evaluates different options for the shipment of these canisters to a potential geologic repository using either trucks or trains. The analysis revealed that shipment by train would pose the lower risk. However, no ROD has yet been issued regarding these shipments. To bound the risks associated with these additional shipments, this SPD EIS conservatively assumes that all of these shipments would be made by truck, one canister per truck.

Every alternative considered in this SPD EIS would require routine transportation of wastes from the proposed disposition facilities to treatment, storage, or disposal facilities on the sites. This transportation would be handled in the same manner as other site waste shipments, and as shown in Sections 4.3.1.2 and 4.3.2.2, would involve no major increase in the amounts of waste already being managed at these sites. The shipments would pose no greater risks than the ordinary waste shipments at these sites as analyzed in the WM PEIS.

In all, approximately 2,400 shipments of radioactive materials would be carried out by DOE under this alternative. The total distance traveled on public roads by trucks carrying radioactive materials would be 7.5 million km (4.6 million mi).

Impacts of Incident-Free Transportation. The dose to transportation workers from all transportation activities entailed by this alternative has been estimated at 30 person-rem; the dose to the public, 41 person-rem. Accordingly, incident–free transportation of radioactive material associated with this alternative would result in 0.012 LCF among transportation workers and 0.020 LCF in the total affected population over the duration of the transportation activities. (LCFs associated with radiological releases were estimated by multiplying the occupational [worker] dose by 4.0×10^{-4} cancer per person-rem of exposure, and the public accident and accident-free doses by 5.0×10^{-4} cancer per person-rem of exposure [ICRP 1991]). The estimated number of nonradiological fatalities from vehicular emissions associated with this alternative is 0.025.

Impacts of Accidents During Transportation (Consequences). The maximum foreseeable offsite transportation accident under this alternative (probability of occurrence: greater than 1 in 10 million per year) is a shipment of plutonium pits from one of DOE's storage locations to the pit conversion facility with a severity category VIII accident in a rural population zone under neutral (average) weather conditions. If this accident were to occur, it could result in a dose of 87 person-rem to the public for an LCF risk of 0.044 and 96 rem to the hypothetical MEI for an LCF risk of 0.096. (The MEI receives a larger dose than the population because it is unlikely that a person would be in position, and remain in position, to receive this hypothetical maximum dose.) No fatalities would be expected to occur. The probability of more severe accidents, different weather conditions at the time of accident, or occurrence in a more densely populated area were also evaluated, and estimated to have a probability lower than 1 chance in 10 million per year. (See Appendix L.6.)

Impacts of Accidents During Transportation (Risks). The total transportation accident risks were estimated by summing the risks to the affected population from all hypothetical accidents. For Alternative 2, those risks are as follows: a radiological dose to the population of 7 person-rem, resulting in a total population risk of 0.004 LCF; and traffic accidents resulting in 0.074 fatalities.

4.3.2.7 Environmental Justice

As discussed in other parts of Section 4.3.2, routine operations conducted under Alternative 2 would pose no significant health risks to the public. The likelihood of an LCF for the MEI residing near Hanford would be approximately 1 in 9 million (see Table 4–28). The number of LCFs expected among the general population residing near Hanford from accident-free operations would be 0.036.

Design basis accidents at the sites would not be expected to cause cancer fatalities among the public (see Section 4.3.2.5). A beyond-design-basis earthquake would be expected to result in LCFs among the general population (see Tables 4–30 through 4–33). However, it is highly unlikely that a beyond-design-basis earthquake would occur. Accidents at the site pose no significant risks (when the probability of occurrence is considered) to the population residing within the area potentially affected by radiological contamination.

As described in Section 4.3.2.6, no radiological or nonradiological fatalities would be expected to result from accident-free transportation conducted under this alternative. Nor would radiological or nonradiological fatalities be expected to result from transportation accidents.

Thus, implementation of Alternative 2 would pose no significant risks to the public, nor would implementation of this alternative pose significant risks to groups within the public, including the risk of disproportionately high and adverse effects on minority and low-income populations.

4.4 ALTERNATIVE 3

Alternative 3 would involve constructing and operating all three facilities for surplus plutonium disposition at SRS. All three facilities would be located in new buildings in F-Area.

4.4.1 Construction

4.4.1.1 Air Quality and Noise

Sources of potential air quality impacts of construction under Alternative 3 at SRS include emissions from fuel-burning construction equipment, soil disturbance by construction equipment and other vehicles, the operation of a concrete batch plant, trucks moving materials and wastes, and employee vehicles. Emissions from these sources are summarized in Appendix G.

A comparison of maximum air pollutant concentrations, including the contribution from SRS construction activities, with standards and guidelines is presented as Table 4–34. Concentrations of air pollutants, especially for PM_{10} and total suspended particulates, would likely increase at the site boundary, but should not exceed the Federal or State ambient air quality standards. Air pollution impacts during construction would be mitigated by applying, as appropriate, standard dust control practices such as watering or sweeping of roads and watering of exposed areas.

Table 4–34. Evaluation of Air Pollutant Concentrations Associated With Construction Under Alternative 3: Pit Conversion and MOX in New Construction and Immobilization in New Construction and DWPF at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m^3)[a]	SPD Increment (Fg/m^3)	Total Site Concentration (Fg/m^3)	Site as a Percent of Standard or Guideline
Criteria pollutants					
Carbon monoxide	8 hours	10,000	4.35	675	6.8
	1 hour	40,000	19.8	5,120	13
Nitrogen dioxide	Annual	100	0.189	11.6	12
PM_{10}	Annual	50	0.0969	5.04	10
	24 hours	150	6.39	92.1	61
Sulfur dioxide	Annual	80	0.0562	16.7	21
	24 hours	365	1.39	223	61
	3 hours	1,300	8.31	733	56
Other regulated pollutants					
Total suspended particulates	Annual	75	0.19	45.6	61
Hazardous and other toxic compounds					
Other toxics[b]	24 hours	150	0.000224	20.7	14

[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: DWPF, Defense Waste Processing Facility; SPD, surplus plutonium disposition.

Source: EPA 1997a; SCDHEC 1996a.

Total vehicle emissions associated with activities at SRS would likely decrease somewhat from current emissions because of an expected decrease in overall site employment during this timeframe.

The location of these facilities relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during construction would include heavy construction equipment, employee vehicles, and truck traffic. Traffic noise associated with the construction of these facilities would occur on the site and along offsite local and regional transportation routes used to bring construction materials and workers to the site. Given the distance to the site boundary (about 8.7 km [5.4 mi]), noise emissions from construction equipment would not be expected to annoy the public. These noise sources would be far enough away from offsite areas that the contribution to offsite noise levels would be small. Some noise sources could have onsite impacts, such as the disturbance of wildlife. However, noise would be unlikely to affect federally listed threatened or endangered species or their critical habitats, as none are known to occur in F- or S-Area (see Section 4.26). Noise from traffic associated with the construction of these facilities would likely produce less than a 1-dB increase in traffic noise levels along roads used to access the site, and thus would not result in any increased annoyance of the public.

Construction workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (OSHA 1997). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of standard silencing packages on construction equipment, administrative controls, engineering controls, and personal hearing protection equipment.

4.4.1.2 Waste Management

Table 4–35 compares the wastes generated during the construction of surplus plutonium disposition facilities at SRS with the existing treatment, storage, and disposal capacity for the various waste types. It is anticipated that no TRU waste, LLW, or mixed LLW would be generated during the 3-year construction period. In addition, no soil contaminated with hazardous or radioactive constituents should be generated during construction. However, if any were generated, the waste would be managed in accordance with site practice and applicable Federal and State regulations. Construction waste generation would be the same for the ceramic and glass immobilization technologies because the same size facility would be built under either scenario. For this SPD EIS, it is assumed that hazardous waste and nonhazardous waste would be treated, stored, and disposed of in accordance with current site practices.

Table 4–35. Potential Waste Management Impacts of Construction Under Alternative 3: Pit Conversion and MOX in New Construction and Immobilization in New Construction and DWPF at SRS

Waste Type[a]	Estimated Additional Waste Generation (m^3/yr)	Estimated Additional Waste Generation as a Percent of[b]		
		Characterization or Treatment Capacity	Storage Capacity	Disposal Capacity
Hazardous	100	NA	NA	NA
Nonhazardous				
Liquid	47,000	17[c]	NA	3[d]
Solid	11,000	NA	NA	NA

[a] See definitions in Appendix F.8.

[b] Treatment capacities, and the disposal capacity for nonhazardous liquid waste, are compared with estimated additional annual waste generation. All other storage and disposal capacities are compared with total estimated additional waste generation assuming a 3-year construction period.

[c] Percent of capacity of F-Area sanitary sewer.

[d] Percent of capacity of Central Sanitary Wastewater Treatment Facility.

Key: DWPF, Defense Waste Processing Facility; NA, not applicable (i.e., it is assumed that the majority of the hazardous waste and nonhazardous solid waste will be treated and disposed of off the site by the construction contractor).

Hazardous wastes generated during the construction of surplus plutonium disposition facilities would be typical of those generated during the construction of an industrial facility. Any hazardous wastes generated during construction would be packaged in DOT-approved containers and shipped off the site to permitted commercial recycling, treatment, and disposal facilities. The additional waste load generated during construction should not have a major impact on the SRS hazardous waste management system.

Nonhazardous solid wastes generated during the construction of surplus plutonium disposition facilities would be packaged in conformance with standard industrial practice and shipped to commercial or municipal facilities for recycling or disposal. Because these wastes would be managed largely at non-DOE facilities, the additional waste load generated during construction should not have a major impact on the nonhazardous solid waste management system at SRS.

To be conservative, it was assumed that all nonhazardous liquid wastes generated during the construction of surplus plutonium disposition facilities 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 would be managed at offsite facilities. Nonhazardous liquid waste generated during the construction of these facilities is estimated to be 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, management of these wastes at SRS should not have a major impact on the nonhazardous liquid waste treatment system during construction.

4.4.1.3 Socioeconomics

Construction-related employment requirements under Alternative 3 would be as indicated in Table 4–36.

Table 4–36. Construction Employment Requirements for Alternative 3: Pit Conversion and MOX in New Construction and Immobilization in New Construction and DWPF at SRS

Year	Pit Conversion	Immobilization	MOX	Total
2001	297	0	0	297
2002	451	506	441	1,398
2003	276	920	772	1,968
2004	0	1,014	508	1,522
2005	0	552	221	773
2006	0	0	208	208

Key: DWPF, Defense Waste Processing Facility.
Source: DOE 1999c; UC 1998c, 1999c, 1999d.

At its peak in 2003, construction of the three new surplus plutonium disposition facilities at SRS under this alternative would require 1,968 construction workers and should generate another 1,580 indirect jobs in the region. As the total employment increase of 3,548 direct and indirect jobs represents only 1.3 percent of the projected REA workforce, it should have no major impact on the REA. Moreover, it should have little impact on the community services currently offered in the ROI. In fact, it should help offset the 20 percent reduction in SRS's total workforce (i.e., from 15,032 to 12,000 workers) projected for the years 1997–2005.

4.4.1.4 Human Health Risk

Radiological Impacts. No radiological risk would be incurred by members of the public from construction activities. A summary of radiological impacts of construction activities on workers at risk is presented in Table 4–37. Construction worker exposures to radiation that derives from other activities at the site, past or present, would be kept as low as is reasonably achievable. To this end, construction workers would be monitored (badged) as appropriate.

Table 4–37. Potential Radiological Impacts on Construction Workers of Alternative 3: Pit Conversion and MOX in New Construction and Immobilization in New Construction and DWPF at SRS

Impact	Pit Conversion[a]	Immobilization[b]	MOX[c]	Total
Total dose (person-rem/yr)	1.4	1.5	1.2	4.1
Annual latent fatal cancers[d]	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[e]
Annual latent fatal cancer risk	1.6×10^{-6}	1.6×10^{-6}	1.6×10^{-6}	1.6×10^{-6}

[a] An estimated average of 341 workers would be associated with annual construction operations.

[b] An estimated average of 374 workers would be associated with annual construction operations at the new facility location adjacent to APSF, if built. The number would be the same for immobilization in either ceramic or glass.

[c] An estimated average of 292 workers would be associated with annual construction operations.

[d] 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, per ICRP 1991.

[e] Represents an average of the doses for all three facilities.

Key: APSF, Actinide Packaging and Storage Facility; DWPF, Defense Waste Processing Facility.

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 1998c, 1998d, 1999c, 1999d.

Hazardous Chemical Impacts. The probability of excess latent cancer incidence associated with exposure to benzene released as a result of surplus plutonium disposition facility construction activities at SRS under this alternative has been estimated to be much less than 1 chance in 1 million over the lifetime of the maximally exposed member of the public.

4.4.1.5 Facility Accidents

The construction of new surplus plutonium disposition facilities at SRS could result in worker injuries or fatalities. DOE-required industrial safety programs would be in place to reduce the risks. Given the estimated 6,166 person-years of construction labor and standard industrial accident rates, approximately 610 cases of nonfatal occupational injury or illness and 0.86 fatality could be expected (DOL 1997a, 1997b). As all construction would be in nonradiological areas, no radiological accidents should occur.

4.4.1.6 Environmental Justice

As discussed in other parts of Section 4.4.1, construction under Alternative 3 would pose no significant health risks to the public. The risks would be negligible regardless of the racial or ethnic composition or the economic status of the population. Therefore, the construction of new facilities at SRS under Alternative 3 would have no significant impacts on minority or low-income populations.

4.4.2 Operations

4.4.2.1 Air Quality and Noise

Potential air quality impacts of the operation of facilities under Alternative 3 at SRS were analyzed using ISCST3. Operational impacts would result from process emissions, emergency diesel generator testing, trucks moving materials and wastes, and employee vehicles.

A comparison of maximum air pollutant concentrations, including the contribution from surplus plutonium disposition facilities, with standards and guidelines is presented as Table 4–38. Concentrations for immobilization in the ceramic and glass forms are the same. [Text deleted.] Concentrations of air pollutants would likely increase at the site boundary, but should not exceed the Federal or State ambient air quality standards. Air pollution impacts during operation would be mitigated; for example, HEPA filtration has been included in the design of these facilities.

Table 4–38. Evaluation of Air Pollutant Concentrations Associated With Operations Under Alternative 3: Pit Conversion and MOX in New Construction and Immobilization in New Construction and DWPF at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m³)[a]	SPD Increment (Fg/m³)	Total Site Concentration (Fg/m³)	Site as a Percent of Standard or Guideline
Criteria pollutants					
Carbon monoxide	8 hours	10,000	0.37	671	6.7
	1 hour	40,000	1.4	5,100	13
Nitrogen dioxide	Annual	100	0.0634	11.4	11
PM_{10}	Annual	50	0.00423	4.94	9.9
	24 hours	150	0.0688	85.8	57
Sulfur dioxide	Annual	80	0.124	16.8	21
	24 hours	365	1.7	224	61
	3 hours	1,300	4.48	729	56
Other regulated pollutants					
Total suspended particulates	Annual	75	0.00423	45.4	61
[Text deleted.]					

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

Key: DWPF, Defense Waste Processing Facility; SPD, surplus plutonium disposition.

Note: No nonradiological hazardous or other toxic compounds would be emitted from these processes.

Source: EPA 1997a; SCDHEC 1996a.

For a discussion of how the operation of these facilities would affect the site's ability to continue to meet NESHAPs limits regarding airborne radiological emissions, see Section 4.32.4.4. There are no other NESHAPs limits applicable to operation of these facilities.

The increased concentrations of nitrogen dioxide, PM_{10}, and sulfur dioxide from the operation of these facilities would be a small fraction of the PSD Class II area increments, as summarized in Table 4–39.

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

Table 4–39. Evaluation of Air Pollutant Increases Associated With Operations Under Alternative 3: Pit Conversion and MOX in New Construction and Immobilization in New Construction and DWPF at SRS

Pollutant	Averaging Period	Increase in Concentration (Fg/m^3)	PSD Class II Area Allowable Increment (Fg/m^3)	Percent of Increment
Nitrogen dioxide	Annual	0.0634	25	0.25
PM_{10}	Annual	0.00423	17	0.025
	24 hours	0.0688	30	0.23
Sulfur dioxide	Annual	0.124	20	0.62
	24 hours	1.70	91	1.9
	3 hours	4.48	512	0.88

Key: DWPF, Defense Waste Processing Facility; PSD, prevention of significant deterioration.
Source: EPA 1997b.

The combustion of fossil fuels associated with Alternative 3 would result in the emission of carbon dioxide, one of the atmospheric gases that are believed to influence the global climate. Annual carbon dioxide emissions from this alternative would represent less than 2×10^{-4} percent of the 1995 annual U.S. emissions of carbon dioxide from fossil fuel combustion and industrial processes, and therefore would not appreciably affect global concentrations of this pollutant.

The location of these facilities relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during operations would include new or existing sources (e.g., cooling systems, vents, motors, material-handling equipment), employee vehicles, and truck traffic. Traffic noise associated with operation of these facilities would occur on the site and along offsite local and regional transportation routes used to bring materials and workers to the site. Given the distance to the site boundary (about 8.7 km [5.4 mi]), noise emissions from equipment would not be expected to annoy the public. These noise sources would be far enough away from offsite areas that their contribution to offsite noise levels would be small. Some noise sources could have onsite impacts, such as the disturbance of wildlife. However, noise would be unlikely to affect federally listed threatened or endangered species or their critical habitats, as none are known to occur in F- or S-Area (see Section 4.26). Noise from traffic associated with operation of these facilities would likely produce less than a 1-dB increase in traffic noise levels along roads used to access the site, and thus would not result in any increased annoyance of the public.

Operations workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulation (OSHA 1997). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of administrative controls, engineering controls, and personal hearing protection equipment.

4.4.2.2 Waste Management

Table 4–40 compares the existing site treatment, storage, and disposal capacities with the expected waste generation rates from operating surplus plutonium disposition facilities at SRS. Although HLW would be used in the immobilization process, no HLW would be generated by surplus plutonium disposition facilities. Waste generation should be the same for the ceramic and glass immobilization technologies.

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. According to 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. Current schedules for shipment of TRU waste to WIPP would accommodate shipment of contact-handled TRU waste from surplus plutonium disposition facilities beginning

Table 4–40. Potential Waste Management Impacts of Operations Under Alternative 3: Pit Conversion and MOX in New Construction and Immobilization in New Construction and DWPF at SRS

Waste Type[a]	Estimated Additional Waste Generation (m^3/yr)	Estimated Additional Waste Generation as a Percent of[b] Characterization or Treatment Capacity	Storage Capacity	Disposal Capacity
TRU[c]	180	10	5	1 of WIPP
LLW	240	1	NA	8
Mixed LLW	5	<1	3	NA
Hazardous	94	1	18	NA
Nonhazardous				
Liquid	110,000	40[d]	NA	8[e]
Solid	3,100	NA	NA	NA

[a] See definitions in Appendix F.8.
[b] Treatment capacities, and the disposal capacity for nonhazardous liquid waste, are compared with estimated additional annual waste generation. All other storage and disposal capacities are compared with total estimated additional waste generation assuming a 10-year operation period.
[c] Includes mixed TRU waste. Facilities are not expected to generate remotely handled TRU waste.
[d] Percent of capacity of F-Area sanitary sewer.
[e] Percent of capacity of Central Sanitary Wastewater Treatment Facility.
Key: DWPF, Defense Waste Processing Facility; LLW, low-level waste; NA, not applicable (i.e., the majority of this waste is not routinely treated, stored, or disposed of on the site); TRU, transuranic; WIPP, Waste Isolation Pilot Plant.

in 2016 (DOE 1997c:17). Therefore, in order to be conservative it is assumed the TRU waste would be stored on the site until 2016. 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 offsite at 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 SRS are described in the *SRS Waste Management Final EIS* (DOE 1995c).

TRU wastes would be treated, packaged, and certified to WIPP waste acceptance criteria at the new facilities. 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.

TRU waste generated at surplus plutonium disposition facilities is estimated to be 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 1,800 m^3 (2,350 yd^3) of TRU waste would be generated over the 10-year operation period. If all the TRU waste were stored on the site, this would be 5 percent of the 34,400-m^3 (45,000-yd^3) storage capacity available at the TRU Waste Storage Pads. Assuming that the waste were stored in 208-l (55-gal) drums that could be stacked two high, and allowing a 50 percent factor for aisle space, a storage area of about 0.26 ha (0.64 acre) would be required. Therefore, impacts of the management of additional quantities of TRU waste at SRS should not be major. Impacts from the treatment of TRU waste to WIPP waste acceptance criteria are described in the WM PEIS (DOE 1997d) and the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997e).

The 1,800 m^3 (2,350 yd^3) of TRU wastes generated by these facilities would be 1 percent of the 143,000-m^3 (187,000-yd^3) contact-handled TRU waste that DOE plans to dispose of at WIPP and 1 percent of the current

168,500-m^3 (220,400-yd^3) limit for WIPP (DOE 1997e:3-3). Impacts of disposal of TRU waste at WIPP are described in the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997e).

LLW would be packaged, certified, and accumulated at the new facilities before transfer for additional treatment and disposal in existing onsite facilities. A total of 2,400 m^3 (3,140 yd^3) of LLW would be generated over the operations period. LLW generated at surplus plutonium disposition facilities is estimated to be 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 disposal land usage factor for SRS published in the *Storage and Disposition PEIS* (DOE 1996a:E-9), 2,400 m^3 (3,140 yd^3) of waste would require 0.27 ha (0.67 acre) of disposal space at SRS. Therefore, impacts of the management of this additional LLW at SRS should not be major.

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 generated at surplus plutonium disposition facilities is estimated to be less than 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 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 would be packaged at the generating facility for treatment and disposal at a combination of onsite and offsite facilities. Assuming that all hazardous waste is managed on the site, hazardous waste generated at surplus plutonium disposition facilities is estimated to be 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. If all LLW, mixed LLW, and hazardous wastes generated at surplus plutonium disposition facilities were treated in the Consolidated Incineration Facility, this additional waste would be 2 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of that facility.

Nonhazardous solid waste would be packaged and transported 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 for disposal (DOE 1998c:3-42). It is unlikely that this additional waste load would have a major impact on the nonhazardous solid waste management system at SRS.

Nonhazardous wastewater would be treated if necessary before being discharged to the F-Area sanitary sewer system, which connects to the Central Sanitary Wastewater Treatment Facility. Nonhazardous liquid waste generated by surplus plutonium disposition facilities is estimated to be 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, management of nonhazardous liquid waste at SRS should not have a major impact on the treatment system.

4.4.2.3 Socioeconomics

After construction, startup, and testing of the new SRS facilities in 2007 under Alternative 3, an estimated 1,120 new workers would be required to operate them (DOE 1999c; UC 1998c, UC 1999c, 1999d). This level of employment should generate another 2,003 indirect jobs in the region. As the total employment requirement of 3,123 direct and indirect jobs represents 1 percent of the projected REA workforce, it should have no major impact on the REA. Moreover, the additional jobs would have little impact on community services currently offered in the ROI. In fact, they should help offset the reduction in SRS's total workforce projected for the years 1997–2010 of 33 percent (i.e., 15,032 to 10,000 workers).

4.4.2.4 Human Health Risk

During normal operations, there would be both radiological and hazardous chemical releases to the environment and also direct in-plant exposures. The resulting doses to, and potential health effects on, the public and workers under Alternative 3 would be as follows.

Radiological Impacts. Table 4–41 reflects the potential radiological impacts on three individual receptor groups: the population living within 80 km (50 mi) of SRS in the year 2010, the maximally exposed member of the public, and the average exposed member of the public. The table depicts projected aggregate latent fatal cancer risk to these groups from 10 years of incident-free operation. To put operational doses into perspective, comparisons with doses from natural background radiation are also provided in the table.

Table 4–41. Potential Radiological Impacts on the Public of Operations Under Alternative 3: Pit Conversion and MOX in New Construction and Immobilization in New Construction and DWPF at SRS

Impact	Pit Conversion	Immobilization		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}

[a] Includes a 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 all three facilities. The total includes the higher of the values for the ceramic and glass immobilization alternatives.

[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 approximately 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 APSF, if built, in 2010 (approximately 790,000).

Key: APSF, Actinide Packaging and Storage Facility; DWPF, Defense Waste Processing Facility.

Source: Appendix J.

Given incident-free operation of all three facilities, the total population dose in the year 2010 would be 1.8 person-rem. The corresponding number of LCFs in this population from 10 years of operation would be 9.0×10^{-3}. The dose to the maximally exposed member of the public from annual operation of all three facilities would be 7.4×10^{-3} mrem. From 10 years of operation, the corresponding LCF risk to this individual would be 3.7×10^{-8}. The impacts on the average individual would be lower.

Estimated impacts resulting from "Total Site" operations are given in the Cumulative Impacts section of this SPD EIS (see Section 4.32). Within that section, projected incremental impacts associated with the operation of the proposed surplus plutonium disposition facilities are added to the impacts of other past, present, and reasonably foreseeable future actions at or near the candidate sites. These impacts are then compared against applicable regulatory standards established by DOE, EPA, and NRC (such as DOE Order 5400.5, the CAA [NESHAPs], the SDWA, and 10 CFR 20).

Doses to involved workers from normal operations are given in Table 4–42; these workers are defined as those directly associated with process activities. Under this alternative, the annual average dose would be 500 mrem to pit conversion facility workers, 750 mrem to immobilization facility workers, and 65 mrem to MOX facility workers. The annual dose received by the total site workforce for each of these facilities is estimated to be 192, 242, and 22 person-rem, respectively. The risks and numbers of LCFs among the different workers from 10 years of operation are included in Table 4–42. Doses to individual workers would be kept to minimal levels by instituting badged monitoring, administrative limits, and ALARA programs (which would include worker rotations).

Table 4–42. Potential Radiological Impacts on Involved Workers of Operations Under Alternative 3: Pit Conversion and MOX in New Construction and Immobilization in New Construction and DWPF at SRS

Impact	Pit Conversion	Immobilization (Ceramic or Glass)	MOX	Total
Number of badged workers	383	323	331	1037
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[a]
10-year latent fatal cancer risk	2.0×10^{-3}	3.0×10^{-3}	2.6×10^{-4}	1.8×10^{-3}

[a] Represents an average of the doses for all three facilities.

Key: DWPF, Defense Waste Processing Facility.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995d). 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 1994a). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1999c; UC 1998c, 1998d, 1999c, 1999d.

Hazardous Chemical Impacts. No hazardous chemicals would be released as a result of operations at SRS under this alternative; thus, no cancer or adverse, noncancer health effects would occur. No carcinogenic chemicals would be released as a result of operations.

4.4.2.5 Facility Accidents

The potential consequences of postulated bounding facility accidents from operation of the pit conversion, immobilization, and MOX facilities at SRS are presented in Tables 4–43 through 4–46. More details on the method of analysis, assumptions, and specific accident scenarios are presented in the discussion of Alternative 2 in Section 4.3.2.5.

Public. The most severe consequences of a design basis accident for the pit conversion facility would be associated with a tritium release; the most severe for the immobilization and MOX facilities, a nuclear criticality. Bounding radiological consequences for the MEI are from the tritium release, which would result in a dose of 0.028 rem, corresponding to an LCF probability of 1.4×10^{-5}. A nuclear criticality of 10^{19} fissions would result in an MEI dose of 1.6×10^{-3} rem at the immobilization facility and 0.016 rem at the MOX facility. Consequences of the tritium release accident for the general population in the environs of SRS would include an estimated

0.050 LCF. The frequency of such an accident is estimated to be between 1 in 10,000 and 1 in 1,000,000 per year.

The combined radiological effects from total collapse of all three facilities in the beyond-design-basis earthquake would be approximately 18 LCFs. It should be emphasized that a seismic event of sufficient magnitude to collapse these facilities would likely cause the collapse of other DOE facilities, and would almost certainly cause widespread failure of homes, office buildings, and other structures in the surrounding area. The overall impact of such an event must therefore be seen in the context not only of the potential radiological

Table 4–43. Accident Impacts of Pit Conversion Under Alternative 3: Pit Conversion and MOX in New Construction and Immobilization in New Construction and DWPF at SRS

		Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	**Frequency (per year)**	**Dose (rem)[a]**	**Probability of Cancer Fatality[b]**	**Dose (rem)[a]**	**Probability of Cancer Fatality[b]**	**Dose (person-rem)[a]**	**Latent Cancer Fatalities[c]**
Fire	Unlikely	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	Unlikely	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	Extremely unlikely	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	Extremely unlikely	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	Extremely unlikely	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	Unlikely	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	Beyond extremely unlikely	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	Extremely unlikely to beyond extremely unlikely	9.2×10^{1}	3.7×10^{-2}	3.6	1.8×10^{-3}	8.5×10^{3}	4.3

[a] For 95th percentile meteorological conditions. With the exception of doses due to criticality and tritium exposure, the stated doses are from the inhalation of plutonium, and represent dose commitments that would be received over the lifetime of the impacted individual. See Appendix K.1.4.2 for a more detailed discussion of pathways.

[b] Increased likelihood (or probability) of cancer fatality for 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 for a hypothetical individual in the offsite population at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[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. The value assumes that the accident has occurred.

Key: DWPF, Defense Waste Processing Facility.

Source: Calculated using the source terms in Table K–14 and the MACCS2 computer code.

impacts of these other facilities, but of hundreds, possibly thousands, of immediate fatalities from falling debris. The frequency of such an earthquake is estimated to be between 1 in 100,000 and 1 in 10,000,000 per year.

Noninvolved Worker. Consistent with the analysis presented in the *Storage and Disposition PEIS*, the noninvolved worker is a hypothetical individual working on the site but not involved in the proposed action, and assumed to be 1,000 m (3,281 ft) from the location of the accident or at the site boundary, whichever is closer, and downwind from that location. For design basis accidents, the radiological consequences for this worker were estimated to be the highest for the criticality at the MOX facility. The consequences of such an accident would include an LCF probability of 1.2×10^{-4}.

Maximally Exposed Involved Worker. 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. Explosions could result in immediate injuries from flying debris, as well as the uptake of plutonium and uranium particulates through inhalation. If a criticality occurred, workers within tens of meters could receive very high to fatal radiation exposures from the initial 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 accident. The design basis and beyond-design-basis earthquakes would also have

Table 4–44. Accident Impacts of Ceramic Immobilization Under Alternative 3: Pit Conversion and MOX in New Construction and Immobilization in New Construction and DWPF at SRS

		Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	**Frequency (per year)**	**Dose (rem)[a]**	**Probability of Cancer Fatality[b]**	**Dose (rem)[a]**	**Probability of Cancer Fatality[b]**	**Dose (person-rem)[a]**	**Latent Cancer Fatalities[c]**
Criticality	Extremely unlikely	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	Unlikely	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)	Extremely unlikely	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	Unlikely	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)	Extremely unlikely	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	Unlikely	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	Beyond extremely unlikely	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	Extremely unlikely to beyond extremely unlikely	5.7×10^{1}	2.3×10^{-2}	2.2	1.1×10^{-3}	5.3×10^{3}	2.7

[a] For 95th percentile meteorological conditions. With the exception of doses due to criticality, the stated doses are from the inhalation of plutonium, and represent dose commitments that would be received over the lifetime of the impacted individual. See Appendix K.1.4.2 for a more detailed discussion of pathways.

[b] Increased likelihood (or probability) of cancer fatality for 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 for a hypothetical individual in the offsite population at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[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. The value assumes that the accident has occurred.

Key: DWPF, Defense Waste Processing Facility; HYDOX, hydride oxidation.

Source: Calculated using the source terms in Table K–15 and the MACCS2 computer code.

substantial consequences, ranging from workers being killed by debris from collapsing equipment and structures to high radiation exposures and uptakes of radionuclides. For most accidents, immediate emergency response actions should reduce the consequences to workers near the accident. As discussed in the Emergency Preparedness sections of Chapter 3, each candidate site has an established emergency management program that would be activated in the event of an accident. Based on the decisions made in the SPD EIS ROD, site emergency management programs would be modified to consider new accidents not in the current program.

Nonradiological Accidents. Surplus plutonium disposition operations at SRS could result in worker injuries and fatalities. DOE-required industrial safety programs would be in place to reduce the risks. Given the estimated employment of 11,535 person-years of labor and the standard DOE occupational accident rates, approximately 420 cases of nonfatal occupational injury or illness and 0.31 fatality could be expected for the duration of operations.

Table 4–45. Accident Impacts of Glass Immobilization Under Alternative 3: Pit Conversion and MOX in New Construction and Immobilization in New Construction and DWPF at SRS

		Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	Frequency (per year)	Dose (rem)[a]	Probability of Cancer Fatality[b]	Dose (rem)[a]	Probability of Cancer Fatality[b]	Dose (person-rem)[a]	Latent Cancer Fatalities[c]
Criticality	Extremely unlikely	1.0×10^{-2}	4.2×10^{-6}	1.6×10^{-3}	7.8×10^{-7}	1.5	8.0×10^{-4}
Explosion in HYDOX furnace	Unlikely	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)	Extremely unlikely	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	Unlikely	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	Unlikely	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	Unlikely	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	Unlikely	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	Beyond extremely unlikely	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	Extremely unlikely to beyond extremely unlikely	5.0×10^{1}	2.0×10^{-2}	2.0	9.8×10^{-4}	4.6×10^{3}	2.3

[a] For 95th percentile meteorological conditions. With the exception of doses due to criticality, the stated doses are from the inhalation of plutonium, and represent dose commitments that would be received over the lifetime of the impacted individual. See Appendix K.1.4.2 for a more detailed discussion of pathways.

[b] Increased likelihood (or probability) of cancer fatality for 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 for a hypothetical individual in the offsite population at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[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. The value assumes that the accident has occurred.

Key: DWPF, Defense Waste Processing Facility; HYDOX, hydride oxidation.

Source: Calculated using the source terms in Table K–16 and the MACCS2 computer code.

Table 4–46. Accident Impacts of MOX Facility Under Alternative 3: Pit Conversion and MOX in New Construction and Immobilization in New Construction and DWPF at SRS

		Impacts on Noninvolved Worker		Impacts at Site Boundary		Impacts on Population Within 80 km	
Accident	Frequency (per year)	Dose (rem)[a]	Probability of Cancer Fatality[b]	Dose (rem)[a]	Probability of Cancer Fatality[b]	Dose (person-rem)[a]	Latent Cancer Fatalities[c]
Criticality	Extremely unlikely	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	Extremely unlikely	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	Unlikely	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	Unlikely	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	Extremely unlikely	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	Unlikely	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	Beyond extremely unlikely	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	Extremely unlikely to beyond extremely unlikely	2.3×10^{2}	9.1×10^{-2}	8.8	4.4×10^{-3}	2.1×10^{4}	1.1×10^{1}

[a] For 95th percentile meteorological conditions. With the exception of doses due to criticality, the stated doses are from the inhalation of plutonium, and represent dose commitments that would be received over the lifetime of the impacted individual. See Appendix K.1.4.2 for a more detailed discussion of pathways.

[b] Increased likelihood (or probability) of cancer fatality for 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 for a hypothetical individual in the offsite population at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[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. The value assumes that the accident has occurred.

Key: DWPF, Defense Waste Processing Facility.

Source: Calculated using the source terms in Table K–19 and the MACCS2 computer code.

4.4.2.6 Transportation

Operational transportation impacts may be divided into two parts: impacts due to incident-free transportation and those due to transportation accidents. They may be further divided into nonradiological and radiological impacts. Nonradiological impacts are specifically vehicular, such as vehicular emissions and traffic accidents. Radiological impacts are those related to the dose received by transportation workers and the public during normal operations and in the case of accidents in which the radioactive materials being shipped may be released. For more detailed information on the transportation analysis performed for this SPD EIS, see Appendix L.

Under Alternative 3, transportation to and from SRS would include the shipment of plutonium pits and clean plutonium metal via SST/SGT from sites throughout the DOE complex to the pit conversion facility.[12] During dismantlement of the pits, some HEU would be recovered. The pit conversion facility would ship HEU via SST/SGT to ORR for storage.[13] After conversion, the plutonium in the pit conversion facility would be in the form of plutonium dioxide. This material would be transferred through a secure tunnel to the MOX facility at SRS for fabrication into MOX fuel pellets.

MOX fuel fabrication also requires uranium dioxide. Quantifying the uranium dioxide transportation requirements for this SPD EIS involved selecting representative sites for the source of the depleted uranium hexafluoride and the conversion facility. A DOE enrichment facility near Portsmouth, Ohio, was chosen as a representative site for the source of the depleted uranium hexafluoride, and the nuclear fuel fabrication facility in Wilmington, North Carolina, as representative of a uranium conversion facility. These sites were also used as representative sites in the *Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement* (DOE 1996e). It is assumed that depleted uranium hexafluoride needed for MOX fuel would be shipped via commercial truck to the uranium conversion facility, where it would be converted into uranium dioxide (see Section 4.3.2.6). After conversion, the depleted uranium dioxide would be shipped via commercial truck from the conversion facility to the MOX facility at SRS. This material would be blended with plutonium dioxide at the MOX facility, fabricated into MOX fuel pellets, and placed in MOX fuel rods. After fabrication, the MOX fuel rods would be shipped to a domestic reactor site, where they would be placed in fuel assemblies and irradiated. Shipments of unirradiated MOX fuel rods would be made in an SST/SGT because unirradiated MOX fuel in large enough quantities is subject to the same security concerns as pure weapons-grade plutonium. It is assumed in this transportation analysis that all MOX fuel is shipped from the MOX facility to the most distant reactor site, North Anna.

Immobilization at SRS under this alternative would require that surplus nonpit plutonium in various forms be shipped from current storage locations (i.e., SRS, Hanford, INEEL, LLNL, LANL, and RFETS) to the immobilization facility at SRS. Even though these materials are not clean plutonium metal or pits, the quantity of the plutonium contained in them would require that they be treated as materials that could be used in nuclear weapons, and thus that shipments be made in SST/SGTs.

Under the preferred technology alternative for immobilization, the surplus plutonium would be immobilized in a ceramic matrix in small cans at the immobilization facility, placed in HLW canisters, and transported via specially designed trucks to the Defense Waste Processing Facility (DWPF) in S-Area. This intrasite transportation—from F-Area to S-Area—could require the temporary shutdown of roads on SRS. It would, however, provide for all the necessary security and for reduced risk to the public; SST/SGTs would not be required.

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[12] Work is currently under way to repackage all pits at Pantex from the AL–R8 container into the AL–R8 SI container for long-term storage. The AL–R8 is not an offsite shipping container as was the AT–400A analyzed in the SPD Draft EIS. Therefore, if the decision were made to site the pit conversion facility at a site other than Pantex, the surplus pits would have to be taken out of the AL–R8 SI and placed in a yet-to-be-developed shipping container. This operation would also require the replacement of some pit-holding fixtures to meet transportation requirements. Under such alternatives, this change would result in a total repackaging exposure of 208 person-rem to Pantex personnel. An increase in worker doses of this magnitude could result in an increase in the expected number of LCFs of 8.3×10^{-2} over the life of the program.

[13] Classified nuclear material parts would also result from pit disassembly. Although current plans are to store these parts at the pit conversion facility, this SPD EIS analyzes the possible transport of these nuclear material parts to LANL. Therefore, the transportation impacts are slightly overstated.

Use of the preferred ceramic (versus glass) matrix for immobilization would also require a small amount of depleted uranium dioxide (i.e., less than 10 t [11 tons] per year). It is assumed that this depleted uranium dioxide would be produced and shipped in the same manner as the depleted uranium dioxide needed by the MOX facility.

After the immobilized plutonium was encased by HLW at DWPF, it would be shipped to a potential geologic repository for ultimate disposition. Because HLW would be displaced by the cans of immobilized plutonium suspended in the HLW canister, additional canisters—to accommodate the displaced HLW—would be required over the life of the immobilization program. According to estimates, up to 145 additional canisters of HLW would be needed to meet the demands of surplus plutonium disposition under Alternative 3. The *Yucca Mountain Draft EIS* evaluates different options for the shipment of these canisters to a potential geologic repository using either trucks or trains. The analysis revealed that shipment by train would pose the lower risk. However, no ROD has yet been issued regarding these shipments. To bound the risks associated with these additional shipments, this SPD EIS conservatively assumes that all of these shipments would be made by truck, one canister per truck..

Every alternative considered in this SPD EIS would require routine transportation of wastes from the proposed disposition facilities to treatment, storage, or disposal facilities on the sites. This transportation would be handled in the same manner as other site waste shipments, and as shown in Sections 4.3.1.2 and 4.3.2.2, would involve no major increase in the amounts of waste already being managed at these sites. The shipments would pose no greater risks than the ordinary waste shipments at these sites as analyzed in the WM PEIS.

In all, approximately 2,500 shipments of radioactive materials would be carried out by DOE under this alternative. The total distance traveled on public roads by trucks carrying radioactive materials would be 4.3 million km (2.7 million mi).

Impacts of Incident-Free Transportation. The dose to transportation workers from all transportation activities entailed by this alternative has been estimated at 60 person-rem; the dose to the public, 67 person-rem. Accordingly, incident-free transportation of radioactive material associated with this alternative would result in 0.024 LCF among transportation workers and 0.034 LCF in the total affected population over the duration of the transportation activities. The estimated number of nonradiological fatalities from vehicular emissions associated with this alternative is 0.019.

Impacts of Accidents During Transportation (Consequences). The maximum foreseeable offsite transportation accident under this Alternative (probability of occurrence: greater than 1 in 10 million per year) is a shipment of plutonium pits from one of DOE's storage locations to the pit conversion facility with a severity category VIII accident in a rural population zone under neutral (average) weather conditions. If this accident were to occur, it could result in a dose of 87 person-rem to the public for an LCF risk of 0.044 and 96 rem to the hypothetical MEI for an LCF risk of 0.096. (The MEI receives a larger dose than the population because it is unlikely that a person would be in position, and remain in position, to receive this hypothetical maximum dose.) No fatalities would be expected to occur. The probability of more severe accidents, different weather conditions at the time of accident, or occurrence in a more densely populated area were also evaluated, and estimated to have a probability lower than 1 chance in 10 million per year. (See Appendix L.6.)

Impacts of Accidents During Transportation (Risks). The total transportation accident risks were estimated by summing the risks to the affected population from all hypothetical accidents. For Alternative 3, those risks are as follows: a radiological dose to the population of 7 person-rem, resulting in a total population risk of 0.004 LCF; and traffic accidents resulting in 0.053 fatality.

4.4.2.7 Environmental Justice

As discussed in other parts of Section 4.4.2, routine operations conducted under Alternative 3 would pose no significant health risks to the public. The likelihood of an LCF for the MEI residing near SRS would be approximately 1 in 30 million (see Table 4–41). The number of LCFs expected among the general population residing near SRS from accident-free operations would be approximately 9.0×10^{-3}.

Design basis accidents at the sites would not be expected to cause cancer fatalities among the public (see Section 4.4.2.5). A beyond-design-basis earthquake would be expected to result in LCFs among the general population (see Tables 4–43 through 4–46). However, it is highly unlikely that a beyond-design-basis earthquake would occur. Accidents at the site pose no significant risks (when the probability of occurrence is considered) to the population residing within the area potentially affected by radiological contamination.

As described in Section 4.4.2.6, no radiological or nonradiological fatalities would be expected to result from accident-free transportation conducted under this alternative. Nor would radiological or nonradiological fatalities be expected to result from transportation accidents.

Thus, implementation of Alternative 3 would pose no significant risks to the public, nor would implementation of this alternative pose significant risks to groups within the public, including the risk of disproportionately high and adverse effects on minority and low-income populations.

4.5 [Section deleted because alternative deleted.]

4.6 ALTERNATIVE 4A

Alternative 4A would involve constructing and operating the pit conversion facility in Zone 4 West at Pantex and the immobilization and MOX facilities at Hanford. The immobilization facility would be located in the existing FMEF building, and the MOX facility would be located in new buildings near FMEF in the 400 Area.

4.6.1 Construction

4.6.1.1 Air Quality and Noise

Sources of potential air quality impacts of construction under Alternative 4A at Pantex include emissions from fuel-burning construction equipment, soil disturbance by construction equipment and other vehicles, the operation of a concrete batch plant, trucks moving materials and wastes, and employee vehicles. Emissions from these sources are summarized in Appendix G.

A comparison of maximum air pollutant concentrations, including the contribution from Pantex construction activities, with standards and guidelines is presented as Table 4–47. Concentrations of air pollutants, especially PM_{10} and total suspended particulates, would likely increase at the site boundary, but should not exceed the Federal or State ambient air quality standards. Air pollution impacts during construction would be mitigated by applying, as appropriate, standard dust control practices such as watering or sweeping of roads and watering of exposed areas.

Total vehicle emissions associated with activities at Pantex would likely decrease somewhat from current emissions because of an expected decrease in overall site employment during this timeframe.

The location of this facility at Pantex relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during construction would include heavy construction equipment, employee vehicles, and truck traffic. Traffic noise associated with the construction of this facility would occur on the site and along offsite local and regional transportation routes used to bring construction materials and workers to the site. Given the distance to the site boundary (about 1.6 km [1.0 mi]), noise emissions from construction equipment would not likely annoy the public. These noise sources would be far enough away from offsite areas that their contribution to offsite noise levels would be small. Some noise sources could result in onsite impacts, such as the disturbance of wildlife. However, noise would be unlikely to affect federally listed threatened or endangered species or their critical habitats, as none are known to occur on or in the immediate vicinity of the proposed site location (see Section 4.26). Traffic associated with the construction of this facility would likely produce a 1-dB increase or less in noise levels along roads used to access the site, and thus would not result in any increased annoyance of the public.

Construction workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (OSHA 1997). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of standard silencing packages on construction equipment, administrative controls, engineering controls, and personal hearing protection equipment.

Sources of potential air quality impacts of construction under Alternative 4A at Hanford, including modification of FMEF for plutonium conversion and immobilization and the construction of a new MOX facility, were analyzed. Construction impacts result from emissions from fuel-burning construction equipment, soil disturbance by construction equipment and other vehicles, the operation of a concrete batch plant, trucks moving materials and wastes, and employee vehicles. Emissions from these sources are summarized in Appendix G.

Table 4–47. Evaluation of Pantex Air Pollutant Concentrations Associated With Construction Under Alternative 4A: Pit Conversion in New Construction at Pantex, and Immobilization in FMEF and HLWVF and MOX in New Construction at Hanford

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m³)[a]	SPD Increment (Fg/m³)	Total Site Concentration (Fg/m³)	Site as a Percent of Standard or Guideline
Criteria pollutants					
Carbon monoxide	8 hours	10,000	3.77	623	6.2
	1 hour	40,000	23.5	3,020	7.5
Nitrogen dioxide	Annual	100	0.501	2.44	2.4
PM_{10}	Annual	50	0.349	9.14	18
	24 hours	150	4.18	93.6	62
Sulfur dioxide	Annual	80	0.0326	0.033	0.041
	24 hours	365	0.392	0.392	0.11
	3 hours	1,300	1.71	1.71	0.13
	30 minutes	1,048	6.98	6.98	0.67
Other regulated pollutants					
Total suspended particulates	3 hours	200	42.7	42.7[b]	21
	1 hour	400	174	174[b]	44
Hazardous and other toxic compounds					
Other toxics[c]	Annual	3[d]	0	0.0547	1.8
	1 hour	75[d]	0	19.4	26

[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 are not listed for existing sources in the source document. Only the contribution from sources associated with the alternative are represented.

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

[Text deleted.]

[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.

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility; SPD, surplus plutonium disposition.

Source: EPA 1997a; TNRCC 1997a, 1997b.

A comparison of maximum air pollutant concentrations, including the contribution from Hanford construction activities, with standards and guidelines is presented as Table 4–48. Concentrations of air pollutants, especially PM_{10} and total suspended particulates, would likely increase at the site boundary, but should not exceed the Federal or State ambient air quality standards as a result of activities at Hanford. Occasional exceedances of the PM_{10} and total suspended particulates standards attributable to natural sources would be expected to continue. The concentrations of toxic air pollutants such as benzene would be unchanged from the No Action Alternative (see discussion of these concentrations in Section 4.2.1.3). Air pollution impacts during operation would be mitigated by including HEPA filtration in the design of these facilities.

Total vehicle emissions associated with activities at Hanford would likely decrease somewhat because of an expected decrease in overall site employment during this timeframe.

The location of these facilities at Hanford relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during construction would include heavy construction equipment, employee vehicles, and truck traffic. Traffic noise associated with the

Table 4–48. Evaluation at Hanford of Air Pollutant Concentrations Associated With Construction Under Alternative 4A: Pit Conversion in New Construction at Pantex, and Immobilization in FMEF and HLWVF and MOX in New Construction at Hanford

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m^3)[a]	SPD Increment (Fg/m^3)	Total Site Concentration (Fg/m^3)	Site as a Percent of Standard or Guideline
Criteria pollutants					
Carbon monoxide	8 hours	10,000	1.39	35.5	0.36
	1 hour	40,000	9.42	57.7	0.14
Nitrogen dioxide	Annual	100	0.109	0.359	0.36
PM_{10}	Annual	50	0.0784	0.0963	0.19
	24 hours	150	3.43	4.2	2.8
Sulfur dioxide	Annual	50	0.011	1.64	3.2
	24 hours	260	0.123	9.03	3.4
	3 hours	1,300	0.834	30.4	2.3
	1 hour	660	2.5	35.4	5.4
Other regulated pollutants					
Total suspended particulates	Annual	60	0.136	0.154	0.26
	24 hours	150	6.04	6.81	4.5
Hazardous and other toxic compounds					
Other toxics[b]	Annual	0.12	0.000008	0.000014	0.012

[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: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility; SPD, surplus plutonium disposition.

Source: EPA 1997a; WDEC 1994.

construction of these facilities would occur on the site and along offsite local and regional transportation routes used to bring construction materials and workers to the site. Given the distance to the site boundary (about 7.1 km [4.4 mi]), noise emissions from construction equipment would not likely annoy the public. These noise sources would be far enough away from offsite areas that their contribution to offsite noise levels would be small. Some noise sources could result in onsite impacts, such as the disturbance of wildlife. Noise would not affect threatened and endangered species because there are no threatened and endangered species habitats near the facility site (see Section 4.26). Traffic associated with the construction of these facilities would likely produce less than a 1-dB increase in noise levels along roads used to access the site, and thus would not result in any increased annoyance of the public.

Construction workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (OSHA 1997). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of standard silencing packages on construction equipment, administrative controls, engineering controls, and personal hearing protection equipment.

4.6.1.2 Waste Management

Tables 4–49 and 4–50 compare the wastes generated during the construction of surplus plutonium disposition facilities at Pantex and Hanford with the existing treatment, storage, and disposal capacity for the various waste

Table 4–49. Potential Waste Management Impacts of Construction at Pantex Under Alternative 4A: Pit Conversion in New Construction at Pantex, and Immobilization in FMEF and HLWVF and MOX in New Construction at Hanford

Waste Type[a]	Estimated Additional Waste Generation (m^3/yr)	Estimated Additional Waste Generation as a Percent of[b] Characterization or Treatment Capacity	Storage Capacity	Disposal Capacity
Hazardous	50	NA	NA	NA
Nonhazardous				
Liquid	5,300	NA	NA	1[c]
Solid	120	NA	NA	NA

[a] See definitions in Appendix F.8.
[b] Treatment capacities, and the disposal capacity for nonhazardous liquid waste, are compared with estimated additional annual waste generation. All other storage and disposal capacities are compared with total estimated additional waste generation assuming a 3-year construction period.
[c] Percent of capacity of the Wastewater Treatment Facility.
Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility; NA, not applicable (i.e., it is assumed that the majority of the hazardous waste and nonhazardous solid waste would be treated and disposed of off the site by the construction contractor).

Table 4–50. Potential Waste Management Impacts of Construction at Hanford Under Alternative 4A: Pit Conversion in New Construction at Pantex, and Immobilization in FMEF and HLWVF and MOX in New Construction at Hanford

Waste Type[a]	Estimated Additional Waste Generation (m^3/yr)	Estimated Additional Waste Generation as a Percent of[b] Characterization or Treatment Capacity	Storage Capacity	Disposal Capacity
Hazardous	27	NA	NA	NA
Nonhazardous				
Liquid	25,000	11[c]	NA	11[d]
Solid	9,000	NA	NA	NA

[a] See definitions in Appendix F.8.
[b] Treatment capacities, and the disposal capacity for nonhazardous liquid waste, are compared with estimated additional annual waste generation. All other storage and disposal capacities are compared with total estimated additional waste generation assuming a 3-year construction period.
[c] Percent of capacity of the 400 Area sanitary sewer.
[d] Percent of capacity of the Energy Northwest (formerly Washington Public Power Supply System) Sewage Treatment Facility.
Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility; NA, not applicable (i.e., it is assumed that the majority of the hazardous waste and nonhazardous solid waste would be treated and disposed of off the site by the construction contractor).

types at each site. It is anticipated that no TRU waste, LLW, or mixed LLW would be generated during the 3-year construction period. In addition, no soil contaminated with hazardous or radioactive constituents should be generated during construction. However, if any were generated, the waste would be managed in accordance with site practice and applicable Federal and State regulations. Construction waste generation would be the same for the ceramic and glass immobilization technologies because the same size facility would be built under either scenario. For this SPD EIS, it is assumed that hazardous waste and nonhazardous waste would be treated, stored, and disposed of in accordance with current site practices.

Hazardous wastes generated during the construction of surplus plutonium disposition facilities would be typical of those generated during the construction of an industrial facility. Any hazardous wastes generated during construction would be packaged in DOT-approved containers and shipped off the site to permitted commercial recycling, treatment, and disposal facilities. The additional waste load generated during construction should not have a major impact on the Pantex or Hanford hazardous waste management systems.

Nonhazardous solid wastes generated during the construction of surplus plutonium disposition facilities would be packaged in conformance with standard industrial practice and shipped to offsite commercial facilities for recycling or disposal. The additional waste load generated during construction should not have a major impact on the nonhazardous solid waste management systems at Pantex or Hanford.

To be conservative, it was assumed that all nonhazardous liquid wastes generated during construction of the pit conversion facility at Pantex would be managed on the site by the Wastewater Treatment Facility, even though it is likely that much of this waste would be collected in portable toilets and would be managed at offsite facilities. Nonhazardous liquid waste generated during the construction of these facilities is estimated to be less than 1 percent of the 946,250-m^3/yr (1,237,700-yd^3/yr) capacity of the Wastewater Treatment Facility, and within the 473,125-m^3/yr (618,848-yd^3/yr) excess capacity of the Pantex Wastewater Treatment Facility (M&H 1997:29). Therefore, management of these wastes at Pantex should not have a major impact on the nonhazardous liquid waste treatment system during construction.

To be conservative, it was assumed that all nonhazardous liquid wastes generated during construction of the immobilization and MOX facilities would be managed on the site at the Energy Northwest (formerly WPPSS) Sewage Treatment Facility, even though it is likely that much of this waste would be collected in portable toilets and would be managed at offsite facilities. Nonhazardous liquid waste generated during the construction of these facilities is estimated to be 11 percent of the 235,000-m^3/yr (307,000-yd^3/yr) capacity of the 400 Area sanitary sewer, 11 percent of the 235,000-m^3/yr (307,000-yd^3/yr) capacity of the Energy Northwest Sewage Treatment Facility, and within the 138,000-m^3/yr (181,000-yd^3/yr) excess capacity of the Energy Northwest Sewage Treatment Facility (Mecca 1997). Therefore, management of these wastes at Hanford should not have a major impact on the nonhazardous liquid waste treatment system during construction.

4.6.1.3 Socioeconomics

Construction-related employment requirements under Alternative 4A would be as indicated in Table 4–51.

Table 4–51. Construction Employment Requirements for Alternative 4A: Pit Conversion in New Construction at Pantex, and Immobilization in FMEF and HLWVF and MOX in New Construction at Hanford

Year	Pit Conversion	Immobilization	MOX	Total
2001	297	0	0	297
2002	451	207	441	1,099
2003	276	376	772	1,424
2004	0	414	508	922
2005	0	226	221	447
2006	0	0	208	208

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility.
Source: DOE 1999c; UC 1998e, UC 1999a, 1999b.

At its peak in 2002, construction of the new pit conversion facility at Pantex under this alternative would require 451 construction workers and generate another 381 indirect jobs in the region. As this total employment requirement of 832 direct and indirect jobs represents only 0.3 percent of the projected REA workforce, it should have no major impact on the REA. Moreover, it should have little impact on community services within the ROI. In fact, it should help offset the nearly 40 percent reduction in the Pantex total workforce (i.e., from 2,944 to 1,750 workers) projected for the years 1997–2005.

At its peak in 2003, construction of the immobiliation and MOX facilities at Hanford would require 1,148 construction workers and should generate another 1,178 indirect jobs in the region. This total employment requirement of 2,326 direct and indirect jobs represents only 0.6 percent of the projected REA workforce, and thus should have no major impact on the REA. It should also have little effect on the community services currently offered in the ROI. In fact, it should help offset the nearly 15 percent reduction in Hanford's workforce (i.e., from 12,882 to approximately 11,000 workers) projected for the years 1997–2005.

4.6.1.4 Human Health Risk

Radiological Impacts. No radiological risk would be incurred by members of the public from construction activities. According to results of recent radiation surveys (DOE 1997f; Antonio 1998) conducted in the Zone 4 area at Pantex and the 400 Area at Hanford, construction workers would not be expected to receive any additional radiation exposure above natural background levels in those areas. Nonetheless, if deemed necessary, workers may be monitored (badged) as a precautionary measure.

Hazardous Chemical Impacts. The probability of excess latent cancer incidence associated with exposure to benzene released as a result of construction activities at Hanford under this alternative has been estimated to be much less than 1 chance in 1 million over the lifetime of the maximally exposed member of the public.

No hazardous chemicals would be released as a result of construction activities at Pantex under this alternative; thus, no cancer or adverse, noncancer health effects would occur.

4.6.1.5 Facility Accidents

The construction of surplus plutonium disposition facilities at Pantex and Hanford could result in worker injuries or fatalities. DOE-required industrial safety programs would be in place to reduce the risks. Given the estimated 4,397 person-years of construction labor and standard industrial accident rates, approximately 440 cases of nonfatal occupational injury or illness and 0.61 fatality could be expected (DOL 1997a, 1997b). As all construction would be in nonradiological areas, no radiological accidents should occur.

4.6.1.6 Environmental Justice

As discussed in the other parts of Section 4.6.1, construction under Alternative 4A would pose no significant health risks to the public. The risks would be negligible regardless of the racial or ethnic composition or the economic status of the population. Therefore, construction activities at Pantex and Hanford under Alternative 4A would have no significant impacts on minority or low-income populations.

4.6.2 Operations

4.6.2.1 Air Quality and Noise

Potential air quality impacts of the operation of the new pit conversion facility under Alternative 4A at Pantex were analyzed using ISCST3. Operational impacts would result from process emissions, emergency diesel generator testing, trucks moving materials and wastes, and employee vehicles. Emissions from these sources are summarized in Appendix G.

A comparison of maximum air pollutant concentrations, including the contribution from the pit conversion facility, with standards and guidelines is presented as Table 4–52. Concentrations of air pollutants would likely increase at the site boundary, but would not exceed the Federal or State ambient air quality standards.

Table 4–52. Evaluation of Pantex Air Pollutant Concentrations Associated With Operations Under Alternative 4A: Pit Conversion in New Construction at Pantex, and Immobilization in FMEF and HLWVF and MOX in New Construction at Hanford

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m^3)[a]	SPD Increment (Fg/m^3)	Total Site Concentration (Fg/m^3)	Site as a Percent of Standard or Guideline
Criteria pollutants					
Carbon monoxide	8 hours	10,000	0.381	620	6.2
	1 hour	40,000	2.14	2,990	7.5
Nitrogen dioxide	Annual	100	0.0374	1.98	2
PM_{10}	Annual	50	0.00215	8.79	18
	24 hours	150	0.0225	89.5	60
Sulfur dioxide	Annual	80	0.00064	0.00064	0.0008
	24 hours	365	0.00753	0.00755	0.0021
	3 hours	1,300	0.0327	0.0328	0.0025
	30 minutes	1,048	0.129	0.129	0.012
Other regulated pollutants					
Total suspended particulates	3 hours	200	0.0937	0.0937[b]	0.047
	1 hour	400	0.274	0.274[b]	0.068
[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 are not reported for existing sources. Only the contribution from sources associated with the alternative are represented.

[Text deleted.]

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility; SPD, surplus plutonium disposition.

Note: No nonradiological hazardous or other toxic compounds would be emitted from these processes.

Source: EPA 1997a; TNRCC 1997a, 1997b.

Air pollution impacts during operation would be mitigated; for example, HEPA filtration has been included in the design of this facility.

For a discussion of how the operation of the pit conversion facility at Pantex would affect the ability to continue to meet NESHAPs limits regarding airborne radiological emissions, see Section 4.32.3.4. There are no other NESHAPs limits applicable to operation of this facility.

The increases in air pollutant concentrations of nitrogen dioxide, PM_{10}, and sulfur dioxide from the operation of this facility would be a small fraction of the PSD Class II area increments as summarized in Table 4–53.

Total vehicle emissions associated with activities at Pantex would likely decrease somewhat from current emissions because of an expected decrease in overall site employment during this timeframe.

The location of this facility at Pantex relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during operation would include new or existing sources (e.g., cooling systems, vents, motors, and material-handling equipment), employee vehicles, and truck traffic. Traffic noise associated with operation of this facility would occur on the site and along offsite local and regional transportation routes used to bring materials and workers to the site. Given the distance to the site boundary (about 1.6 km [1.0 mi]), noise emissions from equipment would not likely annoy the public. These noise sources would be far enough away from offsite areas that their contribution to offsite noise levels would be small. Some noise sources could have onsite impacts, such as the disturbance of wildlife. However, noise would be unlikely to affect federally listed threatened or endangered species or their critical habitats, as none are known to occur on or in the immediate vicinity of the proposed site location (see Section 4.26). Traffic associated with operation of this facility would likely produce less than a 1-dB increase in noise levels along roads used to access the site, and thus would not result in any increased annoyance of the public.

Table 4–53. Evaluation of Pantex Air Pollutant Increases Associated With Operations Under Alternative 4A: Pit Conversion in New Construction at Pantex, and Immobilization in FMEF and HLWVF and MOX in New Construction at Hanford

Pollutant	Averaging Period	Increase in Concentration (Fg/m³)	PSD Class II Area Allowable Increment (Fg/m³)	Percent of Increment
Nitrogen dioxide	Annual	0.0374	25	0.15
PM_{10}	Annual	0.00215	17	0.013
	24 hours	0.0225	30	0.075
Sulfur dioxide	Annual	0.00064	20	0.0032
	24 hours	0.00753	91	0.0083
	3 hours	0.0327	512	0.0064

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility; PSD, prevention of significant deterioration.
Source: EPA 1997b.

Operations workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (OSHA 1997). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of administrative controls, engineering controls, and personal hearing protection equipment.

Potential air quality impacts of the operation of facilities under Alternative 4A at Hanford were analyzed using ISCST3. Operational impacts would result from process emissions, emergency diesel generator testing, trucks moving materials and wastes, and employee vehicles. Emissions from these sources are summarized in Appendix G.

A comparison of maximum air pollutant concentrations, including the contribution from surplus plutonium disposition facilities, with standards and guidelines is presented as Table 4–54. Concentrations for immobilization in the ceramic and glass forms are the same. Concentrations of air pollutants would likely increase at the site boundary, but would not exceed the Federal or State ambient air quality standards as a result of activities at Hanford. Occasional exceedances of the PM_{10} and total suspended particulates standards attributable to natural sources would be expected to continue.

For a discussion of how the operation of the immobilization and MOX facilities at Hanford would affect the ability to continue to meet NESHAPs limits regarding airborne radiological emissions, see Section 4.32.1.4. There are no other NESHAPs limits applicable to operation of these facilities.

The increases in air pollutant concentrations of nitrogen dioxide, PM_{10}, and sulfur dioxide from the operation of these facilities would be a small fraction of the PSD Class II area increments as summarized in Table 4–55.

Total vehicle emissions associated with activities at Hanford would likely decrease somewhat because of an expected decrease in overall site employment during this timeframe.

Table 4–54. Evaluation of Hanford Air Pollutant Concentrations Associated With Operations Under Alternative 4A: Pit Conversion in New Construction at Pantex, and Immobilization in FMEF and HLWVF and MOX in New Construction at Hanford

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m³)[a]	SPD Increment (Fg/m³)	Total Site Concentration (Fg/m³)	Site as a Percent of Standard or Guideline
Criteria pollutants					
Carbon monoxide	8 hours	10,000	0.374	34.5	0.35
	1 hour	40,000	2.55	50.8	0.13
Nitrogen dioxide	Annual	100	0.052	0.302	0.3
PM_{10}	Annual	50	0.00367	0.022	0.043
	24 hours	150	0.0407	0.811	0.54
Sulfur dioxide	Annual	50	0.00343	1.63	3.1
	24 hours	260	0.0382	8.95	3.4
	3 hours	1,300	0.26	29.9	2.3
	1 hour	660	0.779	33.7	5.1
Other regulated pollutants					
Total suspended particulates	Annual	60	0.00367	0.0216	0.036
	24 hours	150	0.0407	0.811	0.54
[Text deleted.]					

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

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility; SPD, surplus plutonium disposition.

Note: No nonradiological hazardous or other toxic compounds would be emitted from these processes.

Source: EPA 1997a; WDEC 1994.

Table 4–55. Evaluation of Hanford Air Pollutant Increases Associated With Operations Under Alternative 4A: Pit Conversion in New Construction at Pantex, and Immobilization in FMEF and HLWVF and MOX in New Construction at Hanford

Pollutant	Averaging Period	Increase in Concentration (Fg/m^3)	PSD Class II Area Allowable Increment (Fg/m^3)	Percent of Increment
Nitrogen dioxide	Annual	0.052	25	0.21
PM_{10}	Annual	0.00367	17	0.022
	24 hours	0.0407	30	0.14
Sulfur dioxide	Annual	0.00343	20	0.017
	24 hours	0.0382	91	0.042
	3 hours	0.26	512	0.051

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility; PSD, prevention of significant deterioration.
Source: EPA 1997b.

The location of these facilities at Hanford relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during operations would include new or existing sources (e.g., cooling systems, vents, motors, material-handling equipment), employee vehicles, and truck traffic. Traffic noise associated with operation of these facilities would occur on the site and along offsite local and regional transportation routes used to bring materials and workers to the site. Given the distance to the site boundary (about 7.1 km [4.4 mi]), noise emissions from equipment would not likely annoy the public. These noise sources would be far enough away from offsite areas that their contribution to offsite noise levels would be small. However, some noise sources could have onsite impacts, such as the disturbance of wildlife. Noise impacts would not affect threatened and endangered species because there are no threatened and endangered species habitats near the facility site (see Section 4.26). Noise from traffic associated with operation of these facilities would likely produce less than a 1-dB increase in traffic noise levels along roads used to access the site, and thus would not result in any increased annoyance of the public.

Operations workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (OSHA 1997). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of administrative controls, engineering controls, and personal hearing protection equipment.

The combustion of fossil fuels associated with Alternative 4A would result in the emission of carbon dioxide, which is one of the atmospheric gases that are believed to influence the global climate. Annual carbon dioxide emissions from this alternative represent less than 6×10^{-5} percent of the 1995 annual U.S. emissions of carbon dioxide from fossil fuel combustion and industrial processes, and therefore would not appreciably affect global concentrations of this pollutant.

4.6.2.2 Waste Management

Tables 4–56 and 4–57 compare the existing site treatment, storage, and disposal capacities with the expected waste generation rates from operating surplus plutonium disposition facilities at Pantex and Hanford. Although HLW would be used in the immobilization process, no HLW would be generated by surplus plutonium disposition facilities. Waste generation at Hanford should be the same for the ceramic and glass immobilization technologies.

Table 4–56. Potential Waste Management Impacts of Operations at Pantex Under Alternative 4A: Pit Conversion in New Construction at Pantex, and Immobilization in FMEF and HLWVF and MOX in New Construction at Hanford[a]

Waste Type[b]	Estimated Additional Waste Generation (m^3/yr)	Estimated Additional Waste Generation as a Percent of[c]		
		Characterization or Treatment Capacity	Storage Capacity	Disposal Capacity
TRU[d]	18	NA	NA	<1 of WIPP
LLW	60	8	25	<1 of NTS
Mixed LLW	1	NA	NA	NA
Hazardous	2	<1	NA	NA
Nonhazardous				
Liquid	25,000	3[e]	NA	3[e]
Solid	1,800	NA	NA	NA

[a] Information summarized from Appendix H.

[b] See definitions in Appendix F.8.

[c] Treatment capacities, and the disposal capacity for nonhazardous liquid waste, are compared with estimated additional annual waste generation. All other storage and disposal capacities are compared with total estimated additional waste generation assuming a 10-year operation period.

[d] Includes mixed TRU waste. Facilities are not expected to generate remotely handled TRU waste.

[e] Percent of capacity of the Wastewater Treatment Facility.

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility; LLW, low-level waste; NA, not applicable (i.e., the majority of this waste is not routinely treated, stored, or disposed of on the site); NTS, Nevada Test Site; TRU, transuranic; WIPP, Waste Isolation Pilot Plant.

Depending in part on decisions in the RODs for the WM PEIS, wastes could be treated (Pantex and Hanford) and disposed of (Hanford) on the sites or at other DOE sites or commercial facilities. According to the ROD

Table 4–57. Potential Waste Management Impacts of Operations at Hanford Under Alternative 4A: Pit Conversion in New Construction at Pantex, and Immobilization in FMEF and HLWVF and MOX in New Construction at Hanford[a]

Waste Type[b]	Estimated Additional Waste Generation (m^3/yr)	Estimated Additional Waste Generation as a Percent of[c]		
		Characterization or Treatment Capacity	Storage Capacity	Disposal Capacity
TRU[d]	160	9	9	1 of WIPP
LLW	170	NA	NA	<1
Mixed LLW	4	<1	<1	<1
Hazardous	78	NA	NA	NA
Nonhazardous				
Liquid	66,000	28[e]	NA	28[f]
Solid	780	NA	NA	NA

[a] Information summarized from Appendix H.

[b] See definitions in Appendix F.8.

[c] Treatment capacities, and the disposal capacity for nonhazardous liquid waste, are compared with estimated additional annual waste generation. All other storage and disposal capacities are compared with total estimated additional waste generation assuming a 10-year operation period.

[d] Includes mixed TRU waste. Facilities are not expected to generate remotely handled TRU waste.

[e] Percent of capacity of the 400 Area sanitary sewer.

[f] Percent of capacity of the Energy Northwest (formerly Washington Public Power Supply System) Sewage Treatment Facility.

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility; LLW, low-level waste; NA, not applicable (i.e., the majority of this waste is not routinely treated, stored, or disposed of on the site); TRU, transuranic; WIPP, Waste Isolation Pilot Plant.

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. 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, in order to be conservative, it is assumed the TRU waste would be stored on the site until 2016. 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 and storage of radioactive, hazardous, mixed, and nonhazardous wastes at Pantex are described in the *Final EIS for the Continued Operation of Pantex and Associated Storage of Nuclear Weapon Components* (DOE 1996c). Impacts of treatment, storage, and disposal of radioactive, hazardous, and mixed wastes at Hanford will be evaluated in the *Hanford Site Solid (Radioactive and Hazardous) Waste Program EIS* that is being prepared by the DOE Richland Operations Office (DOE 1997b).

TRU wastes would be treated, packaged, and certified to WIPP waste acceptance criteria at the new facilities. 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 and a new facility at Pantex.

TRU waste generated at the pit conversion facility at Pantex is estimated to be a total of 180 m^3 (235 yd^3) over the 10-year operation period. Because TRU waste is not currently generated or stored at Pantex, storage space would be provided within the pit conversion facility. Assuming that the waste were stored in 208-l (55-gal) drums that could be stacked two high, and allowing a 50 percent factor for aisle space, a storage area of approximately 260 m^2 (2,800 ft^2) would be required. This would be 1.5 percent of the 17,345 m^2(186,700 ft^2)

of floor space available in the pit conversion facility. Therefore, impacts of the management of TRU waste at Pantex should not be major.

TRU waste generated at the immobilization and MOX facilities at Hanford is estimated to be 9 percent of the 1,820-m^3/yr (2,380-yd^3/yr) capacity of the Waste Receiving and Processing Facility. A total of 1,600 m^3 (2,090 yd^3) of TRU waste would be generated over the 10-year operation period. If all the TRU waste were stored on the site, this would be 9 percent of the 17,000-m^3 (22,200-yd^3) storage capacity available at Hanford. Assuming that the waste were stored in 208-l (55-gal) drums that could be stacked two high, and allowing a 50 percent factor for aisle space, a storage area of about 0.23 ha (0.57 acre) would be required. Therefore, impacts of the management of additional quantities of TRU waste at Hanford should not be major. Impacts from the treatment of TRU waste to WIPP waste acceptance criteria are described in the WM PEIS (DOE 1997d).

The 1,780 m^3 (2,328 yd^3) of TRU wastes generated by the surplus plutonium disposition facilities at Hanford and Pantex would be 1 percent of the 143,000-m^3 (187,000-yd^3) contact-handled TRU waste that DOE plans to dispose of at WIPP and 1 percent of the current 168,500-m^3 (220,400-yd^3) limit for WIPP (DOE 1997e:3-3). Impacts of disposal of TRU waste at WIPP are described in the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997e).

LLW generated at Pantex would be treated, packaged, certified, and accumulated at the pit conversion facility before transfer for additional treatment and disposal in onsite and offsite facilities. LLW generated at the pit conversion facility is estimated to be 8 percent of the 750-m^3/yr (980-yd^3/yr) capacity of the planned Hazardous Waste Treatment and Processing Facility. Waste would be stored on the site on an interim basis before being shipped for offsite disposal. If the shipment of LLW to offsite disposal were delayed, about 600 m^3 (780 yd^3) of LLW may need to be stored at Pantex. This is about 25 percent of the approximately 2,400-m^3 (3,140-yd^3) existing storage capacity at Pantex. Assuming that the waste were stored in 208-l (55-gal) drums that could be stacked two high, and allowing a 50 percent factor for aisle space, a storage area of about 0.1 ha (0.25 acre) is required. Therefore, impacts of the storage of additional quantities of LLW at Pantex should not be major.

LLW from Pantex is currently shipped to NTS for disposal. The additional LLW from operation of the pit conversion facility at Pantex would be 3 percent of the 20,000-m^3 (26,000-yd^3) LLW disposed of 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 disposal land usage factor for NTS published in the *Storage and Disposition PEIS* (DOE 1996a:E-9), the additional LLW from Pantex would require 0.1-ha (0.25-acre) of disposal space at NTS or a similar facility. Therefore, impacts of the management of this additional LLW 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 1996d).

At Hanford, LLW would be packaged, certified, and accumulated at the immobilization and MOX facilities before transfer for additional treatment and disposal in existing onsite facilities. A total of 1,700 m^3 (2,220 yd^3) of LLW would be generated over the operations period. LLW generated at surplus plutonium disposition facilities is estimated to be less than 1 percent of the 1.74 million-m^3 (2.28 million-yd^3) capacity of the LLW Burial Grounds and 1 percent of the 230,000-m^3 (301,000-yd^3) capacity of the Grout Vaults. Using the 3,480 m^3/ha disposal land usage factor for Hanford published in the *Storage and Disposition PEIS* (DOE 1996a:E-9), 1,700 m^3 (2,220 yd^3) of waste would require 0.50-ha (1.2 acre) disposal space at Hanford. Therefore, impacts of the management of this additional LLW at Hanford should not be major.

Mixed LLW would be stabilized, packaged, and stored on the site for treatment and disposal in a manner consistent with the site treatment plan for Pantex. Pantex currently ships mixed LLW to Envirocare of Utah and Diversified Scientific Services, Inc. of Tennessee. These facilities or other treatment or disposal facilities that meet DOE criteria would be used to manage the 10 m^3 (13 yd^3) of waste that would be generated. Therefore, the management of this additional waste at Pantex should not have a major impact on the mixed LLW management system.

At Hanford, mixed LLW would be stabilized, packaged, and stored on the site for treatment and disposal in a manner consistent with the site treatment plan. Mixed LLW generated at the immobilization and MOX facilities is estimated to be less than 1 percent of the 1,820-m^3/yr (2,380-yd^3/yr) capacity of the Waste Receiving and Processing Facility, less than 1 percent of the 16,800-m^3 (22,000-yd^3) capacity of the Central Waste Complex, and less than 1 percent of the 14,200-m^3 (18,600-yd^3) planned disposal capacity of 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. If all TRU waste and mixed LLW generated at surplus plutonium disposition facilities at Hanford were processed in the Waste Receiving and Processing Facility, this additional waste would be 9 percent of the 1,820-m^3/yr (2,380-yd^3/yr) capacity of that facility.

Any hazardous wastes generated during operation of the pit conversion facility at Pantex would be packaged in DOT-approved containers and shipped off the site to licensed commercial recycling, treatment, and disposal facilities. Because these wastes would be less than 1 percent of the 750-m^3/yr (980-yd^3/yr) capacity of the planned Hazardous Waste Treatment and Processing Facility and would be disposed of at offsite commercial facilities, the additional waste load generated during the operations period should not have a major impact on the Pantex hazardous waste management system. If all LLW and hazardous wastes generated at the pit conversion facility at Pantex were processed in the planned Hazardous Waste Treatment and Processing Facility, this additional waste would be 8 percent of the 750-m^3/yr (980-yd^3/yr) capacity of that facility.

At Hanford, hazardous wastes generated during operation of the immobilization and MOX facilities would be packaged in DOT-approved containers and shipped off the site to permitted commercial recycling, treatment, and disposal facilities. The additional waste load generated during the operations period should not have a major impact on the hazardous waste management system at Hanford.

Nonhazardous solid waste would be packaged and transported 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 for offsite disposal. It is unlikely that this additional waste load would have a major impact on the nonhazardous solid waste management systems at Pantex and Hanford.

Nonhazardous wastewater generated by the pit conversion facility would be treated if necessary before being discharged to the Pantex Wastewater Treatment Facility. Nonhazardous liquid waste generated by surplus plutonium disposition facilities at Pantex is estimated to be 3 percent of the 946,250-m^3/yr (1,237,700-yd^3/yr) capacity of the Wastewater Treatment Facility and within the 473,125-m^3/yr (618,848-yd^3/yr) excess capacity of the Pantex Wastewater Treatment Facility (M&H 1997:29). Therefore, management of nonhazardous liquid waste at Pantex should not have a major impact on the treatment system.

At Hanford, nonhazardous wastewater generated by the immobilization and MOX facilities would be treated if necessary before being discharged to the 400 area sanitary sewer system, which connects to the Energy Northwest (formerly WPPSS) Sewage Treatment Facility. Nonhazardous liquid waste generated by surplus plutonium disposition facilities at Hanford is estimated to be 28 percent of the 235,000-m^3/yr (307,000-yd^3/yr) capacity of the 400 Area sanitary sewer, 28 percent of the 235,000-m^3/yr (307,000-yd^3/yr) capacity of the Energy Northwest Sewage Treatment Facility, and within the 138,000-m^3/yr (181,000-yd^3/yr) excess capacity of the Energy Northwest Sewage Treatment Facility (Mecca 1997). Therefore, management of nonhazardous liquid waste at Hanford should not have a major impact on the treatment system.

4.6.2.3 Socioeconomics

Under Alternative 4A, operation of the pit conversion facility at Pantex would begin in 2004 and should require 400 new workers (UC 1998e). This level of employment should generate another 1,355 indirect jobs within the region. As the total employment requirement of 1,755 direct and indirect jobs represents only 0.7 percent of the projected REA workforce, there should be no major impact on the REA. Moreover, the additional required workers should not markedly impact community services within the Pantex ROI. In fact, they should help offset the nearly 40 percent reduction in the total Pantex workforce (i.e., from 2,944 to 1,750 workers) projected for the years 1997–2010.

After construction, startup, and testing of the immobilization and MOX facilities at Hanford in 2007 under Alternative 4A, an estimated 720 new workers would be required to operate them (SAIC 1999c; UC 1998e, 1999a, 1999b). This level of employment would be expected to generate another 1,823 related jobs in the region. The total employment requirement of 2,543 direct and indirect jobs represents 0.6 percent of the projected REA workforce, and thus should have no major impact on the REA. Some of the new jobs created under this alternative could be filled from the ranks of unemployed, currently 11 percent of the REA's population.

This employment requirement could have minor impacts on community services in the ROI, as it should coincide with an expected increase in overall site employment for construction of the tank waste remediation system. Assuming that 91 percent of the new employees associated with this alternative resided in the ROI, an increase of 2,314 new jobs within the workforce would result in an overall population increase of approximately 4,294 persons. This population increase, in conjunction with the normal population growth forecast by the State of Washington, would engender increased construction of local housing units. Given the current population-to-student ratio in the ROI, a population of this size would be expected to include 888 students, and local school districts would increase the number of classrooms to accommodate them.

Community services in the ROI would be expected to change to accommodate the population growth as follows: 55 teachers would be added to maintain the current student-to-teacher ratio of 16:1; 7 police officers would be added to maintain the current officer-to-population ratio of 1.5:1,000; 14 firefighters would be added to maintain the current firefighter-to-population ratio of 3.4:1,000; and 6 physicians would be added to maintain the current physician-to-population ratio of 1.4:1,000. Thus, an additional 82 positions would have to be created to maintain community services at current levels. Hospitals in the ROI would experience a change from the 2.1 beds to 2.0 beds per 1,000 persons unless additional beds were provided. Moreover, average school enrollment would increase to 94.3 percent from the current 92.5 percent unless additional classrooms were built. None of these projected changes should have a major impact on the level of community services currently offered in the ROI.

4.6.2.4 Human Health Risk

During normal operations, there would be both radiological and hazardous chemical releases to the environment, and also direct in-plant exposures. The resulting doses to, and potential health effects on, the public and workers under Aalternative 4A would be as follows.

Radiological Impacts. Table 4–58 reflects the potential radiological impacts on three individual receptor groups at Pantex and Hanford: the population living within 80 km (50 mi) in the year 2010, the maximally exposed member of the public, and the average exposed member of the public. The table depicts the projected aggregate LCF risk to these groups from 10 years of incident-free operation. To put operational doses into perspective, comparisons with doses from natural background radiation are also provided in the table.

Table 4–58. Potential Radiological Impacts on the Public of Operations Under Alternative 4A: Pit Conversion in New Construction at Pantex, and Immobilization in FMEF and HLWVF and MOX in New Construction at Hanford

Impact	Pit Conversion	Immobilization		MOX[a]	Hanford Total
		Ceramic	Glass		
Population within 80 km for year 2010					
Dose (person-rem)	0.58	7.8×10^{-3}	7.1×10^{-3}	0.29	0.30
Percent of natural background[b]	5.8×10^{-4}	6.7×10^{-6}	6.1×10^{-6}	2.5×10^{-4}	2.6×10^{-4}
10-year latent fatal cancers	2.9×10^{-3}	3.9×10^{-5}	3.6×10^{-5}	1.5×10^{-3}	1.5×10^{-3}
Maximally exposed individual					
Annual dose (mrem)	0.062	1.1×10^{-4}	9.7×10^{-5}	4.8×10^{-3}	4.9×10^{-3}
Percent of natural background[b]	0.019	3.7×10^{-5}	3.2×10^{-5}	1.6×10^{-3}	1.6×10^{-3}
10-year latent fatal cancer risk	3.1×10^{-7}	5.5×10^{-10}	4.9×10^{-10}	2.4×10^{-8}	2.5×10^{-8}
Average exposed individual within 80 km[c]					
Annual dose (mrem)	1.9×10^{-3}	2.0×10^{-5}	1.8×10^{-5}	7.5×10^{-4}	7.7×10^{-4}
10-year latent fatal cancer risk	9.5×10^{-9}	1.0×10^{-10}	9.0×10^{-11}	3.8×10^{-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 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. 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 Pantex (299,000) and Hanford (387,800) in 2010.

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility.

Source: Appendix J.

Given incident-free operation of all three facilities, the projected total population dose in the year 2010 would be 0.58 person-rem at Pantex and 0.30 person-rem at Hanford. The corresponding number of LCFs in the population from 10 years of operation would be 2.9×10^{-3} around Pantex and 1.5×10^{-3} around Hanford. The dose to the maximally exposed member of the public from annual operation of the pit conversion facility at Pantex would be 0.062 mrem. From 10 years of operation, the corresponding LCF risk to this individual would be 3.1×10^{-7}. The impacts on the average individual would be lower. The total dose to the maximally exposed member of the public from annual operation of the immobilization and MOX facilities at Hanford would be 4.9×10^{-3} mrem. From 10 years of operation, the corresponding LCF risk to this individual would be 2.5×10^{-8}. The impacts on the average individual would be lower.

Estimated impacts resulting from "Total Site" operations are given in the Cumulative Impacts section of this SPD EIS (see Section 4.32). Within that section, projected incremental impacts associated with the operation of the proposed surplus plutonium disposition facilities are added to the impacts of other past, present, and reasonably foreseeable future actions at or near the candidate sites. These impacts are then compared against applicable regulatory standards established by DOE, EPA, and NRC (such as DOE Order 5400.5, the CAA [NESHAPs], the SDWA, and 10 CFR 20).

Doses to involved workers from normal operations are given in Table 4–59; these workers are defined as those directly associated with process activities. Under this alternative, the annual average dose would be 500 mrem to pit conversion facility workers, 750 mrem to immobilization facility workers, and 65 mrem to MOX facility workers. The annual dose received by the total site workforce for each of these facilities would be an estimated 192, 242, and 22 person-rem, respectively. The risks and numbers of LCFs among the different workers from 10 years of operation are included in Table 4–59. Doses to individual workers would be kept to minimal levels

Table 4–59. Potential Radiological Impacts on Involved Workers of Operations Under Alternative 4A: Pit Conversion in New Construction at Pantex, and Immobilization in FMEF and HLWVF and MOX in New Construction at Hanford

Impact	Pit Conversion	Immobilization (Ceramic or Glass)	MOX	Hanford Total
Number of badged workers	383	323	331	654
Total dose (person-rem/yr)	192	242	22	264
10-year latent fatal cancers	0.77	0.97	0.088	1.1
Average worker dose (mrem/yr)	500	750	65	404[a]
10-year latent fatal cancer risk	2.0×10^{-3}	3.0×10^{-3}	2.6×10^{-4}	1.6×10^{-3}

[a] Represents an average of the doses for both facilities.

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995d and NRC 1999a). 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 1994a). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1999c; UC 1998b, 1998e, 1999a, 1999b.

by instituting badged monitoring, administrative limits, and ALARA programs (which would include worker rotations).

Hazardous Chemical Impacts. No hazardous chemicals would be released as a result of operations at Hanford under this alternative; thus, no cancer or adverse, noncancer health effects would occur. No carcinogenic chemicals would be released as a result of operations.

No hazardous chemicals would be released as a result of operations at Pantex under this alternative; thus, no cancer or adverse, noncancer health effects would occur.

4.6.2.5 Facility Accidents

The potential consequences of postulated bounding facility accidents from operation of the pit conversion facility at Pantex are presented in Table 4–60. The potential consequences of such accidents from operation of the immobilization and MOX facilities at Hanford are equivalent to those included in Alternative 2 (see Tables 4–31 through 4–33). More details on the method of analysis, assumptions, and specific accident scenarios are presented in the discussion of Alternative 2 in Section 4.3.2.5.

Public. The most severe consequences of a design basis accident for this alternative would be associated with a tritium release from the pit conversion facility. Bounding radiological consequences for the MEI are from the tritium release at Pantex, which would result in a dose of 0.087 rem, corresponding to an LCF probability of 4.4×10^{-5}. Among the general population in the environs of Pantex, the tritium release accident would result in an estimated 0.018 LCF. The frequency of such an accident is estimated to be between 1 in 10,000 and 1 in 1,000,000 per year. At Hanford, the design basis accidents for the immobilization and MOX facilities would be equivalent to those presented in Alternative 2, see Section 4.3.2.5.

A beyond-design-basis earthquake at Pantex could result in collapse of the pit conversion facility and an estimated 1.5 LCFs among the general population. A similar earthquake at Hanford could result in total collapse of FMEF and the new MOX facility, with an estimated 35 LCFs (as described in Section 4.3.2.5). It should be emphasized that a seismic event of sufficient magnitude to collapse these facilities would likely cause the collapse of other DOE facilities, and would almost certainly cause widespread failure of homes, office buildings, and other structures in the surrounding area. The overall impact of such an event must therefore be seen in the context not only of the potential radiological impacts of these other facilities, but of

Table 4–60. Accident Impacts of Pit Conversion Under Alternative 4A: Pit Conversion in New Construction at Pantex, and Immobilization in FMEF and HLWVF and MOX in New Construction at Hanford

		Impacts on Noninvolved Worker		Impact at Site Boundary		Impacts on Population Within 80 km	
Accident	Frequency (per year)	Dose (rem)[a]	Probability of Cancer Fatality[b]	Dose (rem)[a]	Probability of Cancer Fatality[b]	Dose (person-rem)[a]	Latent Cancer Fatalities[c]
Fire	Unlikely	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	Unlikely	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	Extremely unlikely	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	Extremely unlikely	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	Extremely unlikely	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	Unlikely	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	Beyond extremely unlikely	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	Extremely unlikely to beyond extremely unlikely	6.4×10^{1}	2.6×10^{-2}	1.0×10^{1}	5.1×10^{-3}	3.0×10^{3}	1.5
Aircraft crash[d]	Beyond extremely unlikely	2.0×10^{2}	7.9×10^{-2}	3.1×10^{1}	1.6×10^{-2}	9.2×10^{3}	4.5

[a] For 95th percentile meteorological conditions. With the exception of doses due to criticality and tritium exposure, the stated doses are from the inhalation of plutonium, and represent dose commitments that would be received over the lifetime of the impacted individual. See Appendix K.1.4.2 for a more detailed discussion of pathways.

[b] Increased likelihood (or probability) of cancer fatality for 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 for a hypothetical individual in the offsite population at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[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. The value assumes that the accident has occurred.

[d] For the aircraft crash accident, the dose at 1,000 m (3,281 ft) is beyond the range of applicability of the standard probability coefficient for determining the likelihood of fatal cancer (i.e., 4×10^{-4} LCF per rem). The standard coefficient would tend to overstate the cancer fatality risk at the stated dose. Also, the dose may be in the range where subacute injury is an additional concern.

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility.

Source: Calculated using the source terms in Table K–12 and the MACCS2 computer code.

hundreds, possibly thousands, of immediate fatalities from falling debris. The frequency of such an earthquake is estimated to be between 1 in 100,000 and 1 in 10,000,000 per year.

A beyond-design-basis aircraft crash at Pantex, involving a large commercial or military jet aircraft, was also evaluated based on public interest. This crash could result in penetration of the pit conversion facility by a crash-induced missile such as a jet turbine shaft, causing a release of plutonium and an estimated 4.5 LCFs among the general population. Other possible consequences of such a crash include immediate fatality to the aircraft occupants, as well as serious injuries and fatalities to persons in the pit conversion facility and the surrounding area who are impacted by the aircraft or building debris. The frequency of such an airplane crash is estimated to be less than 1 in 1,000,000 per year.

Noninvolved Worker. Consistent with the analysis presented in the *Storage and Disposition PEIS*, the noninvolved worker is a hypothetical individual working on the site but not involved in the proposed action, and assumed to be 1,000 m (3,281 ft) from the location of the accident or at the site boundary, whichever is closer, and downwind from that location. For design basis accidents, the radiological consequences for this worker were estimated to be the highest for the criticality at the MOX facility. The consequences of such an accident would include an LCF probability of 2.5×10^{-4}.

Maximally Exposed Involved Worker. 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 either would be able to evacuate immediately or would not be affected by the events. Explosions could result in immediate injuries from flying debris, as well as the uptake of plutonium and uranium particulates through inhalation. If a criticality occurred, workers within tens of meters could receive very high to fatal radiation exposures from the initial 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 accident. The design basis and beyond-design-basis earthquakes would also have substantial consequences, ranging from workers being killed by debris from collapsing equipment and structures to high radiation exposures and uptakes of radionuclides. For most accidents, immediate emergency response actions should reduce the consequences to workers near the accident. As discussed in the Emergency Preparedness sections of Chapter 3, each candidate site has an established emergency management program that would be activated in the event of an accident. Based on the decisions made in the SPD EIS ROD, site emergency management programs would be modified to consider new accidents not in the current program.

Nonradiological Accidents. Surplus plutonium disposition operations at Pantex and Hanford could result in worker injuries and fatalities. DOE-required industrial safety programs would be in place to reduce the risks. Given the estimated employment of 11,885 person-years of labor and the standard DOE occupational accident rates, approximately 430 cases of nonfatal occupational injury or illness and 0.32 fatality could be expected for the duration of operations.

4.6.2.6 Transportation

Operational transportation impacts may be divided into two parts: impacts due to incident-free transportation and those due to transportation accidents. They may be further divided into nonradiological and radiological impacts. Nonradiological impacts are specifically vehicular, such as vehicular emissions and traffic accidents. Radiological impacts are those related to the dose received by transportation workers and the public during normal operations and in the case of accidents in which the radioactive materials being shipped may be released. For more detailed information on the transportation analysis performed for this SPD EIS, see Appendix L.

Under Alternative 4A, transportation to and from Pantex would include the shipment of plutonium pits and clean plutonium metal via SST/SGT from sites throughout the DOE complex to the pit conversion facility.[14] During dismantlement of the pits, some HEU would be recovered. The pit conversion facility would ship HEU via SST/SGT to ORR for storage.[15] After conversion, the plutonium in the pit conversion facility would be in the form of plutonium dioxide. This material would be transported to the MOX facility at Hanford for fabrication into MOX fuel pellets.

MOX fuel fabrication also requires uranium dioxide. Quantifying the uranium dioxide transportation requirements for this SPD EIS involved selecting representative sites for the source of the depleted uranium hexafluoride and the conversion facility. A DOE enrichment facility near Portsmouth, Ohio, was chosen as a representative site for the source of the depleted uranium hexafluoride, and the nuclear fuel fabrication facility in Wilmington, North Carolina, as representative of a uranium conversion facility. These sites were also used as representative sites in the *Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement* (DOE 1996e). It is assumed that depleted uranium hexafluoride needed for MOX fuel would be shipped via commercial truck to the uranium conversion facility, where it would be converted into uranium dioxide (see Section 4.3.2.6). After conversion, the depleted uranium dioxide would be shipped via commercial truck from the conversion facility to the MOX facility at Hanford. This material would be blended with plutonium dioxide at the MOX facility, fabricated into MOX fuel pellets, and placed in MOX fuel rods. After fabrication, the MOX fuel rods would be shipped to a domestic reactor site, where they would be placed in fuel assemblies and irradiated. Shipments of unirradiated MOX fuel rods would be made in an SST/SGT because unirradiated MOX fuel in large enough quantities is subject to the same security concerns as pure weapons-grade plutonium. It is assumed in this transportation analysis that all MOX fuel is shipped from the MOX facility to the most distant reactor site, North Anna.

Immobilization at Hanford under this alternative would require that surplus nonpit plutonium in various forms be shipped from current storage locations (i.e., SRS, Hanford, INEEL, LLNL, LANL, and RFETS) to the immobilization facility at Hanford. Even though these materials are not clean plutonium metal or pits, the quantity of the plutonium contained in them would require that they be treated as materials that could be used in nuclear weapons, and thus that shipments be made in SST/SGTs.

Under the preferred technology alternative for immobilization, the surplus plutonium would be immobilized in a ceramic matrix in small cans at the immobilization facility, placed in HLW canisters, and transported via specially designed trucks to HLWVF in 200 Area. This intrasite transportation—from 400 Area to 200 Area—could require the temporary shutdown of roads on the Hanford site. It would, however, provide for all the necessary security and for reduced risk to the public; SST/SGTs would not be required.

Use of the preferred ceramic (versus glass) matrix for immobilization would also require a small amount of depleted uranium dioxide (i.e., less than 10 t [11 tons] per year). It is assumed that this depleted uranium dioxide would be produced and shipped in the same manner as the depleted uranium dioxide needed by the MOX facility.

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14 Work is currently under way to repackage all pits at Pantex from the AL–R8 container into the AL–R8 SI container for long-term storage. This effort would be completed over 10 years, and the estimated dose to involved workers received from this repackaging activity would be about 104 person-rem. The SPD Draft EIS analyzed repackaging of the pits in an AT–400A container. The change to the AL–R8 SI changes the long-term storage period for pits from 50 to 30 years because of the need to replace a seal in the container after 30 years; the AT–400A does not require that activity. After seal replacement, the pits could continue to be stored for another 30 years.

15 Classified nuclear material parts would also result from pit disassembly. Although current plans are to store these parts at the pit conversion facility, this SPD EIS analyzes the possible transport of these nuclear material parts to LANL. Therefore, the transportation impacts are slightly overstated.

After the immobilized plutonium was encased by HLW at HLWVF, it would be shipped to a potential geologic repository for ultimate disposition. Because HLW would be displaced by the cans of immobilized plutonium suspended in the HLW canister, additional canisters—to accommodate the displaced HLW—would be required over the life of the immobilization program. According to estimates, up to 145 additional canisters of HLW would be needed to meet the demands of surplus plutonium disposition under Alternative 4A. The *Yucca Mountain Draft EIS* evaluates different options for the shipment of these canisters to a potential geologic repository using either trucks or trains. The analysis revealed that shipment by train would pose the lower risk. However, no ROD has yet been issued regarding these shipments. To bound the risks associated with these additional shipments, this SPD EIS conservatively assumes that all of these shipments would be made by truck, one canister per truck.

Under all of the alternatives being considered in this SPD EIS, some transportation would be required to support routine shipments of wastes from the proposed disposition facilities to treatment, storage, or disposal facilities on the sites. This transportation would be handled in the same manner as other site waste shipments, and as shown in Sections 4.6.1.2 and 4.6.2.2, would involve no major increase in the amounts of waste already being managed at these sites. The shipments would pose no greater risks than the ordinary waste shipments at these sites as analyzed in the WM PEIS.

TRU waste generated at Pantex, however, was not covered by the WM PEIS ROD, as there was no such waste at Pantex at the time the ROD was issued, and none was likely to be generated in ongoing site operations. Location of the pit conversion facility at Pantex would result in the generation of TRU waste, as described in Section 4.6.2.2. Moreover, a fairly large increase in the amount of LLW at Pantex (i.e., 25 percent of the site's current storage capacity) could be expected under this alternative. Currently, this type of waste is shipped to the NTS for disposal. In order to account for the transportation of TRU waste from Pantex to WIPP, and LLW from Pantex to NTS, additional shipments are analyzed in this SPD EIS.

In all, approximately 2,200 shipments of radioactive materials would be carried out by DOE under this alternative. The total distance traveled on public roads by trucks carrying radioactive materials would be 6.3 million km (3.9 million mi).

Impacts of Incident-Free Transportation. The dose to transportation workers from all transportation activities entailed at this alternative has been estimated at 30 person-rem; the dose to the public, 41 person-rem. Accordingly, the incident-free transportation of radioactive material associated with this alternative would to result in 0.012 LCF among transportation workers and 0.020 LCF in the total affected population over the duration of the transportation activities. The estimated number of nonradiological fatalities from vehicular emissions associated with this alternative is 0.021.

Impacts of Accidents During Transportation (Consequences). The maximum foreseeable offsite transportation accident under this alternative (probability of occurrence: greater than 1 in 10 million per year) is a shipment of plutonium oxide from the pit conversion facility at Pantex to Hanford with a severity category VIII accident in a rural population zone under neutral (average) weather conditions. If this accident were to occur, it could result in a dose of 624 person-rem to the public for an LCF risk of 0.3 and 684 rem to the hypothetical MEI for an LCF risk of 0.68. (The MEI receives a larger dose than the population because it is unlikely that a person would be in position, and remain in position, to receive this hypothetical maximum dose.) No fatalities would be expected to occur. The probability of more severe accidents, different weather conditions at the time of accident, or occurrence in a more densely populated area were also evaluated, and estimated to have a probability lower than 1 chance in 10 million per year. (See Appendix L.6.)

Impacts of Accidents During Transportation (Risks). The total transportation accident risks were estimated by summing the risks to the affected population from all hypothetical accidents. For Alternative 4A, those risks are as follows: a radiological dose to the population of 8 person-rem, resulting in a total population risk of 0.004 LCF; and traffic accidents resulting in 0.065 fatality.

4.6.2.7 Environmental Justice

As discussed in other parts of Section 4.6.2, routine operations conducted under Alternative 4A would pose no significant health risks to the public. The likelihood of an LCF for the MEI residing near Pantex would be approximately 1 in 3 million, and would be approximately 1 in 40 million for the MEI residing near Hanford (see Table 4–58). The number of LCFs expected among the general populations residing near Pantex and Hanford from accident-free operations would be approximately 2.9×10^{-3} and 1.5×10^{-3}, respectively.

Design basis accidents at the sites would not be expected to cause cancer fatalities among the public. A beyond-design-basis earthquake would be expected to result in LCFs among the general population (see Table 4–60). However, it is highly unlikely that a beyond-design-basis earthquake would occur. Accidents at the sites pose no significant risks (when the probability of occurrence is considered) to the population residing within the area potentially affected by radiological contamination.

As described in Section 4.6.2.6, no radiological or nonradiological fatalities would be expected to result from accident-free transportation conducted under this alternative. Nor would radiological or nonradiological fatalities be expected to result from transportation accidents.

Thus, implementation of Alternative 4A would pose no significant risks to the public, nor would implementation of this alternative pose significant risks to groups within the public, including the risk of disproportionately high and adverse effects on minority and low-income populations.

4.7 ALTERNATIVE 4B

Alternative 4B would involve constructing and operating the pit conversion facility in Zone 4 West at Pantex, and the immobilization and MOX facilities in the existing FMEF building in the 400 Area at Hanford. Activities at Pantex would be the same as under Alternative 4A.

4.7.1 Construction

4.7.1.1 Air Quality and Noise

Potential air quality and noise impacts of construction under Alternative 4B at Pantex are the same as those for Alternative 4A (see Section 4.6.1.1).

Sources of potential air quality impacts of construction under Alternative 4B at Hanford include emissions from fuel-burning construction equipment, soil disturbance by construction equipment and other vehicles, the operation of a concrete batch plant, trucks moving materials and wastes, and employee vehicles. Emissions from these sources are summarized in Appendix G.

A comparison of maximum air pollutant concentrations, including the contribution from construction activities at Hanford, with standards and guidelines is presented as Table 4–61. Concentrations of air pollutants, especially PM_{10} and total suspended particulates, would likely increase at the site boundary, but should not exceed the Federal or State ambient air quality standards as a result of activities at Hanford. Occasional exceedances of the PM_{10} and total suspended particulates standards attributable to natural sources would be expected to continue. Air pollution impacts during construction would be mitigated by applying, as appropriate, standard dust control practices such as watering or sweeping of roads and watering of exposed areas.

Total vehicle emissions associated with activities at Hanford would likely decrease somewhat from current emissions because of an expected decrease in overall site employment during this timeframe. Noise impacts would be similar to those for Alternative 4A at Hanford (see Section 4.6.1.1).

4.7.1.2 Waste Management

At Pantex, construction impacts of this alternative would be the same as for Alternative 4A. See Section 4.6.1.2 for a description of the impacts of this alternative on the waste management infrastructure at Pantex.

Table 4–62 compares the wastes generated during modification of the FMEF building at Hanford with the existing treatment, storage, and disposal capacity for the various waste types. It is anticipated that no TRU waste, LLW, or mixed LLW would be generated during the 3-year modification period. In addition, no soil contaminated with hazardous or radioactive constituents should be generated during modification. However, if any were generated, the waste should be managed in accordance with site practice and applicable Federal and State regulations. Waste generated during modification would be the same for the ceramic and glass immobilization technologies because the same size facility would be built under either scenario. For this SPD EIS, it is assumed that hazardous waste and nonhazardous waste would be treated, stored, and disposed of in accordance with current site practices.

Hazardous wastes generated during modification of the FMEF building would be typical of those generated during the construction of an industrial facility. Any hazardous wastes generated during modification would

Table 4–61. Evaluation of Hanford Air Pollutant Concentrations Associated With Construction Under Alternative 4B: Pit Conversion in New Construction at Pantex, and Immobilization in FMEF and HLWVF and MOX in FMEF at Hanford

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m³)[a]	SPD Increment (Fg/m³)	Total Site Concentration (Fg/m³)	Site as a Percent of Standard or Guideline
Criteria pollutants					
Carbon monoxide	8 hours	10,000	1.29	35.4	0.35
	1 hour	40,000	8.8	57.1	0.14
Nitrogen dioxide	Annual	100	0.1	0.35	0.35
PM_{10}	Annual	50	0.112	0.13	0.26
	24 hours	150	5.17	5.94	4
Sulfur dioxide	Annual	50	0.0102	1.64	3.2
	24 hours	260	0.113	9.02	3.4
	3 hours	1,300	0.768	30.4	2.3
	1 hour	660	2.3	35.2	5.3
Other regulated pollutants					
Total suspended particulates	Annual	60	0.204	0.222	0.37
	24 hours	150	9.45	10.2	6.8
Hazardous and other toxic compounds					
Other toxics[b]	Annual	0.12	0.000008	0.000014	0.012

[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: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility; SPD, surplus plutonium disposition.

Source: EPA 1997a; WDEC 1994.

Table 4–62. Potential Waste Management Impacts of Construction at Hanford Under Alternative 4B: Pit Conversion in New Construction at Pantex, and Immobilization in FMEF and HLWVF and MOX in FMEF at Hanford

Waste Type[a]	Estimated Additional Waste Generation (m^3/yr)	Estimated Additional Waste Generation as a Percent of[b]		
		Characterization or Treatment Capacity	Storage Capacity	Disposal Capacity
Hazardous	30	NA	NA	NA
Nonhazardous				
Liquid	30,000	13[c]	NA	13[d]
Solid	8,000	NA	NA	NA

[a] See definitions in Appendix F.8.

[b] Treatment capacities, and the disposal capacity for nonhazardous liquid waste, are compared with estimated additional annual waste generation. All other storage and disposal capacities are compared with total estimated additional waste generation assuming a 3-year modification period.

[c] Percent of capacity of the 400 Area sanitary sewer.

[d] Percent of capacity of the Energy Northwest (formerly Washington Public Power Supply System) Sewage Treatment Facility.

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility; NA, not applicable (i.e., it is assumed that the majority of the hazardous waste and nonhazardous solid waste would be treated and disposed of off the site by the construction contractor).

be packaged in DOT-approved containers and shipped off the site to permitted commercial recycling, treatment, and disposal facilities. The additional waste load generated during the modification period should not have a major impact on the Hanford hazardous waste management system.

Nonhazardous solid wastes generated during modification of the FMEF building would be packaged in conformance with standard industrial practice and shipped to offsite commercial facilities for recycling or disposal. The additional waste load generated during the modification period should not have a major impact on the nonhazardous solid waste management system at Hanford.

To be conservative, it was assumed that all nonhazardous liquid wastes generated during modification of the FMEF building at Hanford would be managed on the site at the Energy Northwest (formerly WPPSS) Sewage Treatment Facility, even though it is likely that much of this waste would be collected in portable toilets and would be managed at offsite facilities. Nonhazardous liquid waste generated during modification is estimated to be 13 percent of the 235,000-m^3/yr (307,000-yd^3/yr) capacity of the 400 Area sanitary sewer, 13 percent of the 235,000-m^3/yr (307,000-yd^3/yr) capacity of the Energy Northwest Sewage Treatment Facility, and within the 138,000-m^3/yr (181,000-yd^3/yr) excess capacity of the Energy Northwest Sewage Treatment Facility (Mecca 1997). Therefore, management of these wastes at Hanford should not have a major impact on the nonhazardou liquid waste treatment system during the modification period.

4.7.1.3 Socioeconomics

Construction-related employment requirements for Alternative 4B would be as indicated in Table 4–63.

Table 4–63. Construction Employment Requirements for Alternative 4B: Pit Conversion in New Construction at Pantex, and Immobilization in FMEF and HLWVF and MOX in FMEF at Hanford

Year	Pit Conversion	Immobilization	MOX	Total
2001	297	0	0	297
2002	451	341	441	1,233
2003	276	481	583	1,340
2004	0	421	451	872
2005	0	281	221	502
2006	0	0	208	208

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility.
Source: DOE 1999c; UC 1998e, 1999a, 1999b.

Employment requirements for the construction of a new pit conversion facility at Pantex under this alternative would be the same as those for Alternative 4A (see Section 4.6.1.3).

At its peak in 2003, construction of the immobilization and MOX facilities at Hanford would require 1,064 construction workers and generate another 1,092 indirect jobs in the region. As this total employment requirement of 2,156 direct and indirect jobs in 2003 represents less than 0.6 percent of the projected REA workforce, it should have no major impact on the REA. This requirement should also have little impact on community services currently offered in the ROI. In fact, it should help offset the approximately 15 percent reduction in Hanford employment (i.e., from 12,882 to approximately 11,000 workers) projected for the years 1997–2005.

4.7.1.4 Human Health Risk

Radiological Impacts. No radiological risk would be incurred by members of the public from construction activities. According to recent radiation surveys (DOE 1997f; Antonio 1998) conducted in the Zone 4 area at Pantex and the 400 Area at Hanford, construction workers would not be expected to receive any additional radiation exposure above natural background levels in those areas. Nonetheless, if deemed necessary, workers may be monitored (badged) as a precautionary measure.

Hazardous Chemical Impacts. The probability of excess latent cancer incidence associated with exposure to benzene released as a result of construction activities at Hanford under this alternative has been estimated to be much less than 1 chance in 1 million over the lifetime of the maximally exposed member of the public.

No hazardous chemicals would be released as a result of construction activities at Pantex under this alternative; therefore, no cancer or adverse, noncancer health effects would occur.

4.7.1.5 Facility Accidents

The construction of new plutonium conversion facilities at Pantex and Hanford could result in worker injuries or fatalities. DOE-required industrial safety programs would be in place to reduce the risks. Given the estimated 4,452 person-years of construction labor and standard industrial accident rates, approximately 440 cases of nonfatal occupational injury or illness and 0.62 fatality could be expected (DOL 1997a, 1997b). As all construction would be in nonradiological areas, no radiological accidents should occur.

4.7.1.6 Environmental Justice

As discussed in the other parts of Section 4.7.1, construction under Alternative 4B would pose no significant health risks to the public. The risks would be negligible regardless of the racial or ethnic composition or the economic status of the population. Therefore, construction activities under Alternative 4B at Pantex and Hanford would have no significant impacts on minority or low-income populations.

4.7.2 Operations

4.7.2.1 Air Quality and Noise

Potential air quality and noise impacts of the operation of the new pit conversion facility under Alternative 4B at Pantex are the same as those for Alternative 4A (see Section 4.6.2.1).

Potential air quality impacts of the operation of facilities under 4B at Hanford were analyzed using ISCST3 as described in Appendix F.1. Operational impacts would result from process emissions, emergency diesel generator testing, trucks moving materials and wastes, and employee vehicles. Emissions from these sources are summarized in Appendix G.

A comparison of maximum air pollutant concentrations, including the contribution from surplus plutonium disposition facilities, with standards and guidelines is presented as Table 4–64. Concentrations for immobilization in the ceramic and glass forms are the same. Concentrations of air pollutants would likely increase at the site boundary, but would not exceed the Federal or State ambient air quality standards as a result of Hanford activities. Occasional exceedances of the PM_{10} and total suspended particulates standards attributable to natural sources would be expected to continue. Air pollution impacts during operation would be mitigated; for example, HEPA filtration has been included in the design of these facilities.

Table 4–64. Evaluation of Hanford Air Pollutant Concentrations Associated With Operations Under Alternative 4B: Pit Conversion in New Construction at Pantex, and Immobilization in FMEF and HLWVF and MOX in FMEF at Hanford

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m³)[a]	SPD Increment (Fg/m³)	Total Site Concentration (Fg/m³)	Site as a Percent of Standard or Guideline
Criteria pollutants					
Carbon monoxide	8 hours	10,000	0.507	34.6	0.35
	1 hour	40,000	3.45	51.8	0.13
Nitrogen dioxide	Annual	100	0.0707	0.321	0.32
PM_{10}	Annual	50	0.00499	0.023	0.046
	24 hours	150	0.0555	0.825	0.55
Sulfur dioxide	Annual	50	0.00468	1.64	3.1
	24 hours	260	0.0520	8.96	3.4
	3 hours	1,300	0.354	30	2.3
	1 hour	660	1.06	34	5.2
Other regulated pollutants					
Total suspended particulates	Annual	60	0.00499	0.0229	0.038
	24 hours	150	0.0555	0.825	0.55
[Text deleted.]					

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

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility; SPD, surplus plutonium disposition.

Note: No nonradiological hazardous or other toxic compounds would be emitted from these processes.

Source: EPA 1997a; WDEC 1994.

For a discussion of how the operation of the immobilization and MOX facilities at Hanford would affect the ability to continue to meet NESHAPs limits regarding airborne radiological emissions, see Section 4.32.1.4. There are no other NESHAPs limits applicable to operation of these facilities.

The increases in air pollutant concentrations of nitrogen dioxide, PM_{10}, and sulfur dioxide from the operation of these facilities would be a small fraction of the PSD Class II area increments as summarized in Table 4–65.

Table 4–65. Evaluation of Hanford Air Pollutant Increases Associated With Operations Under Alternative 4B: Pit Conversion in New Construction at Pantex, and Immobilization in FMEF and HLWVF and MOX in FMEF at Hanford

Pollutant	Averaging Period	Increase in Concentration (Fg/m³)	PSD Class II Area Allowable Increment (Fg/m³)	Percent of Increment
Nitrogen dioxide	Annual	0.0707	25	0.28
PM_{10}	Annual	0.00499	17	0.029
	24 hours	0.0555	30	0.19
Sulfur dioxide	Annual	0.00468	20	0.023
	24 hours	0.0520	91	0.057
	3 hours	0.354	512	0.069

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility; PSD, prevention of significant deterioration.

Source: EPA 1997b.

Total vehicle emissions associated with activities at Hanford would likely decrease somewhat because of an expected decrease in overall site employment during this timeframe.

Noise impacts would be similar to those for Alternative 4A at Hanford (see Section 4.6.2.1).

The combustion of fossil fuels associated with Alternative 4B would result in the emission of carbon dioxide, which is one of the atmospheric gases that are believed to influence the global climate. Annual carbon dioxide emissions from this alternative represent less than 6×10^{-5} percent of the 1995 annual U.S. emissions of carbon dioxide from fossil fuel combustion and industrial processes, and therefore would not appreciably affect global concentrations of this pollutant.

4.7.2.2 Waste Management

Impacts of operations for this alternative would be the same as for Alternative 4A. See Section 4.6.2.2 for a description of the impacts of this alternative on the waste management infrastructure at Pantex and Hanford.

4.7.2.3 Socioeconomics

Employment requirements for operation of the new pit conversion facility at Pantex under Alternative 4B would be the same as those for Alternative 4A (see Section 4.6.2.3).

[Text deleted.] After construction, startup, and testing of the immobilization and MOX facilities at Hanford in 2007 under Alternative 4B, an estimated 765 new workers would be required to operate them (DOE 1999c; UC 1998e, 1999a, 1999b). This level of employment would be expected to generate another 1,937 related jobs in the region. The total employment requirement of 2,702 direct and indirect jobs represents 0.7 percent of the projected REA workforce, and thus should have no major impact on the REA. Some of the new jobs created under this alternative could be filled from the ranks of the unemployed, currently 11 percent of the REA's population.

This employment requirement could have minor impacts on community services in the ROI, as it should coincide with an expected increase in overall site employment for construction of the tank waste remediation system. Assuming that 91 percent of the new employees associated with this alternative resided in the ROI, an increase of 2,459 new jobs within the workforce would result in an overall population increase of approximately 4,562 persons. This population increase, in conjunction with the normal population growth forecast by the State of Washington, would engender increased construction of local housing units. Given the current population-to-student ratio in the ROI, a population of this size would be expected to include 944 students, and local school districts would increase the number of classrooms to accommodate them.

Community services in the ROI would be expected to change to accommodate the population growth as follows: 59 teachers would be added to maintain the current student-to-teacher ratio of 16:1; 7 police officers would be added to maintain the current officer-to-population ratio of 1.5:1,000; 15 firefighters would be added to maintain the current firefighter-to-population ratio of 3.4:1,000; and 6 physicians would be added to maintain the current physician-to-population ratio of 1.4:1,000. Thus, an additional 87 positions would have to be created to maintain community services at current levels. Hospitals in the ROI would experience a drop from the 2.1 beds to 2.0 beds per 1,000 persons unless additional beds were provided. Moreover, average school enrollment would increase to 94.4 percent from the current 92.5 percent unless additional classrooms were built. None of these projected changes should have a major impact on the level of community services currently offered in the ROI.

4.7.2.4 Human Health Risk

During normal operation of the surplus plutonium disposition facilities, there would be both radiological and hazardous chemical releases to the environment, and also direct in-plant exposures. The resulting doses to, and potential health effects on, the public and workers under Alternative 4B would be as follows.

Radiological Impacts. Table 4–66 reflects the potential radiological impacts on three individual receptor groups at Pantex and Hanford: the population living within 80 km (50 mi) in the year 2010, the maximally exposed member of the public, and the average exposed member of the public. The table depicts the projected aggregate LCF risk to these groups from 10 years of incident-free operation. To put operational doses into perspective, comparisons with doses from natural background radiation are also provided in the table.

Table 4–66. Potential Radiological Impacts on the Public of Operations Under Alternative 4B: Pit Conversion in New Construction at Pantex, and Immobilization in FMEF and HLWVF and MOX in FMEF at Hanford

Impact	Pit Conversion	Immobilization		MOX[a]	Hanford Total
		Ceramic	Glass		
Population within 80 km for year 2010					
Dose (person-rem)	0.58	7.8×10^{-3}	7.1×10^{-3}	0.14	0.15
Percent of natural background[b]	5.8×10^{-4}	6.7×10^{-6}	6.1×10^{-6}	1.2×10^{-4}	1.3×10^{-4}
10-year latent fatal cancers	2.9×10^{-3}	3.9×10^{-5}	3.6×10^{-5}	6.9×10^{-4}	7.3×10^{-4}
Maximally exposed individual					
Annual dose (mrem)	0.062	1.1×10^{-4}	9.7×10^{-5}	1.8×10^{-3}	1.9×10^{-3}
Percent of natural background[b]	0.019	3.7×10^{-5}	3.2×10^{-5}	6.1×10^{-4}	6.5×10^{-4}
10-year latent fatal cancer risk	3.1×10^{-7}	5.5×10^{-10}	4.9×10^{-10}	9.3×10^{-9}	9.9×10^{-9}
Average exposed individual within 80 km[c]					
Annual dose (mrem)	1.9×10^{-3}	2.0×10^{-5}	1.8×10^{-5}	3.5×10^{-4}	3.7×10^{-4}
10-year latent fatal cancer risk	9.5×10^{-9}	1.0×10^{-10}	9.0×10^{-11}	1.7×10^{-9}	1.8×10^{-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] 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. 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 Pantex (299,000) and Hanford (387,800) in 2010.

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility.

Source: Appendix J.

Given incident-free operation of all three facilities, the projected total population dose in the year 2010 would be 0.58 person-rem at Pantex and 0.15 person-rem at Hanford. The corresponding number of LCFs in the population from 10 years of operation would be 2.9×10^{-3} around Pantex and 7.3×10^{-4} around Hanford. The dose to the maximally exposed member of the public from annual operation of the pit conversion facility at Pantex would be 0.062 mrem. From 10 years of operation, the corresponding LCF risk of to this individual would be 3.1×10^{-7}. The impacts on the average individual would be lower. The total dose to the maximally exposed member of the public from annual operation of the immobilization and MOX facilities at Hanford would be 1.9×10^{-3} mrem. From 10 years of operation, the corresponding LCF risk to this individual would be 9.9×10^{-9}. The impacts on the average individual would be lower.

Estimated impacts resulting from "Total Site" operations are given in the Cumulative Impacts section of this SPD EIS (see Section 4.32). Within that section, projected incremental impacts associated with the operation of the proposed surplus plutonium disposition facilities are added to the impacts of other past, present, and reasonably foreseeable future actions at or near the candidate sites. These impacts are then compared against applicable regulatory standards established by DOE, EPA, and NRC (such as DOE Order 5400.5, the CAA [NESHAPs], the SDWA, and 10 CFR 20).

Doses to involved workers from normal operations are given in Table 4–67; these workers are defined as those directly associated with process activities. Under this alternative, the annual average dose would be 500 mrem to pit conversion facility workers, 750 mrem to immobilization facility workers, and 65 mrem to MOX facility workers. The annual dose received by the total site workforce for each of these facilities would be an estimated 192, 274, and 22 person-rem, respectively. The risks and numbers of LCFs among the different workers from 10 years of operation are included in Table 4–67. Doses to individual workers would be kept to minimal levels by instituting badged monitoring, administrative limits, and ALARA programs (which would include worker rotations).

Table 4–67. Potential Radiological Impacts on Involved Workers of Operations Under Alternative 4B: Pit Conversion in New Construction at Pantex, and Immobilization in FMEF and HLWVF and MOX in FMEF at Hanford

Impact	Pit Conversion	Immobilization (Ceramic or Glass)	MOX	Hanford Total
Number of badged workers	383	365	331	696
Total dose (person-rem/yr)	192	274	22	296
10-year latent fatal cancers	0.77	1.1	0.088	1.2
Average worker dose (mrem/yr)	500	750	65	425[a]
10-year latent fatal cancer risk	2.0×10^{-3}	3.0×10^{-3}	2.6×10^{-4}	1.7×10^{-3}

[a] Represents an average of the doses for both facilities.

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995d and NRC 1999a). 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 1994a). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1999c; UC 1998b, 1998e, 1999a, 1999b.

Hazardous Chemical Impacts. No hazardous chemicals would be released as a result of operations at Hanford under this alternative; thus, no cancer or adverse, noncancer health effects would occur. No carcinogenic chemicals would be released.

4.7.2.5 Facility Accidents

The potential consequences of postulated bounding facility accidents from operation of the pit conversion facility at Pantex are equivalent to those of Alternative 4A (see Table 4–60), and the potential consequences from operation of the immobilization facility at Hanford, equivalent to those included in Alternative 2 (see Tables 4–31 and 4–32). The potential impacts of such accidents from operation of the MOX facility in FMEF at Hanford are presented in Table 4–68. More details on the method of analysis, assumptions, and specific accident scenarios are presented in the discussion of Alternative 2 in Section 4.3.2.5.

Public. The most severe consequences of a design basis accident for the pit conversion and immobilization facilities under this alternative would be equivalent to the accidents discussed in Section 4.6.2.5 and Section 4.3.2.5, respectively. The most severe consequences of a design basis accident for the MOX facility in FMEF would be a nuclear criticality. A nuclear criticality of 10^{19} fissions would result in an MEI dose of 0.019 rem for the MOX facility corresponding to an LCF probability of 9.4×10^{-6}. Among the general

Table 4–68. Accident Impacts of MOX Facility Under Alternative 4B: Pit Conversion in New Construction at Pantex, and Immobilization in FMEF and HLWVF and MOX in FMEF at Hanford

		Impacts on Noninvolved Worker		Impact at Site Boundary		Impacts on Population Within 80 km	
Accident	Frequency (per year)	Dose (rem)[a]	Probability of Cancer Fatality[b]	Dose (rem)[a]	Probability of Cancer Fatality[b]	Dose (person-rem)[a]	Latent Cancer Fatalities[c]
Criticality	Extremely unlikely	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	Extremely unlikely	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	Unlikely	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	Unlikely	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	Extremely unlikely	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	Unlikely	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	Beyond extremely unlikely	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	Extremely unlikely to beyond extremely unlikely	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] For 95th percentile meteorological conditions. With the exception of doses due to criticality, the stated doses are from the inhalation of plutonium, and represent dose commitments that would be received over the lifetime of the impacted individual. See Appendix K.1.4.2 for a more detailed discussion of pathways.

[b] Increased likelihood (or probability) of cancer fatality for 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 for a hypothetical individual in the offsite population at the site boundary) if exposed to the indicated dose. The value assumes that the accident has occurred.

[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. The value assumes that the accident has occurred.

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility.

Source: Calculated using the source terms in Table K–8 and the MACCS2 computer code.

population around Hanford, an estimated 0.019 LCF could occur as a result of the MOX criticality accident. The frequency of such an accident is estimated to be between 1 in 10,000 and 1 in 1,000,000 per year.

A beyond-design-basis earthquake at Hanford could result in collapse of FMEF, including both immobilization (as described in Section 4.3.2.5) and MOX facilities (as described below), with an estimated 35 LCFs. It should be emphasized that a seismic event of sufficient magnitude to collapse these facilities would likely cause the collapse of other DOE facilities, and would almost certainly cause widespread failure of homes, office buildings, and other structures in the surrounding area.

The overall impact of such an event must therefore be seen in the context not only of the potential radiological impacts of these other facilities, but of hundreds, possibly thousands, of immediate fatalities from falling debris. The frequency of such an earthquake is estimated to be between 1 in 100,000 and 1 in 10,000,000 per year.

The beyond-design-basis accidents at Pantex would be equivalent to those discussed in Section 4.6.2.5.

Noninvolved Worker. Consistent with the analysis presented in the *Storage and Disposition PEIS*, the noninvolved worker is a hypothetical individual working on the site but not involved in the proposed action, and assumed to be 1,000 m (3,281 ft) from the location of the accident or at the site boundary, whichever is closer, and downwind from that location. For design basis accidents, the radiological consequences for this worker were estimated to be highest for the tritium release at the pit conversion facility. The consequences of such an accident would include an LCF probability of 8.7×10^{-5}.

Maximally Exposed Involved Worker. 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. Explosions could result in immediate injuries from flying debris, as well as the uptake of plutonium and uranium particulates through inhalation. If a criticality occurred, workers within tens of meters could receive very high to fatal radiation exposures from the initial 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 accident. The design basis and beyond-design-basis earthquakes would also have substantial consequences, ranging from workers being killed by debris from collapsing equipment and structures to high radiation exposures and uptakes of radionuclides. For most accidents, immediate emergency response actions should reduce the consequences to workers near the accident. As discussed in the Emergency Preparedness sections of Chapter 3, each candidate site has an established emergency management program that would be activated in the event of an accident. Based on the decisions made in the SPD EIS ROD, site emergency management programs would be modified to consider new accidents not in the current program.

Nonradiological Accidents. Surplus plutonium disposition operations at Pantex and Hanford could result in worker injuries and fatalities. DOE-required industrial safety programs would be in place to reduce the risks. Given the estimated employment of 12,030 person-years of labor and the standard DOE occupational accident rates, approximately 430 cases of nonfatal occupational injury or illness and 0.32 fatality could be expected for the duration of operations.

4.7.2.6 Transportation

Because the only difference between Alternative 4A and 4B is the location of the MOX facility within 400 Area at Hanford, the transportation required for Alternative 4B would be the same as that for Alternative 4A. Therefore, the transportation risks associated with Alternative 4B are equivalent to those discussed in Section 4.6.2.6.

4.7.2.7 Environmental Justice

As discussed in other parts of Section 4.7.2, routine operations conducted under Alternative 4B would pose no significant health risks to the public. The likelihood of an LCF for the MEI residing near Pantex would be approximately 1 in 3 million (see Table 4–66); the likelihood for the MEI residing near Hanford would be essentially zero. The number of LCFs expected among the general population residing near Pantex and Hanford from accident-free operations would increase by approximately 2.9×10^{-3} and 7.3×10^{-4}, respectively.

Design basis accidents at the sites would not be expected to cause cancer fatalities among the public (see Section 4.7.2.5). A beyond-design-basis earthquake would be expected to result in LCFs among the general population (see Tables 4–31, 4–32, 4–60, and 4–68). However, it is highly unlikely that a beyond-design-basis earthquake would occur. Accidents at the sites pose no significant risks (when the probability of occurrence is considered) to the population residing within the area potentially affected by radiological contamination.

As described in Section 4.7.2.6, no radiological or nonradiological fatalities would be expected to result from accident-free transportation conducted under this alternative. Nor would radiological or nonradiological fatalities be expected to result from transportation accidents.

Thus, implementation of Alternative 4B would pose no significant risks to the public, nor would implementation of this alternative pose significant risks to groups within the public, including the risk of disproportionately high and adverse effects on minority and low-income populations.

4.8 ALTERNATIVE 5

Alternative 5 would involve constructing and operating the pit conversion facility in Zone 4 West at Pantex and the immobilization and MOX facilities at SRS. The immobilization and MOX facilities would be located in new buildings in F-Area. Activities at Pantex would be the same as under Alternative 4A.

4.8.1 Construction

4.8.1.1 Air Quality and Noise

Potential air quality impacts of the construction of surplus plutonium disposition facilities under Alternative 5 at Pantex are the same as those for Alternative 4A (see Section 4.6.1.1).

Noise impacts are the same as those for Alternative 4A at Pantex (see Section 4.6.1.1).

Sources of potential air quality impacts of construction under Alternative 5 at SRS include emissions from fuel-burning construction equipment, soil disturbance by construction equipment and other vehicles, the operation of a concrete batch plant, trucks moving materials and wastes, and employee vehicles. Emissions from these sources are summarized in Appendix G.

A comparison of maximum air pollutant concentrations, including the contribution from construction activities at SRS, with standards and guidelines is presented as Table 4–69. Concentrations of air pollutants, especially PM_{10} and total suspended particulates, would likely increase at the site boundary, but should not exceed the Federal or State ambient air quality standards. Air pollution impacts during construction would be mitigated by applying, as appropriate, standard dust control practices such as watering or sweeping of roads and watering of exposed areas.

Total vehicle emissions associated with activities at SRS would likely decrease somewhat from current emissions because of an expected decrease in overall site employment during this timeframe.

The location of these facilities at SRS relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during construction would include heavy construction equipment, employee vehicles, and truck traffic. Traffic noise associated with the construction of these facilities would occur on the site and along offsite local and regional transportation routes used to bring construction materials and workers to the site. Given the distance to the site boundary (about 8.7 km [5.4 mi]), noise emissions from construction equipment would not likely annoy the public. These noise sources would be far enough away from offsite areas that their contribution to offsite noise levels would be small. Some noise sources could result in onsite impacts, such as the disturbance of wildlife. However, noise would be unlikely to affect federally listed threatened or endangered species or their critical habitats, as none are known to occur in F- or S-Area (see Section 4.26). Traffic associated with the construction of these facilities would likely produce less than a 1-dB increase in traffic noise levels along roads used to access the site, and thus would not result in any increased annoyance of the public.

Construction workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (OSHA 1997). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of standard silencing packages on construction equipment, administrative controls, engineering controls, and personal hearing protection equipment.

Table 4–69. Evaluation of SRS Air Pollutant Concentrations Associated With Construction Under Alternative 5: Pit Conversion in New Construction at Pantex, and Immobilization in New Construction and DWPF and MOX in New Construction at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m^3)[a]	SPD Increment (Fg/m^3)	Total Site Concentration (Fg/m^3)	Site as a Percent of Standard or Guideline
Criteria pollutants					
Carbon monoxide	8 hours	10,000	3.44	675	6.7
	1 hour	40,000	15.6	5,110	13
Nitrogen dioxide	Annual	100	0.129	11.5	12
PM_{10}	Annual	50	0.0551	5	10
	24 hours	150	5.36	91.1	61
Sulfur dioxide	Annual	80	0.0523	16.7	21
	24 hours	365	1.29	223	61
	3 hours	1,300	7.73	733	56
Other regulated pollutants					
Total suspended particulates	Annual	75	0.0901	45.5	61
Hazardous and other toxic compounds					
Other toxics[b]	24 hours	150	0.000224	20.7	14

[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: DWPF, Defense Waste Processing Facility; SPD, surplus plutonium disposition.

Source: EPA 1997a; SCDHEC 1996a.

4.8.1.2 Waste Management

At Pantex, construction impacts of this alternative would be the same as for Alternative 4A. See Section 4.6.1.2 for a description of the impacts of this alternative on the waste management infrastructure at Pantex.

Table 4–70 compares the wastes generated during the construction of surplus plutonium disposition facilities at SRS with the existing treatment, storage, and disposal capacity for the various waste types. It is anticipated that no TRU waste, LLW, or mixed LLW would be generated during the 3-year construction period. In addition, no soil contaminated with hazardous or radioactive constituents should be generated during construction. However, if any were generated, the waste would be managed in accordance with site practice and applicable Federal and State regulations. Construction waste generation would be the same for the ceramic and glass immobilization technologies because the same size facility would be built under either scenario. For this SPD EIS, it is assumed that hazardous waste and nonhazardous waste would be treated, stored, and disposed of in accordance with current site practices.

Hazardous wastes generated during the construction of surplus plutonium disposition facilities would be typical of those generated during the construction of an industrial facility. Any hazardous wastes generated during construction would be packaged in DOT-approved containers and shipped off the site to permitted commercial recycling, treatment, and disposal facilities. The additional waste load generated during construction should not have a major impact on the SRS hazardous waste management system.

Table 4–70. Potential Waste Management Impacts of Construction at SRS Under Alternative 5: Pit Conversion in New Construction at Pantex, and Immobilization in New Construction and DWPF and MOX in New Construction at SRS

Waste Type[a]	Estimated Additional Waste Generation (m^3/yr)	Estimated Additional Waste Generation as a Percent of[b]		
		Characterization or Treatment Capacity	Storage Capacity	Disposal Capacity
Hazardous	54	NA	NA	NA
Nonhazardous				
Liquid	41,000	15[c]	NA	3[d]
Solid	11,000	NA	NA	NA

[a] See definitions in Appendix F.8.
[b] Treatment capacities, and the disposal capacity for nonhazardous liquid waste, are compared with estimated additional annual waste generation. All other storage and disposal capacities are compared with total estimated additional waste generation assuming a 3-year construction period.
[c] Percent of capacity of F-Area sanitary sewer.
[d] Percent of capacity of the Central Sanitary Wastewater Treatment Facility.
Key: DWPF, Defense Waste Processing Facility; NA, not applicable (i.e., it is assumed that the majority of the hazardous waste and nonhazardous solid waste would be treated and disposed of off the site by the construction contractor).

Nonhazardous solid wastes generated during the construction of surplus plutonium disposition facilities would be packaged in conformance with standard industrial practice and shipped to commercial or municipal facilities for recycling or disposal. The additional waste load generated during construction should not have a major impact on the nonhazardous solid waste management system at SRS.

To be conservative, it was assumed that all nonhazardous liquid wastes generated during the construction of the immobilization and MOX facilities would be managed on the site at the Central Sanitary Wastewater Treatment Facility, even though it is likely that much of this waste would be collected in portable toilets and would be managed at offsite facilities. Nonhazardous liquid waste generated during the construction of these facilities is estimated to be 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, management of these wastes at SRS should not have a major impact on the nonhazardous liquid waste treatment system during construction.

4.8.1.3 Socioeconomics

Construction-related employment requirements for Alternative 5 would be as indicated in Table 4–71.

At its peak in 2002, construction of the new pit conversion facility at Pantex under this alternative would require 451 construction workers and generate another 381 indirect jobs in the region. As the total employment requirement of 832 direct and indirect jobs represents only 0.3 percent of the projected REA workforce, it should have no major impact on the REA. It should also have little impact on community services within the ROI. In fact, it should help offset the nearly 40 percent reduction in the total Pantex workforce from—i.e., from 2,944 to 1,750 workers—projected for the years 1997–2005.

At its peak in 2003, construction of the immobilization and MOX facilities at SRS would require 1,692 construction workers and generate another 1,358 indirect jobs in the region. The total employment requirement of 3,050 direct and indirect jobs represents 1.1 percent of the projected REA workforce, and thus should have no major impact on the REA. This requirement should also have little impact on community services within the ROI. In fact, it should help offset the nearly 20 percent reduction in SRS' overall labor force—i.e., from 15,032 to 12,000 workers—projected for the years 1997–2005.

Table 4–71. Construction Employment Requirements for Alternative 5: Pit Conversion in New Construction at Pantex, and Immobilization in New Construction and DWPF and MOX in New Construction at SRS

Year	Pit Conversion	Immobilization	MOX	Total
2001	297	0	0	297
2002	451	506	441	1,398
2003	276	920	772	1,968
2004	0	1,014	508	1,522
2005	0	552	221	773
2006	0	0	208	208

Key: DWPF, Defense Waste Processing Facility.
Source: DOE 1999c; UC 1998e, 1999c, 1999d.

4.8.1.4 Human Health Risk

Radiological Impacts. No radiological risk would be incurred by members of the public from construction activities. A summary of radiological impacts of construction activities on workers at risk is presented in Table 4–72. According to a recent radiation survey (DOE 1997f) conducted in the Zone 4 area at Pantex, construction workers would not be expected to receive any additional radiation exposure above natural background levels in the area. Data indicate, at SRS however, that a construction worker could be exposed to radiation deriving from other activities, past or present, at the site. Regardless of location, construction worker exposures would be limited to ensure that doses are kept as low as is reasonably achievable, and workers would be monitored (badged) as appropriate.

Table 4–72. Potential Radiological Impacts on Construction Workers of Alternative 5: Pit Conversion in New Construction at Pantex, and Immobilization in New Construction and DWPF and MOX in New Construction at SRS

Impact	Pit Conversion[a]	Immobilization[b]	MOX[c]	SRS Total
Total dose (person-rem/yr)	0	1.5	1.2	2.7
Annual latent fatal cancers[d]	0	6.0×10^{-4}	4.8×10^{-4}	1.1×10^{-3}
Average worker dose (mrem/yr)	0	4	4	4[e]
Annual latent fatal cancer risk	0	1.6×10^{-6}	1.6×10^{-6}	1.6×10^{-6}

[a] An estimated average of 342 workers would be associated with annual construction operations.
[b] An estimated average of 374 workers would be associated with annual construction operations at the new facility location adjacent to APSF, if built. The number would be the same for immobilization in either ceramic or glass.
[c] An estimated average of 292 workers would be associated with annual construction operations.
[d] 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, per ICRP 1991.
[e] Represents an average of the doses for both facilities.
Key: APSF, Actinide Packaging and Storage Facility; DWPF, Defense Waste Processing Facility.
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: DOE 1997f; ICRP 1991; NAS 1990; UC 1998d, 1998e, 1999c, 1999d.

Hazardous Chemical Impacts. The probability of excess latent cancer incidence associated with exposure to benzene released as a result of construction activities at SRS under this alternative has been estimated to be much less than 1 chance in 1 million over the lifetime of the maximally exposed member of the public.

No hazardous chemicals would be released as a result of construction activities at Pantex under this alternative; thus, no cancer or adverse, noncancer health effects would occur.

4.8.1.5 Facility Accidents

The construction of surplus plutonium disposition facilities at Pantex and SRS could result in worker injuries or fatalities. DOE-required industrial safety programs would be in place to reduce the risks. Given the estimated 6,166 person-years of construction labor and standard industrial accident rates, approximately 610 cases of nonfatal occupational injury or illness and 0.86 fatality could be expected (DOL 1997a, 1997b). As all construction would be in nonradiological areas, no radiological accidents should occur.

4.8.1.6 Environmental Justice

As discussed in the other parts of Section 4.8.1, construction under Alternative 5 would pose no significant health risks to the public. The risks would be negligible regardless of the racial or ethnic composition or the economic status of the population. Therefore, construction activities conducted under Alternative 5 at SRS would have no significant impacts on minority or low-income populations.

4.8.2 Operations

4.8.2.1 Air Quality and Noise

Potential air quality impacts of the operation of the new pit conversion facility under Alternative 5 at Pantex are the same as those for Alternative 4A (see Section 4.6.2.1). Noise impacts are the same as those for Alternative 4A at Pantex (see Section 4.6.2.1).

Source of potential air quality impacts of the operation of facilities under Alternative 5 at SRS were analyzed using ISCST3. Operational impacts would result from process emissions, emergency diesel generator testing, trucks moving materials and wastes, and employee vehicles. Emissions from these sources are summarized in Appendix G.

A comparison of maximum air pollutant concentrations, including the contribution from surplus plutonium disposition facilities, with standards and guidelines is presented as Table 4–73. Concentrations of air pollutant concentrations would likely increase at the site boundary, but would not exceed the Federal or State ambient air quality standards. Air pollution impacts during operation would be mitigated; for example, HEPA filtration has been included in the design of these facilities.

For a discussion of how the operation of the immobilization and MOX facilities at SRS would affect the ability to continue to meet NESHAPs limits regarding airborne radiological emissions, see Section 4.32.4.4. There are no other NESHAPs limits applicable to operation of these facilities.

The increases in concentrations of nitrogen dioxide, PM_{10}, and sulfur dioxide are a small fraction of the PSD Class II area increments, as summarized in Table 4–74.

Total vehicle emissions associated with activities at SRS would likely decrease somewhat from current emissions because of an expected decrease in overall site employment during this timeframe.

The location of these facilities at SRS relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during operations would include new or existing sources (e.g., cooling systems, vents, motors, material-handling equipment), employee vehicles,

Table 4–73. Evaluation of SRS Air Pollutant Concentrations Associated With Operations Under Alternative 5: Pit Conversion in New Construction at Pantex, and Immobilization in New Construction and DWPF and MOX in New Construction at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m^3)[a]	SPD Increment (Fg/m^3)	Total Site Concentration (Fg/m^3)	Site as a Percent of Standard or Guideline
Criteria pollutants					
Carbon monoxide	8 hours	10,000	0.275	671	6.7
	1 hour	40,000	1.03	5,100	13
Nitrogen dioxide	Annual	100	0.0347	11.4	11
PM_{10}	Annual	50	0.0024	4.94	9.9
	24 hours	150	0.0428	85.8	57
Sulfur dioxide	Annual	80	0.0829	16.8	21
	24 hours	365	1.14	223	61
	3 hours	1,300	3.03	728	56
Other regulated pollutants					
Total suspended particulates	Annual	75	0.0024	45.4	61
[Text deleted.]					

[a] The more stringent of the Federal and State standards is presented if both exist for the averaging period.
Key: DWPF, Defense Waste Processing Facility; SPD, surplus plutonium disposition.
Note: No nonradiological hazardous or other toxic compounds would be emitted from these processes.
Source: EPA 1997a; SCDHEC 1996a.

Table 4–74. Evaluation of SRS Air Pollutant Increases Associated With Operations Under Alternative 5: Pit Conversion in New Construction at Pantex, and Immobilization in New Construction and DWPF and MOX in New Construction at SRS

Pollutant	Averaging Period	Increase in Concentration (Fg/m^3)	PSD Class II Area Allowable Increment (Fg/m^3)	Percent of Increment
Nitrogen dioxide	Annual	0.0347	25	14
PM_{10}	Annual	0.0024	17	0.014
	24 hours	0.0428	30	0.14
Sulfur dioxide	Annual	0.0829	20	0.42
	24 hours	1.14	91	1.3
	3 hours	3.03	512	0.59

Key: DWPF, Defense Waste Processing Facility; PSD, prevention of significant deterioration.
Source: EPA 1997b.

and truck traffic. Traffic noise associated with operation of these facilities would occur on the site and along offsite local and regional transportation routes used to bring materials and workers to the site. Given the distance to the site boundary (about 8.7 km [5.4 mi]), noise emissions from equipment would not likely annoy the public. These noise sources would be far enough away from offsite areas that their contribution to offsite noise levels would be small. Some noise sources could result in onsite impacts, such as the disturbance of wildlife.

However, noise would be unlikely to affect federally listed threatened or endangered species or their critical habitats, as none are known to occur in F- or S-Area (see Section 4.26). Traffic associated with operation of these facilities would likely produce less than a 1-dB increase in traffic noise levels along roads used to access the site, and thus would not result in any increased annoyance of the public.

Operations workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (OSHA 1997). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of administrative controls, engineering controls, and personal hearing protection equipment.

The combustion of fossil fuels associated with Alternative 5 would result in the emission of carbon dioxide, one of the atmospheric gases that are believed to influence the global climate. Annual carbon dioxide emissions from this alternative would represent less than 2×10^{-4} percent of the 1995 annual U.S. emissions of carbon dioxide from fossil fuel combustion and industrial processes, and therefore would not appreciably affect global concentrations of this pollutant.

4.8.2.2 Waste Management

At Pantex, operation impacts of this alternative would be the same as for Alternative 4A. Therefore, see Section 4.6.2.2 for a description of the impacts of this alternative on the waste management infrastructure at Pantex.

Table 4–75 compares the existing site treatment, storage, and disposal capacities with the expected waste generation rates from operating surplus plutonium disposition facilities at SRS. Although HLW would be used in the immobilization process, no HLW would be generated by surplus plutonium disposition facilities. Waste generation at SRS should be the same for the ceramic and glass immobilization technologies.

Table 4–75. Potential Waste Management Impacts of Operations at SRS Under Alternative 5: Pit Conversion in New Construction at Pantex, and Immobilization in New Construction and DWPF and MOX in New Construction at SRS

Waste Type[a]	Estimated Additional Waste Generation (m^3/yr)	Estimated Additional Waste Generation as a Percent of[b]		
		Characterization or Treatment Capacity	Storage Capacity	Disposal Capacity
TRU[c]	160	9	5	1 of WIPP
LLW	180	1	NA	6
Mixed LLW	4	<1	2	NA
Hazardous	92	1	18	NA
Nonhazardous				
Liquid	81,000	29[d]	NA	6[e]
Solid	1,300	NA	NA	NA

[a] See definitions in Appendix F.8.

[b] Treatment capacities, and the disposal capacity for nonhazardous liquid waste, are compared with estimated additional annual waste generation. All other storage and disposal capacities are compared with total estimated additional waste generation assuming a 10-year operation period.

[c] Includes mixed TRU waste. Facilities are not expected to generate remotely handled TRU waste.

[d] Percent of capacity of F-Area sanitary sewer.

[e] Percent of capacity of Central Sanitary Wastewater Treatment Facility.

Key: DWPF, Defense Waste Processing Facility; LLW, low-level waste; NA, not applicable (i.e., the majority of this waste is not routinely treated, stored, or disposed of on the site); TRU, transuranic; WIPP, Waste Isolation Pilot Plant.

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. According to 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. 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, in order to be conservative, it is assumed the TRU waste would be stored on the site until 2016. 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 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 1995c).

TRU wastes would be treated, packaged, and certified to WIPP waste acceptance criteria at the new facilities. 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.

TRU wastes generated at the immobilization and MOX facilities at SRS are estimated to be 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 1,600 m^3 (2,090 yd^3) of TRU waste would be generated over the 10-year operation period. If all the TRU waste were stored on the site, this would be 5 percent of the 34,400-m^3 (45,000-yd^3) storage capacity available at the TRU Waste Storage Pads. Assuming that the waste were stored in 208-l (55-gal) drums that could be stacked two high, and allowing a 50 percent factor for aisle space, a storage area of about 0.23 ha (0.57 acre) would be required. Therefore, impacts of the management of additional quantities of TRU waste at SRS should not be major. Impacts from the treatment of TRU waste to WIPP waste acceptance criteria are described in the WM PEIS (DOE 1997d).

The 1,780 m^3 (2,328 yd^3) of additional TRU wastes generated at Pantex and SRS 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 1 percent of the current 168,500-m^3 (220,400-yd^3) limit for WIPP (DOE 1997e:3-3). Impacts of disposal of TRU waste at WIPP are described in the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997e).

At SRS, LLW would be packaged, certified, and accumulated at the immobilization and MOX facilities before transfer for additional treatment and disposal in existing onsite facilities. A total of 1,800 m^3 (2,350 yd^3) of LLW would be generated over the operations period. LLW generated at surplus plutonium disposition facilities is estimated to be 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 disposal land usage factor for SRS published in the *Storage and Disposition PEIS* (DOE 1996a:E-9), 1,800 m^3 (2,350 yd^3) of waste would require 0.20 ha (0.49 acre) of disposal space at SRS. Therefore, impacts of the management of this additional LLW at SRS should not be major.

At SRS, 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. Mixed LLW generated at the immobilization and MOX facilities is estimated to be 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 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.

At SRS, any hazardous wastes generated during operation of the immobilization and MOX facilities would be packaged for treatment and disposal at a combination of onsite and offsite facilities. Assuming that all hazardous waste is managed on the site, hazardous waste generated for this combination of facilities is estimated to be

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. If all LLW, mixed LLW, and hazardous wastes generated at the immobilization and MOX facilities at SRS were treated in the Consolidated Incineration Facility, this additional waste would be 2 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of that facility.

Nonhazardous solid waste would be packaged and transported 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 for disposal (DOE 1998c:3-42). It is unlikely that this additional waste load would have a major impact on the nonhazardous solid waste management system at SRS.

At SRS, nonhazardous wastewater generated by the immobilization and MOX facilities would be treated if necessary before being discharged to the F-Area sanitary sewer system, which connects to the Central Sanitary Wastewater Treatment Facility. Nonhazardous liquid waste generated by surplus plutonium disposition facilities at SRS is estimated to be 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 (1,890,357-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, management of nonhazardous liquid waste at SRS should not have a major impact on the treatment system.

4.8.2.3 Socioeconomics

Under Alternative 5, operation of the pit conversion facility at Pantex would begin in 2004 and should require 400 new workers (UC 1998e). This level of employment should generate another 1,355 indirect jobs within the region. The total employment requirement of 1,755 direct and indirect jobs represents 0.7 percent of the projected REA workforce, and thus should have no major impact on the REA. It should also have little impact on community services within the Pantex ROI. In fact, it should help offset the nearly 40 percent reduction in the total Pantex workforce (i.e., from 2,944 to 1,750 workers) projected for the years 1997–2010.

After construction, startup, and testing of the immobilization and MOX facilities at SRS in 2007 under Alternative 5, an estimated 720 new workers would be required to operate them (DOE 1999c; UC 1999c, 1999d). This level of employment would be expected to generate another 1,287 indirect jobs within the region. The total employment requirement of 2,007 direct and indirect jobs represents less than 0.7 percent of the projected REA workforce, and thus should have no major impact on the REA. The additional required workers should also have little impact on community services within the ROI. In fact, they should help offset the 33 percent reduction in the total SRS workforce (i.e., 15,032 to 10,000 workers) projected for the years 1997–2010.

4.8.2.4 Human Health Risk

During normal operations, there would be both radiological and hazardous chemical releases to the environment and also direct in-plant exposures. The resulting doses to, and potential health effects on, the public and workers under Alternative 5 would be as follows.

Radiological Impacts. Table 4–76 reflects the potential radiological impacts on three individual receptor groups at Pantex and SRS: the population living within 80 km (50 mi) in the year 2010, the maximally exposed member of the public, and the average exposed member of the public. The table depicts the projected aggregate LCF risk to these groups from 10 years of incident-free operation. To put operational doses into perspective, comparisons with doses from natural background radiation are also provided in the table.

Given incident-free operation of all three facilities, the total population dose in the year 2010 would be 0.58 person-rem at Pantex and 0.18 person-rem at SRS. The corresponding number of LCFs in the population

Table 4–76. Potential Radiological Impacts on the Public of Operations Under Alternative 5: Pit Conversion in New Construction at Pantex, and Immobilization in New Construction and DWPF and MOX in New Construction at SRS

Impact	Pit Conversion	Immobilization		MOX[a]	SRS Total
		Ceramic	Glass		(Ceramic or Glass)
Population within 80 km for year 2010					
Dose (person-rem)	0.58	2.8×10^{-3}	2.6×10^{-3}	0.18	0.018
Percent of natural background[b]	5.8×10^{-4}	1.2×10^{-6}	1.1×10^{-6}	7.8×10^{-5}	7.9×10^{-5}
10-year latent fatal cancers	2.9×10^{-3}	1.4×10^{-5}	1.3×10^{-5}	9.1×10^{-4}	9.2×10^{-4}
Maximally exposed individual					
Annual dose (mrem)	0.062	2.8×10^{-5}	2.6×10^{-5}	3.7×10^{-3}	3.7×10^{-3}
Percent of natural background[b]	0.019	9.5×10^{-6}	8.8×10^{-6}	1.3×10^{-3}	1.3×10^{-3}
10-year latent fatal cancer risk	3.1×10^{-7}	1.4×10^{-10}	1.3×10^{-10}	1.9×10^{-8}	1.9×10^{-8}
Average exposed individual within 80 km[c]					
Annual dose (mrem)	1.9×10^{-3}	3.6×10^{-6}	3.3×10^{-6}	2.3×10^{-4}	2.3×10^{-4}
10-year latent fatal cancer risk	9.5×10^{-9}	1.8×10^{-11}	1.6×10^{-11}	1.2×10^{-9}	1.2×10^{-9}

[a] Includes a 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 Pantex is 332 mrem for the average individual; the population within 80 km (50 mi) in 2010 would receive 99,300 person-rem. 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 approximately 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 Pantex (299,000) and the SRS APSF (approximately 790,000), if built, in 2010.

Key: APSF, Actinide Packaging and Storage Facility; DWPF, Defense Waste Processing Facility.

Source: Appendix J.

from 10 years of operation would be 2.9×10^{-3} around Pantex and 9.2×10^{-4} around SRS. The dose to the maximally exposed member of the public from annual operation of the pit conversion facility at Pantex would be 0.062 mrem. From 10 years of operation, the corresponding LCF risk to this individual would be 3.1×10^{-7}. The impacts on the average individual would be lower. The total dose to the maximally exposed member of the public from annual operation of the immobilization and MOX facilities at SRS would be 3.7×10^{-3} mrem. From 10 years of operation, the corresponding LCF risk to this individual would be 1.9×10^{-8}. The impacts on the average individual would be lower.

Estimated impacts resulting from "Total Site" operations are given in the Cumulative Impacts section of this SPD EIS (see Section 4.32). Within that section, projected incremental impacts associated with operation of the proposed surplus plutonium disposition facilities are added to the impacts of other past, present, and reasonably foreseeable future actions at or near the candidate sites. These impacts are then compared against applicable regulatory standards established by DOE, EPA, and NRC (such as DOE Order 5400.5, the CAA [NESHAPs], the SDWA, and 10 CFR 20).

Doses to involved workers from normal operations are given in Table 4–77; these workers are defined as those directly associated with process activities. Under this alternative, the annual average dose would be 500 mrem to pit conversion facility workers, 750 mrem to immobilization facility workers, and 65 mrem to MOX facility workers. The annual dose received by the total site workforce for each of these facilities has been estimated at 192, 242, and 22 person-rem, respectively. The risks and numbers of LCFs among the different workers from 10 years of operation are included in Table 4–77. Doses to individual workers would be kept to minimal levels by instituting badged monitoring, administrative limits, and ALARA programs (which would include worker rotations).

Table 4–77. Potential Radiological Impacts on Involved Workers of Operations Under Alternative 5: Pit Conversion in New Construction at Pantex, and Immobilization in New Construction and DWPF and MOX in New Construction at SRS

Impact	Pit Conversion	Immobilization (Ceramic or Glass)	MOX	SRS Total
Number of badged workers	383	323	331	654
Total dose (person-rem/yr)	192	242	22	264
10-year latent fatal cancers	0.77	0.97	0.088	1.1
Average worker dose (mrem/yr)	500	750	65	404[a]
10-year latent fatal cancer risk	2.0×10^{-3}	3.0×10^{-3}	2.6×10^{-4}	1.6×10^{-3}

[a] Represents an average of the doses for both facilities.

Key: DWPF, Defense Waste Processing Facility.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995d and NRC 1999a). 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 1994a). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1999c; UC 1998d, 1998e, 1999c, 1999d.

Hazardous Chemical Impacts. No hazardous chemicals would be released as a result of operations at SRS under this alternative; thus, no cancer or adverse, noncancer health effects would occur. No carcinogenic chemicals would be released.

No hazardous chemicals would be released as a result of operations at Pantex under this alternative; thus, no cancer or adverse, noncancer health effects would occur.

4.8.2.5 Facility Accidents

The potential consequences of postulated bounding facility accidents from operation of the pit conversion facility at Pantex would be equivalent to those of Alternative 4A (see Table 4–60), and the potential consequences from operation of the immobilization and MOX facilities at SRS, equivalent to those included in Alternative 3 (see Tables 4–44 through 4–46). More details on the method of analysis, assumptions, and specific accident scenarios are presented for Alternative 2 in Section 4.3.2.5.

Public. The most severe consequences of a design basis accident for the pit conversion facility are shown in Section 4.6.2.5; the most severe consequences for the immobilization and MOX facilities, in Section 4.4.2.5.

A beyond-design-basis earthquake at SRS could result in total collapse of the immobilization and MOX facilities, with an estimated 14 LCFs (as described in Section 4.4.2.5). It should be emphasized that a seismic event of sufficient magnitude to collapse these facilities would likely cause the collapse of other DOE facilities, and would almost certainly cause widespread failure of homes, office buildings, and other structures in the surrounding area. The overall impact of such an event must therefore be seen in the context not only of the potential radiological impacts of these other facilities, but of hundreds, possibly thousands, of immediate fatalities from falling debris. The frequency of such an earthquake is estimated to be between 1 in 100,000 and 1 in 10,000,000 per year.

The beyond-design-basis accidents at Pantex would be equivalent to those discussed in Section 4.6.2.5.

Noninvolved Worker. Consistent with the analysis presented in the *Storage and Disposition PEIS*, the noninvolved worker is a hypothetical individual working on the site but not involved in the proposed action, and assumed to be 1,000 m (3,281 ft) from the location of the accident or at the site boundary, whichever is closer, and downwind from that location. For design basis accidents, the radiological consequences for this worker were estimated to be highest for the criticality at the MOX facility. The consequences of such an accident would include an LCF probability of 1.2×10^{-4}.

Maximally Exposed Involved Worker. 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. Explosions could result in immediate injuries from flying debris, as well as the uptake of plutonium and uranium particulates through inhalation. If a criticality occurred, workers within tens of meters could receive very high to fatal radiation exposures from the initial 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 accident. The design basis and beyond-design-basis earthquakes would also have substantial consequences, ranging from workers being killed by debris from collapsing equipment and structures to high radiation exposures and uptakes of radionuclides. For most accidents, immediate emergency response actions should reduce the consequences to workers near the accident. As discussed in the Emergency Preparedness sections of Chapter 3, each candidate site has an established emergency management program that would be activated in the event of an accident. Based on the decisions made in the SPD EIS ROD, site emergency management programs would be modified to consider new accidents not in the current program.

Nonradiological Accidents. Surplus plutonium disposition operations at Pantex and SRS could result in worker injuries and fatalities. DOE-required industrial safety programs would be in place to reduce the risks. Given the estimated employment of 11,535 person-years of labor and the standard DOE occupational accident rates, approximately 420 cases of nonfatal occupational injury or illness and 0.31 fatality could be expected for the duration of operations.

4.8.2.6 Transportation

Operational transportation impacts may be divided into two parts: impacts due to incident-free transportation and those due to transportation accidents. They may be further divided into nonradiological and radiological impacts. Nonradiological impacts are specifically vehicular, such as vehicular emissions and traffic accidents. Radiological impacts are those related to the dose received by transportation workers and the public during normal operations and in the case of accidents in which the radioactive materials being shipped may be released. For more detailed information on the transportation analysis performed for this SPD EIS, see Appendix L.

Under Alternative 5, transportation to and from Pantex would include the shipment of plutonium pits and clean plutonium metal via SST/SGT from sites throughout the DOE complex to the pit conversion facility.[16] During dismantlement of the pits, some HEU would be recovered. The pit conversion facility would ship HEU via

[16] Work is currently under way to repackage all pits at Pantex from the AL–R8 container into the AL–R8 SI container for long-term storage. This effort would be completed over 10 years, and the estimated dose to involved workers received from this repackaging activity would be about 104 person-rem. The SPD Draft EIS analyzed repackaging of the pits in an AT–400A container. The change to the AL–R8 SI changes the long-term storage period for pits from 50 to 30 years because of the need to replace a seal in the container after 30 years; the AT–400A does not require that activity. After seal replacement, the pits could continue to be stored for another 30 years

SST/SGT to ORR for storage.[17] After conversion, the plutonium in the pit conversion facility would be in the form of plutonium dioxide. This material would be transported to the to the MOX facility at SRS for fabrication into MOX fuel pellets.

MOX fuel fabrication also requires uranium dioxide. Quantifying the uranium dioxide transportation requirements for this SPD EIS involved selecting representative sites for the source of the depleted uranium hexafluoride and the conversion facility. A DOE enrichment facility near Portsmouth, Ohio, was chosen as a representative site for the source of the depleted uranium hexafluoride, and the nuclear fuel fabrication facility in Wilmington, North Carolina, as representative of a uranium conversion facility. These sites were also used as representative sites in the *Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement* (DOE 1996e). It is assumed that depleted uranium hexafluoride needed for MOX fuel would be shipped via commercial truck to the uranium conversion facility, where it would be converted into uranium dioxide (see Section 4.3.2.6). After conversion, the depleted uranium dioxide would be shipped via commercial truck from the conversion facility to the MOX facility at SRS. This material would be blended with plutonium dioxide at the MOX facility, fabricated into MOX fuel pellets, and placed in MOX fuel rods. After fabrication, the MOX fuel rods would be shipped to a domestic reactor site, where they would be placed in fuel assemblies and irradiated. Shipments of unirradiated MOX fuel rods would be made in an SST/SGT because unirradiated MOX fuel in large enough quantities is subject to the same security concerns as pure weapons-grade plutonium. It is assumed in this transportation analysis that all MOX fuel is shipped from the MOX facility to the most distant reactor site, North Anna.

Immobilization at SRS under this alternative would require that surplus nonpit plutonium in various forms be shipped from current storage locations (i.e., SRS, Hanford, INEEL, LLNL, LANL, and RFETS) to the immobilization facility at SRS. Even though these materials are not clean plutonium metal or pits, the quantity of the plutonium contained in them would require that they be treated as materials that could be used in nuclear weapons, and thus that shipments be made in SST/SGTs.

Under the preferred technology alternative for immobilization, the surplus plutonium would be immobilized in a ceramic matrix in small cans at the immobilization facility, placed in HLW canisters, and transported via specially designed trucks to DWPF in S-Area. This intrasite transportation—from F-Area to S-Area—could require the temporary shutdown of roads on SRS. It would, however, provide for all the necessary security and for reduced risk to the public; SST/SGTs would not be required.

Use of the preferred ceramic (versus glass) matrix for immobilization would also require a small amount of depleted uranium dioxide (i.e., less than 10 t [11 tons] per year). It is assumed that this depleted uranium dioxide would be produced and shipped in the same manner as the depleted uranium dioxide needed by the MOX facility.

After the immobilized plutonium was encased by HLW at DWPF, it would be shipped to a potential geologic repository for ultimate disposition. Because HLW would be displaced by the cans of immobilized plutonium suspended in the HLW canister, additional canisters would be required over the life of the immobilization program. According to estimates, up to 145 additional canisters of HLW would be needed to meet the demands of surplus plutonium disposition under Alternative 5. The *Yucca Mountain Draft EIS* evaluates different options for the shipment of these canisters to a potential geologic repository using either trucks or trains. The analysis revealed that shipment by train would pose the lower risk. However, no ROD has yet been issued regarding these shipments. To bound the risks associated with these additional shipments, this SPD EIS conservatively assumes that all of these shipments would be made by truck, one canister per truck.

[17] Classified nuclear material parts would also result from pit disassembly. Although current plans are to store these parts at the pit conversion facility, this SPD EIS analyzes the possible transport of these nuclear material parts to LANL. Therefore, the transportation impacts are slightly overstated.

Every alternative considered in this SPD EIS would require routine transportation of wastes from the proposed disposition facilities to treatment, storage, or disposal facilities on the sites. This transportation would be handled in the same manner as other site waste shipments, and as shown in Sections 4.8.1.2 and 4.8.2.2, would involve no major increase in the amounts of waste already being managed at these sites. The shipments would pose no greater risks than the ordinary waste shipments at these sites, as analyzed in the WM PEIS.

However, TRU waste generated at Pantex was not covered by the WM PEIS ROD, as there was no such waste at Pantex at the time the ROD was issued, and none was likely to be generated in ongoing site operations. Location of the pit conversion facility at Pantex would result in the generation of TRU waste, as described in Section 4.8.2.2. Moreover, a fairly large increase in the amount of LLW at Pantex (i.e., 25 percent of the site's current storage capacity) could be expected under this alternative. Currently, this type of waste is shipped to the NTS for disposal. In order to account for the transportation of TRU waste from Pantex to WIPP and LLW from Pantex to NTS, additional shipments are analyzed in this SPD EIS.

In all, approximately 2,300 shipments of radioactive materials would be carried out by DOE under this alternative. The total distance traveled on public roads by trucks carrying radioactive materials would be 3.8 million km (2.4 million mi).

Impacts of Incident-Free Transportation. The dose to transportation workers from all transportation activities entailed by this alternative has been estimated at 60 person-rem; the dose to the public, 67 person-rem. Accordingly, the incident-free transportation of radioactive material associated with this alternative would result in 0.024 LCF among transportation workers and 0.033 LCF in the total affected population over the duration of the transportation activities. The estimated number of nonradiological fatalities from vehicular emissions associated with this alternative is 0.016.

Impacts of Accidents During Transportation (Consequences). The maximum foreseeable offsite transportation accident under this alternative (probability of occurrence: greater than 1 in 10 million per year) is a shipment of plutonium oxide from the pit conversion facility at Pantex to Savannah River with a severity category VIII accident in a rural population zone under neutral (average) weather conditions. If this accident were to occur, it could result in a dose of 624 person-rem to the public for an LCF risk of 0.3 and 684 rem to the hypothetical MEI for an LCF risk of 0.68. (The MEI receives a larger dose than the population because it is unlikely that a person would be in position, and remain in position, to receive this hypothetical maximum dose.) No fatalities would be expected to occur. The probability of more severe accidents, different weather conditions at the time of accident, or occurrence in a more densely populated area were also evaluated, and estimated to have a probability lower than 1 chance in 10 million per year. (See Appendix L.6.)

Impacts of Accidents During Transportation (Risks). The total transportation accident risks were estimated by summing the risks to the affected population from all hypothetical accidents. For Alternative 5 those risks are as follows: a radiological dose to the population of 9 person-rem, resulting in a total population risk of 0.004 LCF; and traffic accidents resulting in 0.050 fatality.

4.8.2.7 Environmental Justice

As discussed in other parts of Section 4.8.2, routine operations conducted under Alternative 5 would pose no significant health risks to the public. The likelihood of an LCF for the MEI residing near Pantex would be approximately 1 in 3 million (see Table 4–76); the likelihood for the MEI residing near SRS would be essentially zero. The number of LCFs expected among the general population residing near Pantex and SRS from accident-free operations would increase by approximately 2.9×10^{-3} and 9.2×10^{-4}, respectively.

Design basis accidents at the site would not be expected to cause cancer fatalities among the public (see Section 4.8.2.5). A beyond-design-basis earthquake would be expected to result in LCFs among the general population (see Tables 4–60 and 4–43 through 4–46). However, it is highly unlikely that a beyond-design-basis earthquake would occur. Accidents at the sites pose no significant risks (when the probability of occurrence is considered) to the population residing within the area potentially affected by radiological contamination.

As described in Section 4.8.2.6, no radiological or nonradiological fatalities would be expected to result from accident-free transportation conducted under this alternative. Nor would radiological or nonradiological fatalities be expected to result from transportation accidents.

Thus, implementation of Alternative 5 would pose no significant risks to the public, nor would implementation of this alternative pose significant risks to groups within the public, including the risk of disproportionately high and adverse effects on minority and low-income populations.

4.9 [Section deleted because alternative deleted.]

4.10 ALTERNATIVE 6A

Alternative 6A would involve constructing and operating the pit conversion and MOX facilities at Hanford and the immobilization facility at SRS. The pit conversion facility would be located in the existing FMEF building with the MOX facility located in a new building near FMEF. The immobilization facility would be located in a new facility in F-Area.

4.10.1 Construction

4.10.1.1 Air Quality and Noise

Sources of potential air quality impacts of Hanford construction under Alternative 6A include emissions from fuel-burning construction equipment, soil disturbance by construction equipment and other vehicles, the operation of a concrete batch plant, trucks moving materials and wastes, and employee vehicles. Emissions from these sources are summarized in Appendix G.

A comparison of maximum air pollutant concentrations, including the contribution from Hanford construction activities, with standards and guidelines is presented as Table 4–78. Concentrations of air pollutants, especially PM_{10} and total suspended particulates, would likely increase at the site boundary, but should not exceed the Federal or State ambient air quality standards as a result of Hanford activities. Occasional exceedances of the PM_{10} and total suspended particulates standards attributable to natural sources would be expected to continue. Air pollution impacts during construction would be mitigated by applying, as appropriate, standard dust control practices such as watering or sweeping of roads and watering of exposed areas.

Total vehicle emissions associated with activities at Hanford would likely decrease somewhat from current emissions during the planned construction period because of an expected decrease in overall site employment.

The location of these facilities at Hanford relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during construction would include heavy construction equipment, employee vehicles, and truck traffic. Traffic noise associated with the construction of these facilities would occur on the site and along offsite local and regional transportation routes used to bring construction materials and workers to the site. Given the distance to the site boundary (about 7.1 km [4.4 mi]), noise emissions from construction equipment would not likely annoy the public. These noise sources would be far enough away from offsite areas that their contribution to offsite noise levels would be small. Some noise sources could result in onsite impacts, such as the disturbance of wildlife. However, noise would be unlikely to affect federally listed threatened or endangered species or their critical habitats, as none are known to occur on or in the immediate vicinity of the proposed site location (see Section 4.26). Traffic associated with the construction of these facilities would likely produce less than a 1-dB increase in traffic noise levels along roads used to access the site, and thus would not result in any increased annoyance of the public.

Sources of potential air quality impacts of construction under Alternative 6A at SRS include emissions from fuel-burning construction equipment, soil disturbance by construction equipment and other vehicles, the operation of a concrete batch plant, trucks moving materials and wastes, and employee vehicles. Emissions from these sources are summarized in Appendix G.

A comparison of maximum air pollutant concentrations, including the contribution from construction activities at SRS, with standards and guidelines is presented as Table 4–79. Concentrations of air pollutants, especially

Table 4–78. Evaluation of Hanford Air Pollutant Concentrations Associated With Construction Under Alternative 6A: Pit Conversion in FMEF and MOX in New Construction at Hanford, and Immobilization in New Construction and DWPF at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m^3)[a]	SPD Increment (Fg/m^3)	Total Site Concentration (Fg/m^3)	Site as a Percent of Standard or Guideline
Criteria pollutants					
Carbon monoxide	8 hours	10,000	1.34	35.4	0.35
	1 hour	40,000	9.1	57.4	0.14
Nitrogen dioxide	Annual	100	0.104	0.354	0.35
PM_{10}	Annual	50	0.103	0.121	0.24
	24 hours	150	3.59	4.36	2.9
Sulfur dioxide	Annual	50	0.00979	1.64	3.2
	24 hours	260	0.109	9.02	3.4
	3 hours	1,300	0.74	30.4	2.3
	1 hour	660	2.22	35.1	5.3
Other regulated pollutants					
Total suspended particulates	Annual	60	0.209	0.23	0.38
	24 hours	150	6.74	7.5	5.0
Hazardous and other toxic compounds					
Other toxics[b]	Annual	0.12	0.000008	0.000014	0.012

[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: DWPF, Defense Waste Processing Facility; FMEF, Fuels and Materials Examination Facility; SPD, surplus plutonium disposition.

Source: EPA 1997a; WDEC 1994.

PM_{10} and total suspended particulates, would likely increase at the site boundary, but should not exceed the Federal or State ambient air quality standards. Air pollution impacts during construction would be mitigated by applying, as appropriate, standard dust control practices such as watering or sweeping of roads and watering of exposed areas.

Total vehicle emissions associated with activities at SRS would likely decrease somewhat from current emissions because of an expected decrease in overall site employment during this timeframe.

The location of these facilities at SRS relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during construction would include heavy construction equipment, employee vehicles, and truck traffic. Traffic noise associated with the construction of these facilities would occur on the site and along offsite local and regional transportation routes used to bring construction materials and workers to the site. Given the distance to the site boundary (about 8.7 km [5.4 mi]), noise emissions from construction equipment would not likely annoy the public. These noise sources would be far enough away from offsite areas that their contribution to offsite noise levels would be small. Some noise sources could result in onsite impacts, such as the disturbance of wildlife. Noise should not affect threatened and endangered species because there are no threatened and endangered species habitats near the facility site (see Section 4.26). Noise from traffic associated with the construction of these facilities would likely produce less than a 1-dB increase in traffic noise levels along roads used to access the site, and thus would not result in any increased annoyance of the public.

Table 4–79. Evaluation of SRS Air Pollutant Concentrations Associated With Construction Under Alternative 6A: Pit Conversion in FMEF and MOX in New Construction at Hanford, and Immobilization in New Construction and DWPF at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m^3)[a]	SPD Increment (Fg/m^3)	Total Site Concentration (Fg/m^3)	Site as a Percent of Standard or Guideline
Criteria pollutants					
Carbon monoxide	8 hours	10,000	2.89	674	6.7
	1 hour	40,000	13.1	5,110	13
Nitrogen dioxide	Annual	100	0.108	11.5	11
PM_{10}	Annual	50	0.0366	4.98	10
	24 hours	150	3.56	89.3	60
Sulfur dioxide	Annual	80	0.0502	16.7	21
	24 hours	365	1.24	223	61
	3 hours	1,300	7.42	732	56
Other regulated pollutants					
Total suspended particulates	Annual	75	0.0581	45.4	61
Hazardous and other toxic compounds					
[Text deleted.]					
Other toxics[b]	24 hours	150	0	20.7	14

[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: DWPF, Defense Waste Processing Facility; FMEF, Fuels and Materials Processing Facility, SPD, surplus plutonium disposition.

Source: EPA 1997a; SCDHEC 1996a.

Construction workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (OSHA 1997). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of standard silencing packages on construction equipment, administrative controls, engineering controls, and personal hearing protection equipment.

4.10.1.2 Waste Management

Tables 4–80 and 4–81 compare the wastes generated during the construction of surplus plutonium disposition facilities at Hanford and SRS with the existing treatment, storage, and disposal capacity for the various waste types at each site. It is anticipated that no TRU waste, LLW, or mixed LLW would be generated during the 3-year construction period. In addition, no soil contaminated with hazardous or radioactive constituents should be generated during construction. However, if any were generated, the waste would be managed in accordance with site practice and applicable Federal and State regulations. Construction waste generation would be the same for the ceramic and glass immobilization technologies because the same size facility would be built under either scenario. For this SPD EIS, it is assumed that hazardous waste and nonhazardous waste would be treated, stored, and disposed of in accordance with current site practices.

Hazardous wastes generated during the construction of surplus plutonium disposition facilities at Hanford and SRS would be typical of those generated during the construction of an industrial facility. Any hazardous wastes generated during construction would be packaged in DOT-approved containers and shipped off the site

Table 4–80. Potential Waste Management Impacts of Construction at Hanford Under Alternative 6A: Pit Conversion in FMEF and MOX in New Construction at Hanford, and Immobilization in New Construction and DWPF at SRS

Waste Type[a]	Estimated Additional Waste Generation (m^3/yr)	Estimated Additional Waste Generation as a Percent of[b]		
		Characterization or Treatment Capacity	Storage Capacity	Disposal Capacity
Hazardous	32	NA	NA	NA
Nonhazardous				
Liquid	21,000	9[c]	NA	9[d]
Solid	8,600	NA	NA	NA

[a] See definitions in Appendix F.8.

[b] Treatment capacities, and the disposal capacity for nonhazardous liquid waste, are compared with estimated additional annual waste generation. All other storage and disposal capacities are compared with total estimated additional waste generation assuming a 3-year construction period.

[c] Percent of capacity of the 400 Area sanitary sewer.

[d] Percent of capacity of the Energy Northwest (formerly Washington Public Power Supply System) Sewage Treatment Facility.

Key: FMEF, Fuels and Materials Examination Facility; NA, not applicable (i.e., it is assumed that the majority of the hazardous waste and nonhazardous solid waste would be treated and disposed of off the site by the construction contractor).

Table 4–81. Potential Waste Management Impacts of Construction at SRS Under Alternative 6A: Pit Conversion in FMEF and MOX in New Construction at Hanford, and Immobilization in New Construction and DWPF at SRS

Waste Type[a]	Estimated Additional Waste Generation (m^3/yr)	Estimated Additional Waste Generation as a Percent of[b]		
		Characterization or Treatment Capacity	Storage Capacity	Disposal Capacity
Hazardous	35	NA	NA	NA
Nonhazardous				
Liquid	21,000	8[c]	NA	1[d]
Solid	2,200	NA	NA	NA

[a] See definitions in Appendix F.8.

[b] Treatment capacities, and the disposal capacity for nonhazardous liquid waste, are compared with estimated additional annual waste generation. All other storage and disposal capacities are compared with total estimated additional waste generation assuming a 3-year construction period.

[c] Percent of capacity of F-Area sanitary sewer.

[d] Percent of capacity of the Central Sanitary Wastewater Treatment Facility.

Key: DWPF, Defense Waste Processing Facility; NA, not applicable (i.e., it is assumed that the majority of the hazardous waste and nonhazardous solid waste would be treated and disposed of off the site by the construction contractor).

to permitted commercial recycling, treatment, and disposal facilities. The additional waste load generated during construction should not have a major impact on Hanford or SRS hazardous waste management systems.

Nonhazardous solid wastes generated during the construction of surplus plutonium disposition facilities at Hanford and SRS would be packaged in conformance with standard industrial practice and shipped to commercial or municipal facilities for recycling or disposal. The additional waste load generated during construction should not have a major impact on the nonhazardous solid waste management systems at Hanford or SRS.

To be conservative, it was assumed that all nonhazardous liquid wastes generated during construction of the pit conversion and MOX facilities at Hanford would be managed on the site at the Energy Northwest (formerly WPPSS) Sewage Treatment Facility, even though it is likely that much of this waste would be collected in portable toilets and would be managed at offsite facilities. Nonhazardous liquid waste generated during the construction of these facilities is estimated to be 9 percent of the 235,000-m^3/yr (307,000-yd^3/yr) capacity of the 400 Area sanitary sewer, 9 percent of the 235,000-m^3/yr (307,000-yd^3/yr) capacity of the Energy Northwest Sewage Treatment Facility, and within the 138,000-m^3/yr (181,000-yd^3/yr) excess capacity of the Energy Northwest Sewage Treatment Facility (Mecca 1997). Therefore, management of these wastes at Hanford should not have a major impact on the nonhazardous liquid waste treatment system during construction.

To be conservative, it was also assumed that all nonhazardous liquid wastes generated during construction of the immobilization facility at SRS would be managed on the site at the Central Sanitary Wastewater Treatment Facility, even though it is likely that much of this waste would be collected in portable toilets and would be managed at offsite facilities. Nonhazardous liquid waste generated during the construction of these facilities is estimated to be 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, management of these wastes at SRS should not have a major impact on the nonhazardous liquid waste treatment system during construction.

4.10.1.3 Socioeconomics

Construction-related employment requirements for Alternative 6A would be as indicated in Table 4–82.

Table 4–82. Construction Employment Requirements for Alternative 6A: Pit Conversion in FMEF and MOX in New Construction at Hanford, and Immobilization in New Construction and DWPF at SRS

Year	Pit Conversion	MOX	Immobilization	Total
2001	76	0	0	76
2002	116	441	506	1,063
2003	72	772	920	1,764
2004	0	508	1,014	1,522
2005	0	221	552	773
2006	0	208	0	208

Key: DWPF, Defense Waste Processing Facility; FMEF, Fuels and Materials Examination Facility.
Source: DOE 1999c; UC 1998a, 1999c, 1999d.

At its peak in 2003, construction of the pit conversion and MOX facilities at Hanford under this alternative would require 844 construction workers and generate another 866 indirect jobs in the region. The total employment requirement of 1,710 direct and indirect jobs represents less than 0.5 percent of the projected REA workforce, and thus should have no major impacts on the REA. That requirement should also have little impact on the community services currently offered in the ROI. In fact, it should help offset the nearly 15 percent reduction in Hanford employment (i.e., from 12,882 to approximately 11,000 workers) projected for the years 1997–2005.

At its peak in 2004, construction of the new immobilization facility at SRS would require 1,014 construction workers and generate another 814 indirect jobs in the region. As this total employment requirement of

1,828 direct and indirect jobs represents 0.6 percent of the total projected REA workforce, it should have no major impact on the REA. It should also have little impact on the community services currently offered in the SRS ROI. In fact, it should help offset the nearly 20 percent reduction in SRS's total workforce from its 1997 level (i.e., from 15,032 to 12,000 workers) projected for the years 1997–2005.

4.10.1.4 Human Health Risk

Radiological Impacts. No radiological risk would be incurred by members of the public from construction activities. A summary of radiological impacts of construction activities on workers at risk is presented in Table 4–83. According to recent radiation surveys (Antonio 1998; UC 1998a, 1998b, 1999c, 1999d) conducted at the Hanford 400 Area and SRS F-Area, construction workers at Hanford would not be expected to receive doses above natural background levels. At SRS, however, construction workers could receive small doses above natural background levels. Regardless of location, construction workers may be monitored (badged) as a precautionary measure.

Table 4–83. Potential Radiological Impacts on Construction Workers of Alternative 6A: Pit Conversion in FMEF and MOX in New Construction at Hanford, and Immobilization in New Construction and DWPF at SRS

Impact	Pit Conversion[a]	MOX[b]	Hanford Total	Immobilization[c]
Total dose (person-rem/yr)	0	0	0	1.5
Annual latent fatal cancers[d]	0	0	0	6.0×10^{-4}
Average worker dose (mrem/yr)	0	0	0[e]	4
Annual latent fatal cancer risk	0	0	0	1.6×10^{-6}

[a] An estimated average of 88 workers would be associated with annual construction and modification operations.

[b] An estimated average of 292 workers would be associated with annual construction operations.

[c] An estimated average of 374 workers would be associated with annual construction operations at the new facility location adjacent to APSF, if built. The number would be the same for immobilization in either ceramic or glass.

[d] 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, per ICRP 1991.

[e] Represents an average of the doses for both facilities.

Key: APSF, Actinide Packaging and Storage Facility; DWPF, Defense Waste Processing Facility; FMEF, Fuels and Materials Examination Facility.

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: Antonio 1998; ICRP 1991; NAS 1990; UC 1998a, 1998b, 1999c, 1999d.

Hazardous Chemical Impacts. The probability of excess latent cancer incidence associated with exposure to benzene released as a result of construction activities at Hanford under this alternative has been estimated to be much less than 1 chance in 1 million over the lifetime of the maximally exposed member of the public.

4.10.1.5 Facility Accidents

Surplus plutonium disposition construction activities at Hanford and SRS could result in worker injuries or fatalities. DOE-required industrial safety programs would be in place to reduce the risks. Given the estimated 5,406 person-years of construction labor and standard industrial accident rates, approximately 540 cases of nonfatal occupational injury or illness and 0.75 fatality could be expected (DOL 1997a, 1997b). As all construction would be in nonradiological areas, no radiological accidents should occur.

4.10.1.6 Environmental Justice

As discussed in the other parts of Section 4.10.1, construction under Alternative 6A would pose no significant health risks to the public. The risks would be negligible regardless of the racial or ethnic composition or the economic status of individuals the population. Therefore, construction activities under Alternative 6A at Hanford and SRS would have no significant impacts on minority or low-income populations.

4.10.2 Operations

4.10.2.1 Air Quality and Noise

Potential air quality impacts of the operation of facilities under Alternative 6A at Hanford were analyzed using ISCST3. Operational impacts would result from process emissions, emergency diesel generator testing, trucks moving materials and wastes, and employee vehicles. Emissions from these sources are summarized in Appendix G, including those resulting from surplus plutonium disposition facilities.

A comparison of maximum air pollutant concentrations, including the contribution from surplus plutonium disposition facilities, with standards and guidelines is presented as Table 4–84. Concentrations of air pollutants would likely increase at the site boundary, but would not exceed the Federal or State ambient air quality standards as a result of Hanford activities. Occasional exceedances of the PM_{10} and total suspended particulates standards attributable to natural sources would be expected to continue. Air pollution impacts during operation would be mitigated; for example, HEPA filtration has been included in the design of these facilities.

Table 4–84. Evaluation of Hanford Air Pollutant Concentrations Associated With Operations Under Alternative 6A: Pit Conversion in FMEF and MOX in New Construction at Hanford, and Immobilization in New Construction and DWPF at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m^3)[a]	SPD Increment (Fg/m^3)	Total Site Concentration (Fg/m^3)	Site as a Percent of Standard or Guideline
Criteria pollutants					
Carbon monoxide	8 hours	10,000	0.247	34.3	0.34
	1 hour	40,000	1.68	50	0.13
Nitrogen dioxide	Annual	100	0.031	0.281	0.28
PM_{10}	Annual	50	0.00143	0.0193	0.039
	24 hours	150	0.0159	0.786	0.52
Sulfur dioxide	Annual	50	0.00123	1.63	3.1
	24 hours	260	0.0136	8.92	3.4
	3 hours	1,300	0.0928	29.7	2.3
	1 hour	660	0.278	33.2	5.0
Other regulated pollutants					
Total suspended particulates	Annual	60	0.00143	0.0193	0.032
	24 hours	150	0.0159	0.786	0.52
[Text deleted.]					

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

Key: DWPF, Defense Waste Processing Facility; FMEF, Fuels and Materials Examination Facility; SPD, surplus plutonium disposition.

Note: No nonradiological hazardous or other toxic compounds would be emitted from these processes.

Source: EPA 1997a; WDEC 1994.

For a discussion of how the operation of the pit conversion and MOX facilities at Hanford would affect the ability to continue to meet NESHAPs limits regarding airborne radiological emissions, see Section 4.32.1.4. There are no other NESHAPs limits applicable to operation of these facilities.

The increases in concentrations of nitrogen dioxide, PM_{10}, and sulfur dioxide from operation of these facilities would be a small fraction of the PSD Class II area increments as summarized in Table 4–85.

Table 4–85. Evaluation of Hanford Air Pollutant Increases Associated With Operations Under Alternative 6A: Pit Conversion in FMEF and MOX in New Construction at Hanford, and Immobilization in New Construction and DWPF at SRS

Pollutant	Averaging Period	Increase in Concentration (Fg/m^3)	PSD Class II Area Allowable Increment (Fg/m^3)	Percent of Increment
Nitrogen dioxide	Annual	0.031	25	0.12
PM_{10}	Annual	0.00143	17	0.0084
	24 hours	0.0159	30	0.053
Sulfur dioxide	Annual	0.00123	20	0.0062
	24 hours	0.0136	91	0.015
	3 hours	0.0928	512	0.018

Key: DWPF, Defense Waste Processing Facility; FMEF, Fuels and Materials Examination Facility; PSD, prevention of significant deterioration.

Source: EPA 1997b.

Total vehicle emissions associated with activities at Hanford would likely decrease somewhat because of an expected decrease in overall site employment during this timeframe.

The location of these facilities at Hanford relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during operations would include new or existing sources (e.g., cooling systems, vents, motors, material-handling equipment), employee vehicles, and truck traffic. Traffic noise associated with operation of these facilities would occur on the site and along offsite local and regional transportation routes used to bring materials and workers to the site. Given the distance to the site boundary (about 7.1 km [4.4 mi]), noise emissions from equipment would not likely annoy the public. These noise sources would be far enough away from offsite areas that their contribution to offsite noise levels would be small. Some noise sources could have onsite impacts, such as the disturbance of wildlife. However, noise would be unlikely to affect federally listed threatened or endangered species or their critical habitats, as none are known to occur on or in the immediate vicinity of the proposed site location (see Section 4.26). Noise from traffic associated with operation of these facilities would likely produce less than a 1-dB increase in traffic noise levels along roads used to access the site, and thus would not result in any increased annoyance of the public.

Potential air quality impacts of operation of the new immobilization facility under Alternative 6A at SRS were analyzed using ISCST3. Operation impacts result from process emissions, emergency diesel generator testing, trucks moving materials and wastes, and employee vehicles. Emissions from these sources are summarized in Appendix G.

A comparison of maximum air pollutant concentrations, including those resulting from the immobilization facility, with standards and guidelines is presented as Table 4–86. Concentrations for immobilization in the ceramic and glass forms are the same. Concentration of air pollutants would likely increase at the site boundary, but should not exceed the Federal or State ambient air quality standards. Air pollution impacts during operation would be mitigated; for example, HEPA filtration has been included in the design of the facility.

For a discussion of how the operation of the immobilization facility at SRS would affect the ability to continue to meet NESHAPs limits regarding airborne radiological emissions, see Section 4.32.4.4. There are no other NESHAPs limits applicable to operation of this facility.

The increases in concentrations of nitrogen dioxide, PM_{10}, and sulfur dioxide from the operation of the facility would be a small fraction of the PSD Class II area increments as summarized in Table 4–87.

Table 4–86. Evaluation of SRS Air Pollutant Concentrations Associated With Operations Under Alternative 6A: Pit Conversion in FMEF and MOX in New Construction at Hanford, and Immobilization in New Construction and DWPF at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m³)[a]	SPD Increment (Fg/m³)	Total Site Concentration (Fg/m³)	Site as a Percent of Standard or Guideline
Criteria pollutants					
Carbon monoxide	8 hours	10,000	0.152	671	6.7
	1 hour	40,000	0.657	5,100	13
Nitrogen dioxide	Annual	100	0.0242	11.4	12
PM_{10}	Annual	50	0.00181	4.94	9.9
	24 hours	150	0.032	85.8	57
Sulfur dioxide	Annual	80	0.0442	16.7	21
	24 hours	365	0.61	223	61
	3 hours	1,300	1.63	727	56
Other regulated pollutants					
Total suspended particulates	Annual	75	0.00181	45.4	61
[Text deleted.]					

[a] The more stringent of the Federal and State standards is presented if both exist for the averaging time.

Key: DWPF, Defense Waste Processing Facility; FMEF, Fuels and Materials Examination Facility; SPD, surplus plutonium disposition.

Note: No nonradiological hazardous or other toxic compounds would be emitted from these processes.

Source: EPA 1997a; SCDHEC 1996a.

Table 4–87. Evaluation of SRS Air Pollutant Increases Associated With Operations Under Alternative 6A: Pit Conversion in FMEF and MOX in New Construction at Hanford, and Immobilization in New Construction and DWPF at SRS

Pollutant	Averaging Period	Increase in Concentration (Fg/m³)	PSD Class II Area Allowable Increment (Fg/m³)	Percent of Increment
Nitrogen dioxide	Annual	0.0242	25	0.097
PM_{10}	Annual	0.00181	17	0.011
	24 hours	0.032	30	0.11
Sulfur dioxide	Annual	0.0442	20	0.22
	24 hours	0.61	91	0.67
	3 hours	1.63	512	0.32

Key: DWPF, Defense Waste Processing Facility; FMEF, Fuels and Materials Examination Facility; PSD, prevention of significant deterioration.

Source: EPA 1997b.

Total vehicle emissions associated with activities at SRS would likely decrease somewhat from current emissions because of an expected decrease in overall site employment during this timeframe.

The location of the facility at SRS relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during operation would include new or existing sources (e.g., cooling systems, vents, motors, and material-handling equipment), employee vehicles, and truck traffic. Traffic noise associated with operation of the facility would occur on the site and along offsite local and regional transportation routes used to bring materials and workers to the site. Given the distance to the site boundary (about 8.7 km [5.4 mi]), noise emissions from equipment would not likely annoy the public. These noise sources would be far enough away from offsite areas that their contribution to offsite noise levels would be small. Some noise sources could have onsite impacts, such as the disturbance of wildlife. However, noise would be unlikely to affect federally listed threatened or endangered species or their critical habitats, as none are known to occur in F- or S-Area (see Section 4.26). Traffic associated with operation of the facility would likely produce less than a 1-dB increase in traffic noise levels along roads used to access the site, and thus would not result in any increase in annoyance to the public.

Operations workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (OSHA 1997). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of administrative controls, engineering controls, and personal hearing protection equipment.

The combustion of fossil fuels associated with Alternative 6A would result in the emission of carbon dioxide, one of the atmospheric gases that are believed to influence the global climate. Annual carbon dioxide emissions from this alternative would represent less than 7×10^{-5} percent of the 1995 annual U.S. emissions of carbon dioxide from fossil fuel combustion and industrial processes, and therefore would not appreciably affect global concentrations of this pollutant.

4.10.2.2 Waste Management

Tables 4–88 and 4–89 compare the existing site treatment, storage, and disposal capacities with the expected waste generation rates from operating surplus plutonium disposition facilities at Hanford and SRS. Although HLW would be used in the immobilization process, no HLW would be generated by surplus plutonium disposition facilities. Waste generation at SRS should be the same for the ceramic and glass immobilization technologies.

Table 4–88. Potential Waste Management Impacts of Operations at Hanford Under Alternative 6A: Pit Conversion in FMEF and MOX in New Construction at Hanford, and Immobilization in New Construction and DWPF at SRS

Waste Type[a]	Estimated Additional Waste Generation (m^3/yr)	Estimated Additional Waste Generation as a Percent of[b]		
		Characterization or Treatment Capacity	Storage Capacity	Disposal Capacity
TRU[c]	86	5	5	<1 of WIPP
LLW	150	NA	NA	<1
Mixed LLW	4	<1	<1	<1
Hazardous	5	NA	NA	NA
Nonhazardous				
Liquid	66,000	28[d]	NA	28[e]
Solid	2,200	NA	NA	NA

[a] See definitions in Appendix F.8.
[b] Treatment capacities, and the disposal capacity for nonhazardous liquid waste, are compared with estimated additional annual waste generation. All other storage and disposal capacities are compared with total estimated additional waste generation assuming a 10-year operation period.
[c] Includes mixed TRU waste. Facilities are not expected to generate remotely handled TRU waste.
[d] Percent of capacity of the 400 Area sanitary sewer.
[e] Percent of capacity of the Energy Northwest (formerly Washington Public Power Supply System) Sewage Treatment Facility.

Key: FMEF, Fuels and Materials Examination Facility; LLW, low-level waste; NA, not applicable (i.e., the majority of this waste is not routinely treated, stored, or disposed of on the site); TRU, transuranic; WIPP, Waste Isolation Pilot Plant.

Table 4–89. Potential Waste Management Impacts of Operations at SRS Under Alternative 6A: Pit Conversion in FMEF and MOX in New Construction at Hanford, and Immobilization in New Construction and DWPF at SRS

Waste Type[a]	Estimated Additional Waste Generation (m^3/yr)	Estimated Additional Waste Generation as a Percent of[b]		
		Characterization or Treatment Capacity	Storage Capacity	Disposal Capacity
TRU[c]	95	6	3	1 of WIPP
LLW	81	<1	NA	3
Mixed LLW	1	<1	1	NA
Hazardous	89	<1	17	NA
Nonhazardous				
Liquid	55,000	20[d]	NA	4[e]
Solid	850	NA	NA	NA

[a] See definitions in Appendix F.8.
[b] Treatment capacities, and the disposal capacity for nonhazardous liquid waste, are compared with estimated additional annual waste generation. All other storage and disposal capacities are compared with total estimated additional waste generation assuming a 10-year operation period.
[c] Includes mixed TRU waste. Facilities are not expected to generate remotely handled TRU waste.
[d] Percent of capacity of F-Area sanitary sewer.
[e] Percent of capacity of Central Sanitary Wastewater Treatment Facility.

Key: DWPF, Defense Waste Processing Facility; LLW, low-level waste; NA, not applicable (i.e., the majority of this waste is not routinely treated, stored, or disposed of on the site); TRU, transuranic; WIPP, Waste Isolation Pilot Plant.

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. According to 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. 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, in order to be conservative, it is assumed the TRU waste would be stored on the site until 2016. 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 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 waste at Hanford will be evaluated in the *Hanford Site Solid (Radioactive and Hazardous) Waste Program EIS* that will be prepared by the DOE Richland Operations Office (DOE 1997b). Impacts of treatment, storage, and disposal of radioactive, hazardous, and mixed wastes at SRS are described in the *SRS Waste Management Final EIS* (DOE 1995c).

TRU wastes would be treated, packaged, and certified to WIPP waste acceptance criteria at the new facilities. 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 and the planned TRU Waste Characterization and Certification Facility at SRS.

TRU wastes generated by the pit conversion and MOX facilities at Hanford are estimated to be 5 percent of the 1,820-m^3/yr (2,380-yd^3/yr) capacity of the Waste Receiving and Processing Facility. A total of 860 m^3 (1,120 yd^3) of TRU waste would be generated over the 10-year operation period. If all the TRU waste were stored on the site, this would be 5 percent of the 17,000-m^3 (22,200-yd^3) storage capacity available at Hanford. Assuming that the waste were stored in 208-l (55-gal) drums that could be stacked two high, and allowing a 50 percent factor for aisle space, a storage area of less than 0.12 ha (0.30 acre) would be required. Therefore, impacts of the management of additional quantities of TRU waste at Hanford should not be major. Impacts from the treatment of TRU waste to WIPP waste acceptance criteria are described in the WM PEIS (DOE 1997d).

TRU waste generated at the immobilization facility at SRS is estimated to be 6 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 m^3 (1,240 yd^3) of TRU waste would be generated over the 10-year operation period. If all the TRU waste were stored on the site, this would be 3 percent of the 34,400-m^3 (45,000-yd^3) storage capacity available at the TRU Waste Storage Pads. Assuming that the waste were stored in 208-l (55-gal) drums that could be stacked two high, and allowing a 50 percent factor for aisle space, a storage area of about 0.14 ha (0.35 acre) would be required. Therefore, impacts of the management of additional quantities of TRU waste at SRS should not be major. Impacts from the treatment of TRU waste to WIPP waste acceptance criteria are described in the WM PEIS (DOE 1997d).

The 1,810 m^3 (2,367 yd^3) of TRU wastes generated by the surplus plutonium disposition facilities at Hanford and SRS 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 1 percent of the current 168,500-m^3 (220,400-yd^3) limit for WIPP (DOE 1997e:3-3). Impacts of disposal of TRU waste at WIPP are described in the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997e).

At Hanford, LLW would be packaged, certified, and accumulated at the pit conversion and MOX facilities before transfer for additional treatment and disposal in existing onsite facilities. A total of 1,500 m^3 (1,960 yd^3) of LLW would be generated over the operations period. LLW generated at surplus plutonium disposition facilities is estimated to be less than 1 percent of the 1.74 million-m^3 (2.28 million-yd^3) capacity of the LLW Burial Grounds and 1 percent of the 230,000-m^3 (301,000-yd^3) capacity of the Grout Vaults. Using the 3,480 m^3/ha disposal land usage factor for Hanford published in the *Storage and Disposition PEIS* (DOE 1996a:E-9), 1,500 m^3 (1,960 yd^3)

of waste would require 0.44 ha (1.1 acre) disposal space at Hanford. Therefore, impacts of the management of this additional LLW at Hanford should not be major.

At SRS, LLW would be packaged, certified, and accumulated at the new immobilization facility before transfer for additional treatment and disposal in existing onsite facilities. A total of 810 m^3 (1,060 yd^3) of LLW would be generated over the operations period. LLW generated at surplus plutonium disposition facilities is estimated to be less than 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 disposal land usage factor for SRS published in the *Storage and Disposition PEIS* (DOE 1996a:E-9), 810 m^3 (1,060 yd^3) of waste would require 0.1-ha (0.25-acre) disposal space at SRS. Therefore, impacts of the management of this additional LLW at SRS should not be major.

At Hanford, mixed LLW would be stabilized, packaged, and stored on the site for treatment and disposal in a manner consistent with the site treatment plan. Mixed LLW generated at the pit conversion and MOX facilities is estimated to be less than 1 percent of the 1,820-m^3/yr (2,380-yd^3/yr) capacity of the Waste Receiving and Processing Facility, less than 1 percent of the 16,800-m^3 (22,000-yd^3) capacity of the Central Waste Complex, and less than 1 percent of the 14,200-m^3 (18,600-yd^3) planned disposal capacity of 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. If all TRU waste and mixed LLW generated at surplus plutonium disposition facilities at Hanford were processed in the Waste Receiving and Processing Facility, this additional waste would be 5 percent of the 1,820-m^3/yr (2,380-yd^3/yr) capacity of that facility.

At SRS, 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. Mixed LLW generated at the immobilization facility is estimated to be less than 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of the Consolidated Incineration Facility, 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.

At Hanford, any hazardous wastes generated during operation of the pit conversion and MOX facilities would be packaged in DOT-approved containers and shipped off the site to permitted commercial recycling, treatment, and disposal facilities. The additional waste load generated during the operations period should not have a major impact on Hanford hazardous waste management system.

At SRS, any hazardous wastes generated during operation of the immobilization facility would be packaged for treatment and disposal at a combination of onsite and offsite facilities. Assuming that all hazardous waste is managed on the site, hazardous waste generation for this combination of facilities is estimated to be 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. If all LLW, mixed LLW, and hazardous wastes generated at the immobilization facility at SRS were treated in the Consolidated Incineration Facility, this additional waste would be 1 percent of the 17,830-m^3/yr (23,320-yd^3/yr) capacity of that facility.

Nonhazardous solid waste would be packaged and transported 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 commercial or municipal facilities for disposal. It is unlikely that this additional waste load would have a major impact on the nonhazardous solid waste management systems at Hanford and SRS.

At Hanford, nonhazardous wastewater generated by the pit conversion and MOX facilities would be treated if necessary before being discharged to the 400 Area sanitary sewer system, which connects to the Energy Northwest (formerly WPPSS) Sewage Treatment Facility. Nonhazardous liquid wastes generated by the pit conversion and MOX facilities at Hanford is estimated to be 28 percent of the 235,000-m^3/yr (307,000-yd^3/yr) capacity of the 400 Area sanitary sewer, 28 percent of the 235,000-m^3/yr (307,000-yd^3/yr) capacity of the Energy Northwest Sewage Treatment Facility, and within the 138,000-m^3/yr (181,000-yd^3/yr) excess capacity of the Energy Northwest Sewage Treatment Facility (Mecca 1997). Therefore, management of nonhazardous liquid waste at Hanford should not have a major impact on the treatment system.

At SRS, nonhazardous wastewater would be treated if necessary before being discharged to the F-Area sanitary sewer system, which connects to the Central Sanitary Wastewater Treatment Facility. Nonhazardous liquid waste generated by the immobilization facility at SRS is estimated to be 20 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, management of nonhazardous liquid waste at SRS should not have a major impact on the treatment system.

4.10.2.3 Socioeconomics

After construction, startup, and testing of the pit conversion and MOX facilities at Hanford in 2007 under Alternative 6A, an estimated 785 new workers would be required to operate them (DOE 1999c; UC 1998a). This level of employment would be expected to generate another 1,988 related jobs in the region. The total employment requirement of 2,773 direct and indirect jobs represents less than 0.7 percent of the projected REA workforce, and thus should have no major impact on the REA. Some of the new jobs created under this alternative could be filled from the ranks of the unemployed, currently 11 percent of the REA's population.

This employment requirement could have minor impacts on community services in the ROI, as it should coincide with an increase in overall site employment in connection with construction of the tank waste remediation system. Assuming that 91 percent of the new employees associated with this alternative resided in the ROI, an increase of 2,523 jobs in the workforce would result in an overall population increase of approximately 4,681 persons. This population increase, in conjunction with the normal population growth forecast by the State of Washington State, would engender increased construction of local housing units. Given the current population-to-student ratio in the ROI, a population of this size should include 969 students, and local school districts would be expected to increase the number of classrooms to accommodate them.

Community services in the ROI would change to reflect the growth in population as follows: 60 teachers would be added to maintain the current student-to-teacher ratio of 16:1; 7 police officers would be added to maintain the current officer-to-population ratio of 1.5:1,000; 16 firefighters would be added to maintain the current firefighter-to-population ratio of 3.4:1,000; and 6 physicians would be added to maintain the current physician-to-population ratio of 1.4:1,000. In total, it is estimated that an additional 90 positions would have to be created to maintain community services at current levels. In addition, hospitals in the ROI would experience a drop from 2.1 to 2.0 beds per 1,000 persons unless additional beds were provided. Similarly, the average school enrollment would increase to 94.4 percent from the current rate of 92.5 percent unless additional classrooms were built. None of these projected changes should have a major impact on the level of community services currently offered in the ROI.

After construction, startup, and testing of the immobilization facility at SRS in 2006 under Alternative 6A, an estimated 335 new workers would be required to operate it. This level of employment would generate another 599 indirect jobs within the region. As the total employment requirement of 934 direct and indirect jobs represents 0.3 percent of the total projected REA workforce, it should have no major impact on the REA. In fact, it should help to decrease slightly the 33 percent reduction in SRS employment (i.e., from 15,032 to 10,000 workers) projected for the years 1997–2010.

4.10.2.4 Human Health Risk

During normal operations, there would be both radiological and hazardous chemical releases to the environment, and also direct in-plant exposures. The resulting doses to, and potential health effects on, the public and workers under Alternative 6A would be as follows.

Radiological Impacts. Table 4–90 reflects the potential radiological impacts on three individual receptor groups at Hanford and SRS: the population living within 80 km (50 mi) in the year 2010, the maximally exposed member of the public, and the average exposed member of the public. The table depicts the projected aggregate LCF risk to these groups from 10 years of incident-free operation. To put operational doses into perspective, comparisons with doses from natural background radiation are also provided in the table.

Given incident-free operation of all three facilities, the total population dose in the year 2010 would be 7.2 person-rem at Hanford and 2.8×10^{-3} person-rem at SRS. The corresponding number of LCFs in the population from 10 years of operation would be 0.036 around Hanford and 1.4×10^{-5} around SRS. The total dose to the maximally exposed member of the public from annual operation of the pit conversion and MOX facilities at Hanford would be 0.022 mrem. From 10 years of operation, the corresponding LCF risk to this individual would be 1.1×10^{-7}. The impacts on the average individual would be lower. The dose to the maximally exposed member of the public from annual operation of the immobilization facility at SRS would

Table 4–90. Potential Radiological Impacts on the Public of Operations Under Alternative 6A: Pit Conversion in FMEF and MOX in New Construction at Hanford, and Immobilization in New Construction and DWPF at SRS

Impact	Pit Conversion	MOX[a]	Hanford Total	Immobilization Ceramic	Immobilization Glass
Population within 80 km for year 2010					
Dose (person-rem)	6.9	0.29	7.2	2.8×10^{-3}	2.6×10^{-3}
Percent of natural background[b]	5.9×10^{-3}	2.5×10^{-4}	6.2×10^{-3}	1.2×10^{-6}	1.1×10^{-6}
10-year latent fatal cancers	0.034	1.5×10^{-3}	0.036	1.4×10^{-5}	1.3×10^{-5}
Maximally exposed individual					
Annual dose (mrem)	0.017	4.8×10^{-3}	0.022	2.8×10^{-5}	2.6×10^{-5}
Percent of natural background[b]	5.7×10^{-3}	1.6×10^{-3}	7.3×10^{-3}	9.5×10^{-6}	8.8×10^{-6}
10-year latent fatal cancer risk	8.5×10^{-8}	2.4×10^{-8}	1.1×10^{-7}	1.4×10^{-10}	1.3×10^{-10}
Average exposed individual within 80 km[c]					
Annual dose (mrem)	0.017	7.5×10^{-4}	0.018	3.6×10^{-6}	3.3×10^{-6}
10-year latent fatal cancer risk	8.5×10^{-8}	3.8×10^{-9}	8.9×10^{-8}	1.8×10^{-11}	1.6×10^{-11}

[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] 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. 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 approximately 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 Hanford (387,800) and the SRS APSF (approximately 790,000), if built, in 2010.

Key: APSF, Actinide Packaging and Storage Facility; DWPF, Defense Waste Processing Facility; FMEF, Fuels and Materials Examination Facility.

Source: Appendix J.

be 2.8×10^{-5} mrem. From 10 years of operation, the corresponding LCF risk to this individual would be 1.4×10^{-10}. The impacts on the average individual would be lower.

Estimated impacts resulting from "Total Site" operations are given in the Cumulative Impacts section of this SPD EIS (see Section 4.32). Within that section, projected incremental impacts associated with the operation of the proposed surplus plutonium disposition facilities are added to the impacts of other past, present, and reasonably foreseeable future actions at or near the candidate sites. These impacts are then compared against applicable regulatory standards established by DOE, EPA, and NRC (such as DOE Order 5400.5, the CAA [NESHAPs], the SDWA, and 10 CFR 20).

Doses to involved workers from normal operations are given in Table 4–91; these workers are defined as those directly associated with process activities. Under this alternative, the annual average dose to pit conversion and MOX facility workers would be 500 mrem and 65 mrem, respectively; to immobilization facility workers, 750 mrem. The annual dose received by the total site workforce for each of these facilities has been estimated at 192, 22, and 242 person-rem, respectively. The risks and numbers of LCFs among the different workers from 10 years of operation are included in Table 4–91. Doses to individual workers would be kept to minimal levels by instituting badged monitoring, administrative limits, and ALARA programs (which would include worker rotations).

Hazardous Chemical Impacts. No hazardous chemicals would be released as a result of operations at Hanford under this alternative; thus, no cancer or adverse, noncancer health effects would occur. No carcinogenic chemicals would be released as a result of operations.

Table 4–91. Potential Radiological Impacts on Involved Workers of Operations Under Alternative 6A: Pit Conversion in FMEF and MOX in New Construction at Hanford, and Immobilization in New Construction and DWPF at SRS

Impact	Pit Conversion	MOX	Hanford Total	Immobilization (Ceramic or Glass)
Number of badged workers	383	331	714	323
Total dose (person-rem/yr)	192	22	214	242
10-year latent fatal cancers	0.77	0.088	0.86	0.97
Average worker dose (mrem/yr)	500	65	300[a]	750
10-year latent fatal cancer risk	2.0×10^{-3}	2.6×10^{-4}	1.2×10^{-3}	3.0×10^{-3}

[a] Represents an average of the doses for both facilities.

Key: DWPF, Defense Waste Processing Facility; FMEF, Fuels and Materials Examination Facility.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995d and NRC 1999a). 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 1994a). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1999c; UC 1998a, 1998b, 1999c, 1999d.

4.10.2.5 Facility Accidents

The potential consequences of postulated bounding facility accidents from operation of the pit conversion and MOX facilities at Hanford are equivalent to those included in Alternative 2 (see Tables 4–30 and 4–33) and the potential consequences from operation of the immobilization facility at SRS, equivalent to those included in Alternative 3 (see Tables 4–44 and 4–45). More details on the method of analysis, assumptions, and specific accident scenarios are presented in the discussion of Alternative 2 in Section 4.3.2.5.

Public. The most severe consequences of the design basis accident for the pit conversion and MOX facilities are shown in Section 4.3.2.5; and the most severe consequences for the immobilization facility, in Section 4.4.2.5.

A beyond-design-basis earthquake at Hanford could result in the collapse of the pit conversion facility in FMEF and the MOX facility, and an estimated 39 LCFs among the general population. A similar earthquake at SRS could result in the collapse of the immobilization facility and an estimated 2.7 LCFs among the general population (as described in Section 4.3.2.5). It should be emphasized that a seismic event of sufficient magnitude to collapse these facilities would likely cause the collapse of other DOE facilities, and would almost certainly cause widespread failure of homes, office buildings, and other structures in the surrounding area. The overall impact of such an event must therefore be seen in the context not only of the potential radiological impacts of these other facilities, but of hundreds, possibly thousands, of immediate fatalities from falling debris. The frequency of such an earthquake is estimated to be between 1 in 100,000 and 1 in 10,000,000 per year.

Noninvolved Worker. Consistent with the analysis presented in the *Storage and Disposition PEIS*, the noninvolved worker is a hypothetical individual working on the site but not involved in the proposed action, and assumed to be 1,000 m (3,281 ft) from the location of the accident or at the site boundary, whichever is closer, and downwind from that location. For design basis accidents, the radiological consequences for this worker were estimated to be highest for the criticality at the MOX facility. The consequences of such an accident would include an LCF probability of 2.5×10^{-4}.

Maximally Exposed Involved Worker. 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. Explosions could result in immediate injuries from flying debris, as well as the uptake of plutonium and uranium particulates through inhalation. If a criticality occurred, workers within tens of meters could receive very high to fatal radiation exposures from the initial 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 accident. The design basis and beyond-design-basis earthquakes would also have substantial consequences, ranging from workers being killed by debris from collapsing equipment and structures to high radiation exposures and uptakes of radionuclides. For most accidents, immediate emergency response actions should reduce the consequences to workers near the accident. As discussed in the Emergency Preparedness sections of Chapter 3, each candidate site has an established emergency management program that would be activated in the event of an accident. Based on the decisions made in the SPD EIS ROD, site emergency management programs would be modified to consider new accidents not in the current program.

Nonradiological Accidents. Surplus plutonium disposition operations at Hanford and SRS could result in worker injuries and fatalities. DOE-required industrial safety programs would be in place to reduce the risks. Given the estimated employment of 11,535 person-years of labor and the standard DOE occupational accident rates, approximately 420 cases of nonfatal occupational injury or illness and 0.31 fatality could be expected for the duration of operations.

4.10.2.6 Transportation

Operational transportation impacts may be divided into two parts: impacts due to incident-free transportation and those due to transportation accidents. They may be further divided into nonradiological and radiological impacts. Nonradiological impacts are specifically vehicular, such as vehicular emissions and traffic accidents. Radiological impacts are those related to the dose received by transportation workers and the public during normal operations and in the case of accidents in which the radioactive materials being shipped may be released. For more detailed information on the transportation analysis performed for this SPD EIS, see Appendix L.

Under Alternative 6A, transportation to and from Hanford would include the shipment of plutonium pits and clean plutonium metal via SST/SGT from sites throughout the DOE complex to the pit conversion facility.[18] During dismantlement of the pits, some HEU would be recovered. The pit conversion facility would ship HEU via SST/SGT to ORR for storage.[19] After conversion, the plutonium in the pit conversion facility would be in the form of plutonium dioxide. This material would be transferred through a secure tunnel to the MOX facility at Hanford for fabrication into MOX fuel pellets.

[18] Work is currently under way to repackage all pits at Pantex from the AL–R8 container into the AL–R8 SI container for long-term storage. The AL–R8 is not an offsite shipping container as was the AT–400A analyzed in the SPD Draft EIS. Therefore, if the decision were made to site the pit conversion facility at a site other than Pantex, the surplus pits would have to be taken out of the AL–R8 SI and placed in a yet-to-be-developed shipping container. This operation would also require the replacement of some pit-holding fixtures to meet transportation requirements. Under such alternatives, this change would result in a total repackaging exposure of 208 person-rem to Pantex personnel. An increase in worker doses of this magnitude could result in an increase in the expected number of LCFs of 8.3×10^{-2} over the life of the program.

[19] Classified nuclear material parts would also result from pit disassembly. Although current plans are to store these parts at the pit conversion facility, this SPD EIS analyzes the possible transport of these nuclear material parts to LANL. Therefore, the transportation impacts are slightly overstated.

MOX fuel fabrication also requires uranium dioxide. Quantifying the uranium dioxide transportation requirements for this SPD EIS involved selecting representative sites for the source of the depleted uranium hexafluoride and the conversion facility. A DOE enrichment facility near Portsmouth, Ohio, was chosen as a representative site for the source of the depleted uranium hexafluoride, and the nuclear fuel fabrication facility in Wilmington, North Carolina, as representative of a uranium conversion facility. These sites were also used as representative sites in the *Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement* (DOE 1996e). It is assumed that depleted uranium hexafluoride needed for MOX fuel would be shipped via commercial truck to the uranium conversion facility, where it would be converted into uranium dioxide (see Section 4.3.2.6). After conversion, the depleted uranium dioxide would be shipped via commercial truck from the conversion facility to the MOX facility at Hanford. This material would be blended with plutonium dioxide at the MOX facility, fabricated into MOX fuel pellets, and placed in MOX fuel rods. After fabrication, the MOX fuel rods would be shipped to a domestic reactor site, where they would be placed in fuel assemblies and irradiated. Shipments of unirradiated MOX fuel rods would be made in an SST/SGT because unirradiated MOX fuel in large enough quantities is subject to the same security concerns as pure weapons-grade plutonium. It is assumed in this transportation analysis that all MOX fuel is shipped from the MOX facility to the most distant reactor site, North Anna.

Immobilization at SRS under this alternative would require that surplus nonpit plutonium in various forms be shipped from current storage locations (i.e., SRS, Hanford, INEEL, LLNL, LANL, and RFETS) to the immobilization facility at SRS. Even though these materials are not clean plutonium metal or pits, the quantity of the plutonium contained in them would require that they be treated as materials that could be used in nuclear weapons, and thus that shipments be made in SST/SGTs.

Under the preferred technology alternative for immobilization, the surplus plutonium would be immobilized in a ceramic matrix in small cans at the immobilization facility, placed in HLW canisters, and transported via specially designed trucks to DWPF in S-Area. This intrasite transportation—from F-Area to S-Area—could require the temporary shutdown of roads on the Hanford site. It would, however, provide for all the necessary security and for reduced risk to the public; SST/SGTs would not be required.

Use of the preferred ceramic (versus glass) matrix for immobilization would also require a small amount of depleted uranium dioxide (i.e., less than 10 t [11 tons] per year). It is assumed that this depleted uranium dioxide would be produced and shipped in the same manner as the depleted uranium dioxide needed by the MOX facility.

After the immobilized plutonium was encased by HLW at DWPF, it would eventually be shipped to a potential geologic repository for ultimate disposition. Because HLW would be displaced by the cans of immobilized plutonium suspended in the HLW canister, additional canisters—to accommodate the displaced HLW—would be required over the life of the immobilization program. According to estimates, up to 145 additional canisters of HLW would be needed to meet the demands of surplus plutonium disposition under Alternative 6A. The *Yucca Mountain Draft EIS* evalutes different options for the shipment of these canisters to a potential geologic repository using either trucks or trains. The analysis revealed that shipment by train would pose the lower risk. However, no ROD has yet been issued regarding these shipments. To bound the risks associated with these additional shipments, this SPD EIS conservatively assumes that all of these shipments would be made by truck, one canister per truck.

Every alternative considered in this SPD EIS would require routine transportation of wastes from the proposed disposition facilities to treatment, storage, or disposal facilities on the sites. This transportation would be handled in the same manner as other site waste shipments, and as shown in Sections 4.3.1.2 and 4.3.2.2, would involve no major increase in the amounts of waste already being managed at these sites. The shipments would pose no greater risks than the ordinary waste shipments at these sites as analyzed in the WM PEIS.

In total, approximately 2,500 shipments of radioactive materials would be carried out by DOE under this alternative. The total distance traveled on public roads by trucks carrying radioactive materials would be 8.7 million km (5.4 million mi).

Impacts of Incident-Free Transportation. The dose to transportation workers from all transportation activities entailed by this alternative has been estimated at 61 person-rem; the dose to the public, 71 person-rem. Accordingly, incident-free transportation of radioactive material associated with this alternative would result in 0.024 LCF among transportation workers and 0.035 LCF in the total affected population over the duration of the transportation activities. The estimated number of nonradiological fatalities from vehicular emissions associated with this alternative is 0.033.

Impacts of Accidents During Transportation (Consequences). The maximum foreseeable offsite transportation accident under this alternative (probability of occurrence: greater than 1 in 10 million per year) is a shipment of plutonium pits from one of DOE's storage locations to the pit conversion facility with a severity category VIII accident in a rural population zone under neutral (average) weather conditions. If this accident were to occur, it could result in a dose of 87 person-rem to the public for an LCF risk of 0.044 and 96 rem to the hypothetical MEI for an LCF risk of 0.096. (The MEI receives a larger dose than the population because it is unlikely that a person would be in position, and remain in position, to receive this hypothetical maximum dose.) No fatalities would be expected to occur. The probability of more severe accidents, different weather conditions at the time of accident, or occurrence in a more densely populated area were also evaluated, and estimated to have a probability lower than 1 chance in 10 million per year. (See Appendix L.6.)

Impacts of Accidents During Transportation (Risks). The total transportation accident risks were estimated by summing the risk to the affected population from all hypothetical accidents. For Alternative 6A, those risks are as follows: a radiological dose to the population of 8 person-rem, resulting in a total population risk of 0.004 LCF; and traffic accidents resulting in 0.091 fatality.

4.10.2.7 Environmental Justice

As discussed in other parts of Section 4.10.2, routine operations conducted under Alternative 6A would pose no significant health risks to the public. The likelihood of an LCF for the MEI residing near Hanford would be approximately 1 in 10 million (see Table 4–90); the likelihood for the MEI residing near SRS would be essentially zero. The number of LCFs expected among the general population residing near Hanford and SRS from accident-free operations would increase by approximately 0.034 and 1.3×10^{-5}, respectively.

Design basis accidents at the sites would not be expected to cause cancer fatalities among the public (see Section 4.10.2.5). A beyond-design-basis earthquake would be expected to result in LCFs among the general population (see Tables 4–30, 4–33, 4–44, and 4–45). However, it is highly unlikely that a beyond-design-basis earthquake would occur. Accidents at the sites pose no significant risks (when the probability of occurrence is considered) to the population residing within the area potentially affected by radiological contamination.

As described in Section 4.10.2.6, no radiological or nonradiological fatalities would be expected to result from accident-free transportation conducted under this alternative. Nor would radiological or nonradiological fatalities be expected to result from transportation accidents.

Thus, implementation of Alternative 6A would pose no significant risks to the public, nor would implementation of this alternative pose significant risks to groups within the public, including the risk of disproportionately high and adverse effects on minority and low-income populations.

4.11 ALTERNATIVE 6B

Alternative 6B would involve constructing and operating the pit conversion and MOX facilities at Hanford and the immobilization facility at SRS. The pit conversion and MOX facilities would be located in the existing FMEF building. The immobilization facility would be located in a new facility in F-Area. Activities at SRS would be the same as under Alternative 6A.

4.11.1 Construction

4.11.1.1 Air Quality and Noise

Sources of potential air quality impacts of construction under Alternative 6B at Hanford include emissions from fuel-burning construction equipment, soil disturbance by construction equipment and other vehicles, the operation of a concrete batch plant, trucks moving materials and wastes, and employee vehicles. Emissions from these sources are summarized in Appendix G.

A comparison of maximum air pollutant concentrations, including the contribution from construction activities at Hanford, with standards and guidelines is presented as Table 4–92. Concentrations of air pollutants, especially PM_{10} and total suspended particulates, would likely increase at the site boundary, but would not exceed the Federal or State ambient air quality standards as a result of Hanford Activities. Occasional exceedances of the PM_{10} and total suspended particulates standards attributable to natural sources would be expected to continue. Air pollution impacts during construction would be mitigated by applying, as appropriate, standard dust control practices such as watering or sweeping of roads and watering of exposed areas.

Total vehicle emissions associated with activities at Hanford would likely decrease somewhat from current emissions during the planned construction period because of an expected decrease in overall site employment.

Noise impacts would be the same or less than those for Alternative 6A at Hanford (see Section 4.10.1.1).

Potential air quality impacts of construction under Alternative 6B at SRS are the same as those for Alternative 6A (see Section 4.10.1.1). Noise impacts are the same as those for Alternative 6A at SRS (see Section 4.10.1.1).

4.11.1.2 Waste Management

At SRS, construction impacts of this alternative would be the same as for Alternative 6A. Therefore, see Section 4.10.1.2 for a description of the impacts of this alternative on the waste management infrastructure at SRS.

Table 4–93 compares the wastes generated during the construction of surplus plutonium disposition facilities at Hanford with the existing treatment, storage, and disposal capacity for the various waste types. It is anticipated that no TRU waste, LLW, or mixed LLW would be generated during the 3-year construction period. In addition, no soil contaminated with hazardous or radioactive constituents should be generated during construction. However, if any were generated, the waste would be managed in accordance with site practice and applicable Federal and State regulations. For this SPD EIS, it is assumed that hazardous waste and nonhazardous waste would be treated, stored, and disposed of in accordance with current site practices.

[Table deleted.]

Table 4–92. Evaluation of Hanford Air Pollutant Concentrations Associated With Construction Under Alternative 6B: Pit Conversion and MOX Collocated in FMEF at Hanford, and Immobilization in New Construction and DWPF at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline(Fg/m³)[a]	SPD Increment (Fg/m³)	Total Site Concentration (Fg/m³)	Site as a Percent of Standard or Guideline
Criteria pollutants					
Carbon monoxide	8 hours	10,000	0.491	34.6	0.35
	1 hour	40,000	3.34	51.6	0.13
Nitrogen dioxide	Annual	100	0.0366	0.287	0.29
PM_{10}	Annual	50	0.0565	0.0744	0.15
	24 hours	150	1.65	2.42	1.6
Sulfur dioxide	Annual	50	0.00302	1.63	3.1
	24 hours	260	0.0336	8.94	3.4
	3 hours	1,300	0.228	29.8	2.3
	1 hour	660	0.685	33.6	5.1
Other regulated pollutants					
Total suspended particulates	Annual	60	0.128	0.146	0.24
	24 hours	150	3.26	4.03	2.7
Hazardous and other toxic compounds					
Other toxics[b]	Annual	0.12	0.00000785	0.000014	0.012

[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: DWPF, Defense Waste Processing Facility; FMEF, Fuels and Materials Examination Facility; SPD, surplus plutonium disposition.

Source: EPA 1997a; WDEC 1994.

Table 4–93. Potential Waste Management Impacts of Construction at Hanford Under Alternative 6B: Pit Conversion and MOX Collocated in FMEF at Hanford, and Immobilization in New Construction and DWPF at SRS

Waste Type[a]	Estimated Additional Waste Generation (m^3/yr)	Estimated Additional Waste Generation as a Percent of[b]		
		Characterization or Treatment Capacity	Storage Capacity	Disposal Capacity
Hazardous	22	NA	NA	NA
Nonhazardous				
Liquid	20,000	9[c]	NA	9[d]
Solid	6,800	NA	NA	NA

[a] See definitions in Appendix F.8.

[b] Treatment capacities, and the disposal capacity for nonhazardous liquid waste, are compared with estimated additional annual waste generation. All other storage and disposal capacities are compared with total estimated additional waste generation assuming a 3-year construction period.

[c] Percent of capacity of the 400 Area sanitary sewer.

[d] Percent of capacity of the Energy Northwest (formerly Washington Public Power Supply System) Sewage Treatment Facility.

Key: FMEF, Fuels and Materials Examination Facility; NA, not applicable (i.e., it is assumed that the majority of the hazardous waste and nonhazardous solid waste would be treated and disposed of off the site by the construction contractor).

Hazardous wastes generated during the construction of surplus plutonium disposition facilities at Hanford would be typical of those generated during construction of an industrial facility. Any hazardous wastes generated during construction would be packaged in DOT-approved containers and shipped off the site to permitted commercial recycling, treatment, and disposal facilities. The additional waste load generated during construction should not have a major impact on the Hanford hazardous waste management system.

Nonhazardous solid wastes generated during the construction of surplus plutonium disposition facilities at Hanford would be packaged in conformance with standard industrial practice and shipped to offsite commercial or municipal facilities for recycling or disposal. The additional waste load generated during construction should not have a major impact on the nonhazardous solid waste management system at Hanford.

To be conservative, it was assumed that all nonhazardous liquid wastes generated during modification of the FMEF building at Hanford would be managed on the site at the Energy Northwest (formerly WPPSS) Sewage Treatment Facility, even though it is likely that much of this waste would be collected in portable toilets and would be managed at offsite facilities. Nonhazardous liquid waste generated during modification is estimated to be 9 percent of the 235,000-m^3/yr (307,000-yd^3/yr) capacity of the 400 Area sanitary sewer, 9 percent of the 235,000-m^3/yr (307,000-yd^3/yr) capacity of the Energy Northwest Sewage Treatment Facility, and within the 138,000-m^3/yr (181,000-yd /yr) excess capacity of the Energy Northwest Sewage Treatment Facility (Mecca 1997). Therefore, management of these wastes at Hanford should not have a major impact on the nonhazardous liquid waste treatment system during the modification period.

[Text deleted.]

4.11.1.3 Socioeconomics

Construction-related employment requirements for Alternative 6B would be as indicated in Table 4–94.

Table 4–94. Construction Employment Requirements for Alternative 6B: Pit Conversion and MOX Collocated in FMEF at Hanford, and Immobilization in New Construction and DWPF at SRS

Year	Pit Conversion	MOX	Immobilization	Total
2001	76	0	0	76
2002	116	441	506	1,063
2003	72	583	920	1,575
2004	0	451	1,014	1,465
2005	0	221	552	773
2006	0	208	0	208

Key: DWPF, Defense Waste Processing Facility; FMEF, Fuels and Materials Examination Facility.

Source: DOE 1999c; UC 1998a, 1999c, 1999d.

At its peak in 2003, construction of the pit conversion and MOX facilities at Hanford under this alternative would require 655 construction workers and generate another 672 indirect jobs in the region. The total employment requirement of 1,327 direct and indirect jobs represents less than 0.4 percent of the projected REA workforce, and thus should have no major impact on the REA. It should also have little effect on the community services currently offered in the ROI. In fact, it should help offset the nearly 15 percent reduction in Hanford employment (i.e., from 12,882 to approximately 11,000 workers) projected for the years 1997–2005.

Employment requirements for construction of the immobilization facility at SRS would be the same as those for Alternative 6A (see Section 4.10.1.3).

4.11.1.4 Human Health Risk

Radiological Impacts. No radiological risk would be incurred by members of the public from construction activities. A summary of radiological impacts of construction activities on workers at risk is presented as Table 4–95. According to recent radiation surveys (Antonio 1998; UC 1998a, 1998b, 1999c, 1999d) conducted at the Hanford 400 Area and SRS F-Area, construction workers at Hanford would not be expected to receive doses above natural background levels as a result of other ongoing or past activities. At SRS, however, construction workers may receive small doses above natural background levels. Regardless of location, construction workers may be monitored (badged) as a precautionary measure.

Table 4–95. Potential Radiological Impacts on Construction Workers of Alternative 6B: Pit Conversion and MOX Collocated in FMEF at Hanford, and Immobilization in New Construction and DWPF at SRS

Impact	Pit Conversion[a]	MOX[b]	Hanford Total	Immobilization[c]
Total dose (person-rem/yr)	0	0	0	1.5
Annual latent fatal cancers[d]	0	0	0	6.0×10^{-4}
Average worker dose (mrem/yr)	0	0	0[e]	4
Annual latent fatal cancer risk	0	0	0	1.6×10^{-6}

[a] An estimated average of 88 workers would be associated with annual construction and modification operations.

[b] An estimated average of 254 workers would be associated with annual construction and modification operations.

[c] An estimated average of 374 workers would be associated with annual construction operations at the new facility location adjacent to APSF, if built. The number would be the same for immobilization in either ceramic or glass.

[d] 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, per ICRP 1991.

[e] Represents an average of the doses for both facilities.

Key: APSF, Actinide Packaging and Storage Facility; DWPF, Defense Waste Processing Facility; FMEF, Fuels and Materials Examination Facility.

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 be reduced to levels that are as low as is reasonably achievable.

Source: Antonio 1998; ICRP 1991; NAS 1990; UC 1998a, 1998b, 1999c, 1999d.

Hazardous Chemical Impacts. The probability of excess latent cancer incidence associated with exposure to benzene released as a result of construction activities at Hanford under this alternative has been estimated to be much less than 1 chance in 1 million over the lifetime of the maximally exposed member of the public.

4.11.1.5 Facility Accidents

Surplus plutonium disposition construction activities at Hanford and SRS could result in worker injuries or fatalities. DOE-required industrial safety programs would be in place to reduce the risks. Given the estimated 5,160 person-years of construction labor and standard industrial accident rates, approximately 510 cases of nonfatal occupational injury or illness and 0.72 fatality could be expected (DOL 1997a, 1997b). As all construction would be in nonradiological areas, no radiological accidents should occur.

4.11.1.6 Environmental Justice

As discussed in the other parts of Section 4.11.1, construction under Alternative 6B would pose no significant health risks to the public. The risks would be negligible regardless of the racial or ethnic composition or the economic status of the population. Therefore, construction activities under Alternative 6B at Hanford and SRS would have no significant impacts on minority or low-income populations.

4.11.2 Operations

4.11.2.1 Air Quality and Noise

Potential air quality impacts of the operation of facilities under Alternative 6B at Hanford were analyzed using ISCST3. Operational impacts would result from process emissions, emergency diesel generator testing, trucks moving materials and wastes, and employee vehicles. Emissions from these sources are summarized in Appendix G.

A comparison of maximum air pollutant concentrations, including those resulting from surplus plutonium disposition facilities, with standards and guidelines is presented as Table 4–96. Concentrations of air pollutants would likely increase at the site boundary, but would not exceed the Federal or State ambient air quality standards as a result of Hanford activities. Occasional exceedances of the PM_{10} and total suspended particulates standards attributable to natural sources would be expected to continue. Air pollution impacts during operation would be mitigated; for example, HEPA filtration has been included in the design of these facilities.

Table 4–96. Evaluation of Hanford Air Pollutant Concentrations Associated With Operations Under Alternative 6B: Pit Conversion and MOX Collocated in FMEF at Hanford, and Immobilization in New Construction and DWPF at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m^3)[a]	SPD Increment (Fg/m^3)	Total Site Concentration (Fg/m^3)	Site as a Percent of Standard or Guideline
Criteria pollutants					
Carbon monoxide	8 hours	10,000	0.247	34.3	0.34
	1 hour	40,000	1.68	50	0.13
Nitrogen dioxide	Annual	100	0.031	0.281	0.28
PM_{10}	Annual	50	0.00143	0.0193	0.039
	24 hours	150	0.0159	0.786	0.52
Sulfur dioxide	Annual	50	0.00123	1.63	3.1
	24 hours	260	0.0136	8.92	3.4
	3 hours	1,300	0.0928	29.7	2.3
	1 hour	660	0.278	33.2	5.0
Other regulated pollutants					
Total suspended particulates	Annual	60	0.00143	0.0193	0.032
	24 hours	150	0.0159	0.786	0.52
[Text deleted.]					

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

Key: DWPF, Defense Waste Processing Facility; FMEF, Fuels and Materials Examination Facility; SPD, surplus plutonium disposition.

Note: No nonradiological hazardous or other toxic compounds would be emitted from these processes.

Source: EPA 1997a; WDEC 1994.

For a discussion of how the operation of the pit conversion and MOX facilities at Hanford would affect the ability to continue to meet NESHAPs limits regarding airborne radiological emissions, see Section 4.32.1.4. There are no other NESHAPs limits applicable to operation of these facilities.

The increases in concentrations of nitrogen dioxide, PM_{10}, and sulfur dioxide from the operation of these facilities would be a small fraction of the PSD Class II area increments as summarized in Table 4–97. Noise impacts would be similar to those for Alternative 6A at Hanford (see Section 4.10.2.1).

Table 4–97. Evaluation of Hanford Air Pollutant Increases Associated With Operations Under Alternative 6B: Pit Conversion and MOX Collocated in FMEF at Hanford, and Immobilization in New Construction and DWPF at SRS

Pollutant	Averaging Period	Increase in Concentration (Fg/m^3)	PSD Class II Area Allowable Increment (Fg/m^3)	Percent of Increment
Nitrogen dioxide	Annual	0.031	25	0.12
PM_{10}	Annual	0.00143	17	0.0084
	24 hours	0.0159	30	0.053
Sulfur dioxide	Annual	0.00123	20	0.0062
	24 hours	0.0136	91	0.015
	3 hours	0.0928	512	0.018

Key: DWPF, Defense Waste Processing Facility; FMEF, Fuels and Materials Examination Facility; PSD, prevention of significant deterioration.
Source: EPA 1997b.

Total vehicle emissions associated with activities at Hanford would likely decrease somewhat because of an expected decrease in overall site employment during this timeframe.

Potential air quality impacts of operation of the immobilization facility under Alternative 6B at SRS are the same as those for Alternative 6A (see Section 4.10.2.1). Noise impacts are the same as those for Alternative 6A at SRS (see Section 4.10.2.1).

The combustion of fossil fuels associated with Alternative 6B would result in the emission of carbon dioxide, one of the atmospheric gases that are believed to influence the global climate. Annual carbon dioxide emissions from this alternative would represent less than 7×10^{-5} percent of the 1995 annual U.S. emissions of carbon dioxide from fossil fuel combustion and industrial processes, and therefore would not appreciably affect global concentrations of this pollutant.

4.11.2.2 Waste Management

Impacts of operations for this alternative would be the same as for Alternative 6A. Therefore, see Section 4.10.2.2 for a description of the impacts of this alternative on the waste management infrastructure at Hanford and SRS.

4.11.2.3 Socioeconomics

Employment requirements for operation of the pit conversion and MOX facilities at Hanford under Alternative 6B would be the same as those for Alternative 6A (see Section 4.10.2.3).

Employment requirements for operation of the immobilization facility at SRS under Alternative 6B would be the same as those for Alternative 6A (see Section 4.10.2.3).

4.11.2.4 Human Health Risk

During normal operations, there would be both radiological and hazardous chemical releases to the environment, and also direct in-plant exposures. The resulting doses to, and potential health effects on, the public and workers under Alternative 6B would be as follows.

Radiological Impacts. Table 4–98 reflects the potential radiological impacts on three individual receptor groups at Hanford and SRS: the population living within 80 km (50 mi) in the year 2010, the maximally exposed member of the public, and the average exposed member of the public. The table depicts the projected aggregate LCF risk to these groups from 10 years of incident-free operation. To put operational doses into perspective, comparisons with doses from natural background radiation are also provided in the table.

Table 4–98. Potential Radiological Impacts on the Public of Operations Under Alternative 6B: Pit Conversion and MOX Collocated in FMEF at Hanford, and Immobilization in New Construction and DWPF at SRS

Impact	Pit Conversion	MOX[a]	Hanford Total	Immobilization	
				Ceramic	Glass
Population within 80 km for year 2010					
Dose (person-rem)	6.9	0.14	7.0	2.8×10^{-3}	2.6×10^{-3}
Percent of natural background[b]	5.9×10^{-3}	1.2×10^{-4}	6.0×10^{-3}	1.2×10^{-6}	1.1×10^{-6}
10-year latent fatal cancers	0.034	7.0×10^{-4}	0.035	1.4×10^{-5}	1.3×10^{-5}
Maximally exposed individual					
Annual dose (mrem)	0.017	1.8×10^{-3}	0.019	2.8×10^{-5}	2.6×10^{-5}
Percent of natural background[b]	5.7×10^{-3}	6.1×10^{-4}	6.3×10^{-3}	9.5×10^{-6}	8.8×10^{-6}
10-year latent fatal cancer risk	8.5×10^{-8}	9.3×10^{-9}	9.5×10^{-8}	1.4×10^{-10}	1.3×10^{-10}
Average exposed individual within 80 km[c]					
Annual dose (mrem)	0.017	3.5×10^{-4}	0.017	3.6×10^{-6}	3.3×10^{-6}
10-year latent fatal cancer risk	8.5×10^{-8}	1.7×10^{-9}	8.7×10^{-8}	1.8×10^{-11}	1.6×10^{-11}

[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] 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. 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 approximately 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 Hanford (387,800) and the SRS APSF (approximately 790,000), if built, in 2010.

Key: APSF, Actinide Packaging and Storage Facility; DWPF, Defense Waste Processing Facility; FMEF, Fuels and Materials Examination Facility.

Source: Appendix J.

Given incident-free operation of all three facilities, the total population dose in the year 2010 would be 7.0 person-rem at Hanford and 2.8×10^{-3} person-rem at SRS. The corresponding number of LCFs in the population from 10 years of operation would be 0.035 around Hanford and 1.4×10^{-5} around SRS. The total dose to the maximally exposed member of the public from annual operation of the pit conversion and MOX facilities at Hanford would be 0.019 mrem. From 10 years of operation, the corresponding LCF risk to this individual would be 9.5×10^{-8}. The impacts on the average individual would be lower. The dose to the maximally exposed member of the public from annual operation of the immobilization facility at SRS would be 2.8×10^{-5} mrem. From 10 years of operation, the corresponding LCF risk to this individual would be 1.4×10^{-10}. The impacts on the average individual would be lower.

Estimated impacts resulting from "Total Site" operations are given in the Cumulative Impacts section of this SPD EIS (see Section 4.32). Within that section, projected incremental impacts associated with the operation of the proposed surplus plutonium disposition facilities are added to the impacts of other past, present, and reasonably foreseeable future actions at or near the candidate sites. These impacts are then compared against applicable regulatory standards established by DOE, EPA, and NRC (such as DOE Order 5400.5, the CAA [NESHAPs], the SDWA, and 10 CFR 20).

Doses to involved workers from normal operations are given in Table 4–99; these workers are defined as those directly associated with process activities. Under this alternative, the annual average dose to pit conversion and MOX facility workers would be 500 mrem and 65 mrem, respectively; to immobilization facility workers, 750 mrem. The annual dose received by the total site workforce for each of these facilities has been estimated at 192, 22, and 242 person-rem, respectively. The risks and numbers of LCFs among the different workers from 10 years of operation are included in Table 4–99. Doses to individual workers would be kept to minimal levels by instituting badged monitoring, administrative limits, and ALARA programs (which would include worker rotations).

Table 4–99. Potential Radiological Impacts on Involved Workers of Operations Under Alternative 6B: Pit Conversion and MOX Collocated in FMEF at Hanford, and Immobilization in New Construction and DWPF at SRS

Impact	Pit Conversion	MOX	Hanford Total	Immobilization (Ceramic or Glass)
Number of badged workers	383	331	714	323
Total dose (person-rem/yr)	192	22	214	242
10-year latent fatal cancers	0.77	0.088	0.86	0.97
Average worker dose (mrem/yr)	500	65	300[a]	750
10-year latent fatal cancer risk	2.0×10^{-3}	2.6×10^{-4}	1.2×10^{-3}	3.0×10^{-3}

[a] Represents an average of the doses for both facilities.

Key: DWPF, Defense Waste Processing Facility; FMEF, Fuels and Materials Examination Facility.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995d and NRC 1999a). 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 1994a). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1999c; UC 1998a, 1998b, 1999c, 1999d.

Hazardous Chemical Impacts. No hazardous chemicals would be released as a result of operations at Hanford under this alternative; thus, no cancer or adverse, noncancer health effects would occur. No carcinogenic chemicals would be released as a result of operations.

4.11.2.5 Facility Accidents

The potential consequences of postulated bounding facility accidents from operation of the pit conversion facility at Hanford are equivalent to those included in Alternative 2 (see Table 4–30); potential consequences from operation of the MOX facility in FMEF at Hanford would be equivalent to those included in Alternative 4B (see Table 4–68); and potential consequences from operation of the immobilization facility at SRS, equivalent to those included in Alternative 3 (see Tables 4–44 and 4–45). More details on the method of analysis, assumptions, and specific accident scenarios are presented in the discussion of Alternative 2 in Section 4.3.2.5.

Public. For the most severe consequences of the design basis accident for the pit conversion, MOX, and immobilization facilities, see Sections 4.3.2.5, 4.7.2.5, and 4.4.2.5, respectively.

A beyond-design-basis earthquake at Hanford could result in the collapse of the pit conversion and MOX facilities in FMEF (as described in Sections 4.3.2.5 and 4.7.2.5, respectively) and an estimated 39 LCFs among the general population. It should be emphasized that a seismic event of sufficient magnitude to collapse these facilities would likely cause the collapse of other DOE facilities, and would almost certainly cause widespread failure of homes, office buildings, and other structures in the surrounding area. The overall impact of such an event must therefore be seen in the context not only of the potential radiological impacts of these other facilities, but of hundreds, possibly thousands, of immediate fatalities from falling debris. The frequency of such an earthquake is estimated to be between 1 in 100,000 and 1 in 10,000,000 per year.

The beyond-design-basis accident at SRS would be equivalent to that discussed in Section 4.10.2.5.

Noninvolved Worker. Consistent with the analysis presented in the *Storage and Disposition PEIS*, the noninvolved worker is a hypothetical individual working on the site but not involved in the proposed action, and assumed to be 1,000 m (3,281 ft) from the location of the accident or at the site boundary, whichever is closer, and downwind from that location. For design basis accidents, the radiological consequences for this worker were estimated to be highest for the tritium release at the pit conversion facility. The consequences of such an accident would include an LCF probability of 1.8×10^{-4}.

Maximally Exposed Involved Worker. 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. Explosions could result in immediate injuries from flying debris, as well as the uptake of plutonium and uranium particulates through inhalation. If a criticality occurred, workers within tens of meters could receive very high to fatal radiation exposures from the initial 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 accident. The design basis and beyond-design-basis earthquakes would also have substantial consequences, ranging from workers being killed by debris from collapsing equipment and structures to high radiation exposures and uptakes of radionuclides. For most accidents, immediate emergency response actions should reduce the consequences to workers near the accident. As discussed in the Emergency Preparedness sections of Chapter 3, each candidate site has an established emergency management program that would be activated in the event of an accident. Based on the decisions made in the SPD EIS ROD, site emergency management programs would be modified to consider new accidents not in the current program.

Nonradiological Accidents. Surplus plutonium disposition operations at Hanford and SRS could result in worker injuries and fatalities. DOE-required industrial safety programs would be in place to reduce the risks. Given the estimated employment of 11,535 person-years of labor and the standard DOE occupational accident rates, approximately 420 cases of nonfatal occupational injury or illness and 0.31 fatality could be expected for the duration of operations.

4.11.2.6 Transportation

Because the only difference between Alternative 6A and 6B is the location of the MOX facility within 400 Area at Hanford, the transportation required for Alternative 6B would be the same as that for Alternative 6A. Therefore, the transportation risks associated with Alternative 6B are equivalent to those discussed in Section 4.10.2.6.

4.11.2.7 Environmental Justice

As discussed in other parts of Section 4.11.2, routine operations conducted under Alternative 6B would pose no significant health risks to the public. The likelihood of an LCF for the MEI residing near Hanford would be approximately 1 in 10 million (see Table 4–98); the likelihood for the MEI residing near SRS would be essentially zero. The number of LCFs expected among the general population residing near Hanford and SRS from accident-free operations would increase by approximately 0.035 and 1.4×10^{-5}, respectively.

Design basis accidents at the sites would not be expected to cause cancer fatalities among the public (see Section 4.11.2.5). A beyond-design-basis earthquake would be expected to result in LCFs among the general population (see Tables 4–30, 4–44, 4–45, and 4–68). However, it is highly unlikely that a beyond-design-basis earthquake would occur. Accidents at the sites pose no significant risks (when the probability of occurrence is considered) to the population residing within the area potentially affected by radiological contamination.

As described in Section 4.11.2.6, no radiological or nonradiological fatalities would be expected to result from accident-free transportation conducted under this alternative. Nor would radiological or nonradiological fatalities be expected to result from transportation accidents.

Thus, implementation of Alternative 6B would pose no significant risks to the public, nor would implementation of this alternative pose significant risks to groups within the public, including the risk of disproportionately high and adverse effects on minority and low-income populations.

4.12 [Section deleted because alternative deleted.]

4.13 [Section deleted because alternative deleted.]

4.14 ALTERNATIVE 7

Alternative 7 would involve constructing and operating the pit conversion and MOX facilities at INEEL and the immobilization facility at SRS. The pit conversion facility would be located in the existing Fuel Processing Facility (FPF) building, and the MOX facility would be located in a new building. The immobilization facility would be located in a new building in F-Area. Activities at SRS would be the same as under Alternative 6A.

4.14.1 Construction

4.14.1.1 Air Quality and Noise

Sources of potential air quality impacts of construction under Alternative 7 at INEEL include emissions from fuel-burning construction equipment, soil disturbance by construction equipment and other vehicles, the operation of a concrete batch plant, trucks moving materials and wastes, and employee vehicles. Emissions from these sources are summarized in Appendix G.

A comparison of maximum air pollutant concentrations, including the contribution from construction activities at INEEL, with standards and guidelines is presented as Table 4–100. Concentrations of air pollutants, especially PM_{10} and total suspended particulates, would likely increase at the site boundary, but would not exceed the Federal or State ambient air quality standards. Air pollution impacts during construction would be mitigated by applying, as appropriate, standard dust control practices such as watering or sweeping of roads and watering of exposed areas.

Table 4–100. Evaluation of INEEL Air Pollutant Concentrations Associated With Construction Under Alternative 7: Pit Conversion in FPF and MOX in New Construction at INEEL, and Immobilization in New Construction and DWPF at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m³)[a]	SPD Increment (Fg/m³)	Total Site Concentration (Fg/m³)	Site as a Percent of Standard or Guideline
Criteria pollutants					
Carbon monoxide	8 hours	10,000	2.07	304	3
	1 hour	40,000	5.6	1220	3.1
Nitrogen dioxide	Annual	100	0.184	11.2	11
PM_{10}	Annual	50	0.151	3.15	6.3
	24 hours	150	5.9	44.9	30
Sulfur dioxide	Annual	80	0.0163	6.02	7.5
	24 hours	365	0.208	137	38
	3 hours	1,300	0.837	592	46
Hazardous and other toxic compounds					
Other toxics[b]	Annual	0.12	0.00001	0.029	24

[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: DWPF, Defense Waste Processing Facility; FPF, Fuel Processing Facility; SPD, surplus plutonium disposition.

Source: EPA 1997a; ID DHW 1995.

Total vehicle emissions associated with activities at INEEL would likely decrease somewhat from current emissions because of an expected decrease in overall site employment during this timeframe.

The location of these facilities at INEEL relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during construction would include heavy construction equipment, employee vehicles, and truck traffic. Traffic noise associated with the construction of these facilities would occur on the site and along offsite local and regional transportation routes used to bring construction materials and workers to the site. Given the distance to the site boundary (about 12 km [7.5 mi]), noise emissions from construction equipment would not be expected to annoy the public. These noise sources would be far enough away from offsite areas that the contribution to offsite noise levels would be small. Some noise sources could result in onsite impacts, such as the disturbance of wildlife. However, noise would be unlikely to affect federally listed threatened or endangered species or their critical habitats, as none are known to occur on or in the immediate vicinity of the proposed site location (see Section 4.26). Traffic associated with the construction of these facilities would likely produce less than a 1-dB increase in noise levels along roads used to access the site, and thus would not result in any increased annoyance of the public.

Construction workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (OSHA 1997). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of standard silencing packages on construction equipment, administrative controls, engineering controls, and personal hearing protection equipment.

Potential air quality impacts of construction under Alternative 7 at SRS are the same as those for Alternative 6A at SRS (see Section 4.10.1.1). Noise impacts are the same as those for Alternative 6A at SRS (see Section 4.10.1.1).

4.14.1.2 Waste Management

At SRS, construction impacts of this alternative would be the same as for Alternative 6A. See Section 4.10.1.2 for a description of the impacts of this alternative on the waste management infrastructure at SRS.

Table 4–101 compares the wastes generated during the construction of surplus plutonium disposition facilities at INEEL with the existing treatment, storage, and disposal capacity for the various waste types. It is anticipated that no TRU waste, LLW, or mixed LLW would be generated during the 3-year construction period. In addition, no soil contaminated with hazardous or radioactive constituents should be generated during construction. However, if any were generated, the waste would be managed in accordance with site practice and applicable Federal and State regulations. For this SPD EIS, it is assumed that hazardous waste and nonhazardous waste would be treated, stored, and disposed of in accordance with current site practices.

Hazardous wastes generated during the construction of surplus plutonium disposition facilities at INEEL would be typical of those generated during the construction of an industrial facility. Any hazardous wastes generated during construction would be packaged in DOT-approved containers and shipped off the site to permitted commercial recycling, treatment, and disposal facilities. The additional waste load generated during construction should not have a major impact on the INEEL hazardous waste management system.

Nonhazardous solid wastes generated during the construction of surplus plutonium disposition facilities at INEEL would be packaged in conformance with standard industrial practice and shipped to offsite commercial facilities for recycling or disposal. The additional waste load generated during construction should not have a major impact on the nonhazardous solid waste management system at INEEL.

Table 4–101. Potential Waste Management Impacts of Construction Under Alternative 7: Pit Conversion in FPF and MOX in New Construction at INEEL

Waste Type[a]	Estimated Additional Waste Generation (m^3/yr)	Estimated Additional Waste Generation as a Percent of[b]		
		Characterization or Treatment Capacity	Storage Capacity	Disposal Capacity
Hazardous	35	NA	NA	NA
Nonhazardous				
Liquid	22,000	13[c]	NA	1[d]
Solid	8,600	NA	NA	NA

[a] See definitions in Appendix F.8.

[b] Treatment capacities, and the disposal capacity for nonhazardous liquid waste, are compared with estimated additional annual waste generation. All other storage and disposal capacities are compared with total estimated additional waste generation assuming a 3-year construction period.

[c] Percent of capacity of the FPF sanitary sewer.

[d] Percent of capacity of the INTEC Sewage Treatment Plant.

Key: FPF, Fuel Processing Facility; INTEC, Idaho Nuclear Technology and Engineering Center; NA, not applicable (i.e., it is assumed that the majority of the hazardous waste and nonhazardous solid waste would be treated and disposed of off the site by the construction contractor).

To be conservative, it was assumed that all nonhazardous liquid wastes generated during construction of the pit conversion and MOX facilities at INEEL would be managed on the site at the Idaho Nuclear Technology and Engineering Center (INTEC) Sewage Treatment Plant, even though it is likely that much of this waste would be collected in portable toilets and would be managed at offsite facilities. Nonhazardous liquid waste generated during the construction of these facilities is estimated to be 13 percent of the 166,000-m^3/yr (217,000-yd^3/yr) capacity of the FPF sanitary sewer, 1 percent of the 3.2 million-m^3/yr (4.2 million-yd^3/yr) capacity of the INTEC Sewage Treatment Plant, and within the 3,117,000-m^3/yr (4,077,000-yd^3/yr excess capacity of the INTEC Sewage Treatment Plant (Abbott et al. 1997:20). Therefore, management of these wastes at INEEL should not have a major impact on the nonhazardous liquid waste treatment system during construction.

4.14.1.3 Socioeconomics

Construction-related employment requirements for Alternative 7 would be as indicated in Table 4–102.

Table 4–102. Construction Employment Requirements for Alternative 7: Pit Conversion in FPF and MOX in New Construction at INEEL, and Immobilization in New Construction and DWPF at SRS

Year	Pit Conversion	MOX	Immobilization	Total
2001	100	0	0	100
2002	154	441	506	1,101
2003	94	772	920	1,786
2004	0	508	1,014	1,522
2005	0	221	552	773
2006	0	208	0	208

Key: DWPF, Defense Waste Processing Facility; FPF, Fuel Processing Facility.

Source: DOE 1999c; UC 1998f, 1999c, 1999d.

At its peak in 2003, construction of the pit conversion and MOX facilities at INEEL under this alternative would require 866 construction workers and generate another 884 indirect jobs in the region. As the total employment requirement of 1,750 direct and indirect jobs represents 1.0 percent of the total projected REA workforce, it should have no major impact on the REA. It should also have a minimal impact on community services provided within the INEEL ROI. In fact, it should help offset the approximately 13 percent reduction in INEEL's total labor force (i.e., from 8,291 to 7,250 workers) projected for the years 1997–2005.

Employment requirements for construction of a new immobilization facility at SRS under Alternative 7 would be the same as those for Alternative 6A (see Section 4.10.1.3).

4.14.1.4 Human Health Risk

Radiological Impacts. No radiological risk would be incurred by members of the public from construction activities. A summary of radiological impacts of construction activities on workers at risk is presented in Table 4–103. According to recent radiation surveys (Mitchell et al. 1997; UC 1998f, 1998g, 1999c, 1999d) conducted at the INEEL INTEC area and the SRS F-Area, construction workers at either site could receive doses above natural background radiation levels as a result of exposure to radiation deriving from other activities, past or present, at the site. Regardless of location, construction worker exposures would be limited to ensure that doses are kept as low as is reasonably achievable, and workers would be monitored (badged) as appropriate.

Table 4–103. Potential Radiological Impacts on Construction Workers of Alternative 7: Pit Conversion in FPF and MOX in New Construction at INEEL, and Immobilization in New Construction and DWPF at SRS

Impact	Pit Conversion[a]	MOX[b]	INEEL Total	Immobilization[c]
Total dose (person-rem/yr)	0.55	1.4	2.0	1.5
Annual latent fatal cancers[d]	2.2×10^{-4}	5.5×10^{-4}	7.7×10^{-4}	6.0×10^{-4}
Average worker dose (mrem/yr)	4.7[e]	4.7[e]	4.7[f]	4
Annual latent fatal cancer risk	1.9×10^{-6}	1.9×10^{-6}	1.9×10^{-6}	1.6×10^{-6}

[a] An estimated average of 116 workers would be associated with annual construction and modification operations.

[b] An estimated average of 292 workers would be associated with annual construction operations.

[c] An estimated average of 374 workers would be associated with annual construction operations at the new facility location adjacent to APSF, if built. The number would be the same for immobilization in either ceramic or glass.

[d] 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, per ICRP 1991.

[e] Value is based on the number of expected construction workdays per year and an 8-hr workday.

[f] Represents an average of the doses for both facilities.

Key: APSF, Actinide Packaging and Storage Facility; DWPF, Defense Waste Processing Facility; FPF, Fuel Processing Facility.

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: Mitchell et al. 1997; ICRP 1991; NAS 1990; UC 1998f, 1998g, 1999c, 1999d.

Hazardous Chemical Impacts. The probability of excess latent cancer incidence associated with exposure to benzene released as a result of construction activities at INEEL under this alternative has been estimated to be much less than 1 chance in 1 million over the lifetime of the maximally exposed member of the public.

4.14.1.5 Facility Accidents

The construction of surplus plutonium disposition facilities at INEEL and SRS could result in worker injuries or fatalities. DOE-required industrial safety programs would be in place to reduce the risks. Given the estimated 5,490 person-years of construction labor and standard industrial accident rates, approximately 540 cases of nonfatal occupational injury or illness and 0.76 fatality could be expected (DOL 1997a, 1997b). As all construction would be in nonradiological areas, no radiological accidents should occur.

4.14.1.6 Environmental Justice

As discussed in the other parts of Section 4.14.1, construction under Alternative 7 would pose no significant health risks to the public. The risks would be negligible regardless of the racial or ethnic composition or the economic status of the population. Therefore, construction activities under Alternative 7 at INEEL and SRS would have no significant impacts on minority or low-income populations.

4.14.2 Operations

4.14.2.1 Air Quality and Noise

Potential air quality impacts of the operation of facilities under Alternative 7 at INEEL were analyzed using ISCST3. Operational impacts would result from process emissions, emergency diesel generator testing, trucks moving materials and wastes, and employee vehicles. Emissions from these sources are summarized in Appendix G.

A comparison of maximum air pollutant concentrations, including the contribution from surplus plutonium disposition facilities, with standards and guidelines is presented as Table 4–104. Concentrations of air pollutants would likely increase at the site boundary, but would not exceed the Federal or State ambient air quality standards. Air pollution impacts during operation would be mitigated, for example, HEPA filtration has been included in the design of these facilities.

Table 4–104. Evaluation of INEEL Air Pollutant Concentrations Associated With Operations Under Alternative 7: Pit Conversion in FPF and MOX in New Construction at INEEL, and Immobilization in New Construction and DWPF at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m³)[a]	SPD Increment (Fg/m³)	Total Site Concentration (Fg/m³)	Site as a Percent of Standard or Guideline
Criteria pollutants					
Carbon monoxide	8 hours	10,000	0.762	303	3.0
	1 hour	40,000	3.14	1,220	3.1
Nitrogen dioxide	Annual	100	0.144	11.1	11
PM_{10}	Annual	50	0.00833	3.01	6
	24 hours	150	0.089	39.1	26
Sulfur dioxide	Annual	80	0.345	6.35	7.9
	24 hours	365	3.46	140	38
	3 hours	1,300	18.6	610	47
[Text deleted.]					

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

Key: DWPF, Defense Waste Processing Facility; FPF, Fuel Processing Facility; SPD, surplus plutonium disposition.

Note: No nonradiological hazardous or other toxic compounds would be emitted from these processes.

Source: EPA 1997a; ID DHW 1995.

For a discussion of how the operation of the pit conversion and MOX facilities at INEEL would affect the ability to continue to meet NESHAPs limits regarding airborne radiological emissions, see Section 4.32.2.4. There are no other NESHAPs limits applicable to operation of these facilities.

The increases in concentrations of nitrogen dioxide, PM_{10}, and sulfur dioxide from the operation of these facilities would be a small fraction of the PSD Class II area increments as summarized in Table 4–105. INEEL is near a PSD Class I area, Craters of the Moon National Monument. The contribution to air pollutant concentrations for this area are estimated to be 0.01 Fg/m³ or less for nitrogen dioxide and PM_{10}. For sulfur dioxide the annual value is 0.015 Fg/m³, the 24-hr value is 0.16 Fg/m³ and the 3-hr value is 0.69 Fg/m³. These values are all well under the Class I PSD increments.

Table 4–105. Evaluation of INEEL Air Pollutant Increases Associated With Operations Under Alternative 7: Pit Conversion in FPF and MOX in New Construction at INEEL, and Immobilization in New Construction and DWPF at SRS

Pollutant	Averaging Period	Increase in Concentration (Fg/m³)[a]	PSD Class I Area Allowable Increment (Fg/m³)	Percent of Class I Increment[a]	Increase in Concentration[b]	PSD Class II Area Allowable Increment (Fg/m³)	Percent of Class II Increment
Nitrogen dioxide	Annual	0.00661	2.5	0.26	0.144	25	0.58
PM_{10}	Annual	0.000387	4	0.0097	0.00833	17	0.049
	24 hours	0.00492	8	0.061	0.089	30	0.30
Sulfur dioxide	Annual	0.0169	2	0.84	0.345	20	1.7
	24 hours	0.178	5	3.6	3.46	91	3.8
	3 hours	0.786	25	3.1	18.6	512	3.6

[a] At nearest Class I area.

[b] At nearest public access area.

Key: DWPF, Defense Waste Processing Facility; FPF, Fuel Processing Facility; PSD, prevention of significant deterioration.

Source: EPA 1997b.

Total vehicle emissions associated with activities at INEEL would likely decrease somewhat from current emissions because of an expected decrease in overall site employment during this timeframe.

The location of these facilities at INEEL relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during operations would include new or existing sources (e.g., cooling systems, vents, motors, material-handling equipment), employee vehicles, and truck traffic. Traffic noise associated with operation of these facilities would occur on the site and along offsite local and regional transportation routes used to bring materials and workers to the site. Given the distance to the site boundary (about 12 km [7.5 mi]), noise emissions from equipment would not likely annoy the public. These noise sources would be far enough away from offsite areas that their contribution to offsite noise levels would be small. Some noise sources could have onsite impacts, such the as disturbance of wildlife. However, noise would be unlikely to affect federally listed threatened or endangered species or their critical habitats, as none are known to occur on or in the immediate vicinity of the proposed site location (see Section 4.26). Noise from traffic associated with operation of these facilities would likely produce less than a 1-dB increase in traffic noise levels along roads used to access the site, and thus would not result in any increased annoyance of the public.

Operations workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (OSHA 1997). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of administrative controls, engineering controls, and personal hearing protection equipment.

Potential air quality impacts of operation of the new immobilization facility under Alternative 7 at SRS are the same as those for Alternative 6A (see Section 4.10.2.1). Noise impacts are the same as those for Alternative 6A at SRS (see Section 4.10.2.1).

The combustion of fossil fuels associated with Alternative 7 would result in the emission of carbon dioxide, one of the atmospheric gases that are believed to influence the global climate. Annual carbon dioxide emissions from this alternative would represent less than 3×10^{-4} percent of the 1995 annual U.S. emissions of carbon dioxide from fossil fuel combustion and industrial processes, and therefore would not appreciably affect global concentrations of this pollutant.

4.14.2.2 Waste Management

At SRS, impacts of operations for this alternative would be the same as for Alternative 6A. See Section 4.10.2.2 for a description of the impacts of this alternative on the waste management infrastructure at SRS.

Table 4–106 compares the existing site treatment, storage, and disposal capacities with the expected waste generation rates from operating surplus plutonium disposition facilities at INEEL. No HLW would be generated by the facilities. 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. According to 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. 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, in order to be conservative, it is assumed the TRU waste would be stored on the site until 2016. 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 INEEL are described in the *DOE Programmatic Spent Nuclear Fuel Management and INEL Environmental Restoration and Waste Management Programs Final EIS* (DOE 1995a).

Table 4–106. Potential Waste Management Impacts of Operations Under Alternative 7: Pit Conversion in FPF and MOX in New Construction at INEEL

Waste Type[a]	Estimated Additional Waste Generation (m^3/yr)	Estimated Additional Waste Generation as a Percent of[b]		
		Characterization or Treatment Capacity	Storage Capacity	Disposal Capacity
TRU[c]	86	1	<1	1 of WIPP
LLW	150	<1	1	<1
Mixed LLW	4	<1	<1	NA
Hazardous	5	NA	1	NA
Nonhazardous				
Liquid	67,000	40[d]	NA	2[e]
Solid	2,200	NA	NA	NA

[a] See definitions in Appendix F.8.

[b] Treatment capacities, and the disposal capacity for nonhazardous liquid waste, are compared with estimated additional annual waste generation. All other storage and disposal capacities are compared with total estimated additional waste generation assuming a 10-year operation period.

[c] Includes mixed TRU waste. Facilities are not expected to generate remotely handled TRU waste.

[d] Percent of capacity of the FPF sanitary sewer.

[e] Percent of capacity of the INTEC Sewage Treatment Plant.

Key: FPF, Fuel Processing Facility; INTEC, Idaho Nuclear Technology and Engineering Center; LLW, low-level waste; NA, not applicable (i.e., the majority of this waste is not routinely treated, stored, or disposed of on the site); TRU, transuranic; WIPP, Waste Isolation Pilot Plant.

TRU wastes would be treated, packaged, and certified to WIPP waste acceptance criteria at the new facilities. 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 wastes generated by the pit conversion and MOX facilities at INEEL is estimated to be 1 percent of the 6,500-m^3/yr (8,500-yd^3/yr) planned capacity of the Advanced Mixed Waste Treatment Project. A total of 860 m^3 (1,120 yd^3) of TRU waste would be generated over the 10-year operation period. If all the TRU waste were stored on the site, this would be less than 1 percent of the 177,300-m^3 (231,900-yd^3) storage capacity available at the Radioactive Waste Management Complex (RWMC). Assuming that the waste were stored in 208-l (55-gal) drums that could be stacked two high, and allowing a 50 percent factor for aisle space, a storage area of 0.12 ha (0.30 acre) would be required. Therefore, impacts of the management of additional quantities of TRU waste at INEEL should not be major. Impacts from the treatment of TRU waste to WIPP waste acceptance criteria are described in the WM PEIS (DOE 1997d).

The 1,810 m^3 (2,367 yd^3) of TRU wastes generated at INEEL and SRS would be 1 percent of the 143,000-m^3 (187,000-yd^3) contact-handled TRU waste that DOE plans to dispose of at WIPP and 1 percent of the current 168,500-m^3 (220,400-yd^3) (DOE 1997e:3-3). Impacts of disposal of TRU waste at WIPP are described in the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997e).

At INEEL, LLW would be packaged, certified, and accumulated at the pit and MOX facilities before transfer for additional treatment and disposal in existing onsite facilities. A total of 1,500 m^3 (1,960 yd^3) of LLW would be generated over the operations period. LLW generated at surplus plutonium disposition facilities is estimated to be less than 1 percent of the 49,610-m^3/yr (64,890-yd^3/yr) treatment capacity of the Waste Experimental Reduction Facility (WERF), 1 percent of the 177,300-m^3 (231,900-yd^3) storage capacity of RWMC, and less than 1 percent of the 37,700-m^3/yr (49,300-yd^3/yr) disposal capacity of RWMC. Using the 6,264 m^3/ha disposal land usage factor for INEEL published in the *Storage and Disposition Final PEIS* (DOE 1996a:E-9), 1,500 m^3

(1,960 yd^3) of waste would require 0.25-ha (0.62-acre) disposal space at INEEL. Therefore, impacts of the management of this additional LLW at INEEL should not be major.

At INEEL, mixed LLW would be stabilized, packaged, and stored on the site for treatment and disposal in a manner consistent with the site treatment plan. Mixed LLW is currently treated on the site with some waste shipped to Envirocare of Utah for disposal. Mixed LLW generated at the pit conversion and MOX facilities is estimated to be 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, and less than 1 percent of the 177,300-m^3 (231,900-yd^3) storage capacity of RWMC. Therefore, the management of this additional waste at INEEL should not have a major impact on the mixed LLW management system.

Any hazardous wastes generated during operation of the pit conversion and MOX facilities at INEEL would be packaged in DOT-approved containers and shipped off the site to permitted commercial recycling, treatment, and disposal facilities. Hazardous waste generation for this combination of facilities is estimated to be 1 percent of the 9,848-m^3 (12,881-yd^3) capacity of the hazardous waste storage buildings. Therefore, the management of these additional hazardous wastes at INEEL should not have a major impact on the hazardous waste management system.

If all TRU waste and mixed LLW generated at surplus plutonium disposition facilities at INEEL were processed in the Advanced Mixed Waste Treatment Project, this additional waste would be 1 percent of the 6,500-m^3/yr (8,500-yd^3/yr) planned capacity of that facility. If all TRU waste, LLW, and mixed LLW generated at surplus plutonium disposition facilities at INEEL were stored at RWMC, this additional waste would be 1 percent of the 177,300-m^3 (231,900-yd^3) capacity of that facility. If all LLW and hazardous wastes generated at surplus plutonium disposition facilities at INEEL were treated at WERF, this additional waste would be less than 1 percent of the 49,610-m^3 (64,890-yd^3) capacity of that facility.

Nonhazardous solid waste would be packaged and transported 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 for offsite disposal. It is unlikely that this additional waste load would have a major impact on the nonhazardous solid waste management system at INEEL.

At INEEL, nonhazardous wastewater generated by the pit conversion and MOX facilities would be treated if necessary before being discharged to the FPF sanitary sewer system, which connects to the INTEC Sewage Treatment Plant. Nonhazardous liquid waste generated by the pit conversion and MOX facilities at INEEL is estimated to be 40 percent of the 166,000-m^3/yr (217,000-yd^3/yr) capacity of the FPF sanitary sewer, 2 percent of the 3.2 million-m^3/yr (4.2 million-yd^3/yr) capacity of the INTEC Sewage Treatment Plant, and within the 3,117,000-m^3/yr (4,077,000-yd /yr) ^{3}excess capacity of the INTEC Sewage Treatment Plant (Abbott et al. 1997:20). Therefore, management of nonhazardous liquid waste at INEEL should not have a major impact on the treatment system.

4.14.2.3 Socioeconomics

After construction, startup, and testing of the pit conversion and MOX facilities at INEEL in 2007 under Alternative 7, an estimated 743 new workers would be required to operate them (DOE 1999c; UC 1998f). This level of employment would be expected to generate another 1,990 indirect jobs within the region. As this total employment requirement of 2,733 new direct and indirect jobs represents about 1.6 percent of the total projected REA workforce, it should have no major impact on the REA. This increase in total employment will have a minimal effect on community services provided within the ROI, in fact, it should help to offset the nearly 13 percent decline in INEEL employment (i.e., from 8,291 to 7,250 workers) projected for the years 1997–2010.

Employment requirements for operation of the immobilization facility at SRS under Alternative 7 would be the same as those for Alternative 6A (see Section 4.10.2.3).

4.14.2.4 Human Health Risk

During normal operations, there would be both radiological and hazardous chemical releases to the environment, and also direct in-plant exposures. The resulting doses to, and potential health effects on, the public and workers under Alternative 7 would be as follows.

Radiological Impacts. Table 4–107 reflects the potential radiological impacts on three individual receptor groups at INEEL and SRS: the population living within 80 km (50 mi) in the year 2010, the maximally exposed member of the public, and the average exposed member of the public. The table depicts the projected aggregate LCF risk to these groups from 10 years of incident-free operation. To put operational doses into perspective, comparisons with doses from natural background radiation are also provided in the table.

Given incident-free operation of all three facilities, the total population dose in the year 2010 would be 2.2 person-rem at INEEL and 2.8×10^{-3} person-rem at SRS. The corresponding number of LCFs in the population from 10 years of operation would be 0.011 around INEEL and 1.4×10^{-5} around SRS. The total dose to the maximally exposed member of the public from annual operation of the pit conversion and MOX facilities at INEEL would be 0.018 mrem. From 10 years of operation, the corresponding LCF risk to this individual would be 9.1×10^{-8}. The impacts on the average individual would be lower. The dose to the

Table 4–107. Potential Radiological Impacts on the Public of Operations Under Alternative 7: Pit Conversion in FPF and MOX in New Construction at INEEL, and Immobilization in New Construction and DWPF at SRS

Impact	Pit Conversion	MOX[a]	INEEL Total	Immobilization Ceramic	Immobilization Glass
Population within 80 km for year 2010					
Dose (person-rem)	2.2	0.037	2.2	2.8×10^{-3}	2.6×10^{-3}
Percent of natural background[b]	3.3×10^{-3}	5.6×10^{-5}	3.3×10^{-3}	1.2×10^{-6}	1.1×10^{-6}
10-year latent fatal cancers	0.011	1.9×10^{-4}	0.011	1.4×10^{-5}	1.3×10^{-5}
Maximally exposed individual					
Annual dose (mrem)	0.015	3.2×10^{-3}	0.018	2.8×10^{-5}	2.6×10^{-5}
Percent of natural background[b]	4.2×10^{-3}	8.8×10^{-4}	5.1×10^{-3}	9.5×10^{-6}	8.8×10^{-6}
10-year latent fatal cancer risk	7.5×10^{-8}	1.6×10^{-8}	9.1×10^{-8}	1.4×10^{-10}	1.3×10^{-10}
Average exposed individual within 80 km[c]					
Annual dose (mrem)	0.012	2.1×10^{-4}	0.012	3.6×10^{-6}	3.3×10^{-6}
10-year latent fatal cancer risk	6.0×10^{-8}	1.1×10^{-9}	6.1×10^{-8}	1.8×10^{-11}	1.6×10^{-11}

[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. 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 approximately 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 INEEL (182,800) and the SRS APSF (approximately 790,000), if built, in 2010.

Key: APSF, Actinide Packaging and Storage Facility; DWPF, Defense Waste Processing Facility; FPF, Fuel Processing Facility.

Source: Appendix J.

maximally exposed member of the public from annual operation of the immobilization facility at SRS would be 2.8×10^{-5} mrem.

From 10 years of operation, the corresponding LCF risk to this individual would be 1.4×10^{-10}. The impacts on the average individual would be lower.

Estimated impacts resulting from "Total Site" operations are given in the Cumulative Impacts section of this SPD EIS (see Section 4.32). Within that section, projected incremental impacts associated with the operation of the proposed surplus plutonium disposition facilities are added to the impacts of other past, present, and reasonably foreseeable future actions at or near the candidate sites. These impacts are then compared against applicable regulatory standards established by DOE, EPA, and NRC (such as DOE Order 5400.5, the CAA [NESHAPs], the SDWA, and 10 CFR 20).

Doses to involved workers from normal operations are given in Table 4–108; these workers are defined as those directly associated with process activities. Under this alternative, the annual average dose to pit conversion and MOX facility workers would be 500 mrem and 65 mrem, respectively; to immobilization facility workers, 750 mrem. The annual dose received by the total site workforce for each of these facilities has been estimated at 170, 22, and 242 person-rem, respectively. The risks and numbers of LCFs among the different workers from 10 years of operation are included in Table 4–108. Doses to individual workers would be kept to minimal levels by instituting badged monitoring, administrative limits, and ALARA programs (which would include worker rotations).

Table 4–108. Potential Radiological Impacts on Involved Workers of Operations Under Alternative 7: Pit Conversion in FPF and MOX in New Construction at INEEL, and Immobilization in New Construction and DWPF at SRS

Impact	Pit Conversion	MOX	INEEL Total	Immobilization (Ceramic or Glass)
Number of badged workers	341	331	672	323
Total dose (person-rem/yr)	170	22	192	242
10-year latent fatal cancers	0.68	0.088	0.77	0.97
Average worker dose (mrem/yr)	500	65	286[a]	750
10-year latent fatal cancer risk	2.0×10^{-3}	2.6×10^{-4}	1.1×10^{-3}	3.0×10^{-3}

[a] Represents an average of the doses for both facilities.

Key: DWPF, Defense Waste Processing Facility; FPF, Fuel Processing Facility.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995d and NRC 1999a). 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 1994a). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1999c; UC 1998f, 1998g, 1999c, 1999d.

Hazardous Chemical Impacts. No hazardous chemicals would be released as a result of operations at INEEL under this alternative; thus, no cancer or adverse, noncancer health effects would occur. No carcinogenic chemicals would be released as a result of operations.

4.14.2.5 Facility Accidents

The potential consequences of postulated bounding facility accidents from operation of the pit conversion facility in FPF and the MOX facility at INEEL are presented in Tables 4–109 and 4–110. The potential consequences from operation of the immobilization facility at SRS would be equivalent to those included in Alternative 3 (see Tables 4–44 and 4–45). More details on the method of analysis, assumptions, and specific accident scenarios are presented in the discussion of Alternative 2 in Section 4.3.2.5.

Public. The most severe consequences of a design basis accident for the pit conversion facility would be associated with a tritium release and for the MOX facility, a nuclear criticality. Bounding radiological consequences for the MEI are from the tritium release at INEEL, which would result in a dose of 0.045 rem, corresponding to an LCF probability of 2.2×10^{-5}. A nuclear criticality of 10^{19} fissions would result in an MEI dose of 0.016 rem at the MOX facility at INEEL. Among the general population in the environs of INEEL, an estimated 4.4×10^{-3} LCF could occur as a result of the bounding tritium release accident. The frequency of such an accident is estimated to be between 1 in 10,000 and 1 in 1,000,000 per year. For a discussion of the most severe consequences of a design basis accident for the immobilization facility, see Section 4.4.2.5.

A beyond-design-basis earthquake at INEEL could result in the collapse of the pit conversion facility in FPF and the MOX facility, and an estimated 1.4 LCFs among the general population. It should be emphasized that a seismic event of sufficient magnitude to collapse these facilities would likely cause the collapse of other DOE facilities, and would almost certainly cause widespread failure of homes, office buildings, and other structures in the surrounding area. The overall impact of such an event must therefore be seen in the context not only of the potential radiological impacts of these other facilities, but of hundreds, possibly thousands, of immediate fatalities from falling debris. The frequency of such an earthquake is estimated to be between 1 in 100,000 and 1 in 10,000,000 per year.

The beyond-design-basis accident at SRS would be equivalent to that discussed in Section 4.10.2.5.

Table 4–109. Accident Impacts of Pit Conversion Under Alternative 7: Pit Conversion in FPF and MOX in New Construction at INEEL, and Immobilization in New Construction and DWPF at SRS

		Impacts on Noninvolved Worker		Impact at Site Boundary		Impacts on Population Within 80 km	
Accident	Frequency (per year)	Dose (rem)[a]	Probability of Cancer Fatality[b]	Dose (rem)[a]	Probability of Cancer Fatality[b]	Dose (person-rem)[a]	Latent Cancer Fatilities[c]
Fire	Unlikely	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	Unlikely	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	Extremely unlikely	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	Extremely unlikely	2.7×10^{-1}	1.1×10^{-4}	4.5×10^{-2}	2.2×10^{-5}	8.8	4.4×10^{-3}
Criticality	Extremely unlikely	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	Unlikely	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	Beyond extremely unlikely	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	Extremely unlikely to beyond extremely unlikely	2.6×10^{2}	1.0×10^{-1}	6.7	3.3×10^{-3}	8.4×10^{2}	4.2×10^{-1}

[a] For 95th percentile meteorological conditions. With the exception of doses due to criticality and tritium exposure , the stated doses are from the inhalation of plutonium, and represent dose commitments that would be received over the lifetime of the impacted individual. See Appendix K.1.4.2 for a more detailed discussion of pathways.

[b] Increased likelihood (or probability) of cancer fatality for 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 for a hypothetical individual in the offsite population at the site boundary) if exposed to the indicated dose. The value that assumes that the accident has occurred.

[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. The value assumes that the accident has occurred.

Key: DWPF, Defense Waste Processing Facility; FPF, Fuel Processing Facility.

Source: Calculated using the source terms in Table K–9 and the MACCS2 computer code.

Noninvolved Worker. Consistent with the analysis presented in the *Storage and Disposition Final PEIS*, the noninvolved worker is a hypothetical individual working on the site but not involved in the proposed action, and assumed to be 1,000 m (3,281 ft) from the location of the accident or at the site boundary, whichever is closer, and downwind from that location. For design basis accidents, the radiological consequences for this worker were estimated to be highest for the criticality at the MOX facility. The consequences of such an accident would include an LCF probability of 3.0×10^{-4}.

Maximally Exposed Involved Worker. 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 either be able to evacuate immediately or would not be affected by the events. Explosions could result in immediate injuries from flying debris, as well as the uptake of plutonium and uranium particulates through inhalation. If a criticality occurred, workers within tens of meters could receive very high to fatal radiation exposures from the initial 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 accident. The design basis and beyond-design-basis earthquakes would also have substantial consequences, ranging from workers being killed by debris from collapsing equipment and structures to high radiation exposures and uptakes of radionuclides. For most accidents, immediate emergency response actions should reduce the consequences to workers near the accident. As discussed in the Emergency Preparedness sections of Chapter 3, each candidate site has an established

Table 4–110. Accident Impacts of MOX Facility Under Alternative 7: Pit Conversion in FPF and MOX in New Construction at INEEL, and Immobilization in New Construction and DWPF at SRS

		Impacts on Noninvolved Worker		Impact at Site Boundary		Impacts on Population Within 80 km	
Accident	**Frequency (per year)**	**Dose (rem)[a]**	**Probability of Cancer Fatality[b]**	**Dose (rem)[a]**	**Probability of Cancer Fatality[b]**	**Dose (person-rem)[a]**	**Latent Cancer Fatalities[c]**
Criticality	Extremely unlikely	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	Extremely unlikely	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	Unlikely	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	Unlikely	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	Extremely unlikely	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	Unlikely	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	Beyond extremely unlikely	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	Extremely unlikely to beyond extremely unlikely	6.5×10^{2}	2.6×10^{-1}	1.6×10^{1}	8.2×10^{-3}	2.1×10^{3}	1.0

[a] For 95th percentile meteorological conditions. With the exception of doses due to criticality, the stated doses are from the inhalation of plutonium, and represent dose commitments that would be received over the lifetime of the impacted individual. See Appendix K.1.4.2 for a more detailed discussion of pathways.

[b] Increased likelihood (or probability) of cancer fatality for 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 for a hypothetical individual in the offsite population at the site boundary) if exposed to the indicated dose. The value that assumes that the accident has occurred.

[c] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km (50 mi) on exposure to the indicated dose. The value assumes that the accident has occurred.

Key: DWPF, Defense Waste Processing Facility; FPF, Fuel Processing Facility.

Source: Calculated using the source terms in Table K–9 and the MACCS2 computer code.

emergency management program that would be activated in the event of an accident. Based on the decisions made in the SPD EIS ROD, site emergency management programs would be modified to consider new accidents not in the current program.

Nonradiological Accidents. Surplus plutonium disposition operations at INEEL and SRS could result in worker injuries and fatalities. DOE-required industrial safety programs would be in place to reduce the risks. Given the estimated employment of 11,115 person-years of labor and the standard DOE occupational accident rates, approximately 400 cases of nonfatal occupational injury or illness and 0.30 fatality could be expected for the duration of operations.

4.14.2.6 Transportation

Operational transportation impacts may be divided into two parts: impacts due to incident-free transportation and those due to transportation accidents. They may be further divided into nonradiological and radiological impacts. Nonradiological impacts are specifically vehicular, such as vehicular emissions and traffic accidents. Radiological impacts are those related to the dose received by transportation workers and the public during normal operations and in the case of accidents in which the radioactive materials being shipped may be released. For more detailed information on the transportation analysis performed for this SPD EIS, see Appendix L.

Under Alternative 7, transportation to and from INEEL would include the shipment of plutonium pits and clean plutonium metal via SST/SGT from sites throughout the DOE complex to the pit conversion facility.[20] During dismantlement of the pits, some HEU would be recovered. The pit conversion facility would ship HEU via SST/SGT to the Oak Ridge Reservation (ORR) for storage.[21] After conversion, the plutonium in the pit conversion facility would be in the form of plutonium dioxide. This material would be transferred through a secure tunnel to the MOX facility at INEEL for fabrication into MOX fuel pellets.

MOX fuel fabrication also requires uranium dioxide. Quantifying the uranium dioxide transportation requirements for this SPD EIS involved selecting representative sites for the source of the depleted uranium hexafluoride and the conversion facility. A DOE enrichment facility near Portsmouth, Ohio, was chosen as a representative site for the source of the depleted uranium hexafluoride, and the nuclear fuel fabrication facility in Wilmington, North Carolina, as representative of a uranium conversion facility. These sites were also used as representative sites in the *Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement* (DOE 1996e). It is assumed that depleted uranium hexafluoride needed for MOX fuel would be shipped via commercial truck to the uranium conversion facility, where it would be converted into uranium dioxide (see Section 4.3.2.6). After conversion, the depleted uranium dioxide would be shipped via commercial truck from the conversion facility to the MOX facility at INEEL. This material would be blended with plutonium dioxide at the MOX facility, fabricated into MOX fuel pellets, and placed in MOX fuel rods. After fabrication, the MOX fuel rods would be shipped to a domestic reactor site, where they would be placed in fuel assemblies and irradiated. Shipments of unirradiated MOX fuel rods would be made in an SST/SGT because unirradiated MOX fuel in large enough quantities is subject to the same security concerns as pure weapons-grade plutonium. It is assumed in this transportation analysis that all MOX fuel is shipped from the MOX facility to the most distant reactor site, North Anna.

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[20] Work is currently under way to repackage all pits at Pantex from the AL–R8 container into the AL–R8 SI container for long-term storage. The AL–R8 is not an offsite shipping container as was the AT–400A analyzed in the SPD Draft EIS. Therefore, if the decision were made to site the pit conversion facility at a site other than Pantex, the surplus pits would have to be taken out of the AL–R8 SI and placed in a yet-to-be-developed shipping container. This operation would also require the replacement of some pit-holding fixtures to meet transportation requirements. Under such alternatives, this change would result in a total repackaging exposure of 208 person-rem to Pantex personnel. An increase in worker doses of this magnitude could result in an increase in the expected number of LCFs of 8.3×10^{-2} over the life of the program.

[21] Classified nuclear material parts would also result from pit disassembly. Although current plans are to store these parts at the pit conversion facility, this SPD EIS analyzes the possible transport of these nuclear material parts to LANL. Therefore, the transportation impacts are slightly overstated.

Immobilization at SRS under this alternative would require that surplus nonpit plutonium in various forms be shipped from current storage locations (i.e., SRS, Hanford, INEEL, LLNL, LANL, and RFETS) to the immobilization facility at SRS. Even though these materials are not clean plutonium metal or pits, the quantity of the plutonium contained in them would require that they be treated as materials that could be used in nuclear weapons, and thus that shipments be made in SST/SGTs.

Under the preferred technology alternative for immobilization, the surplus plutonium would be immobilized in a ceramic matrix in small cans at the immobilization facility, placed in HLW canisters, and transported via specially designed trucks to DWPF in S-Area. This intrasite transportation—from F-Area to S-Area—could require the temporary shutdown of roads on SRS. It would, however, provide for all the necessary security and for reduced risk to the public; SST/SGTs would not be required.

Use of the preferred ceramic (versus glass) matrix for immobilization would also require a small amount of depleted uranium dioxide (i.e., less than 10 t [11 tons] per year). It is assumed that this depleted uranium dioxide would be produced and shipped in the same manner as the depleted uranium dioxide needed by the MOX facility.

After the immobilized plutonium was encased by HLW at DWPF, it would be shipped to a potential geologic repository for ultimate disposition. Because HLW would be displaced by the cans of immobilized plutonium suspended in the HLW canister, additional canisters—to accommodate the displaced HLW—would be required over the life of the immobilization program. According to estimates, up to 145 additional canisters of HLW would be needed to meet the demands of surplus plutonium disposition under Alternative 7. The *Yucca Mountain Draft EIS* evaluates different options for the shipment of these canisters to a potential geologic repository using either trucks or trains. The analysis revealed that shipment by train would pose the lower risk. However, no ROD has yet been issued regarding these shipments. To bound the risks associated with these additional shipments, this SPD EIS conservatively assumes that all of these shipments would be made by truck, one canister per truck..

Every alternative considered in this SPD EIS would require routine transportation of wastes from the proposed disposition facilities to treatment, storage, or disposal facilities on the sites. This transportation would be handled in the same manner as other site waste shipments, and as shown in Sections 4.14.1.2 and 4.14.2.2, would involve no major increase in the amounts of waste already being managed at these sites. The shipments would pose no greater risks than the ordinary waste shipments at these sites as analyzed in the WM PEIS.

In all, approximately 2,500 shipments of radioactive materials would be carried out by DOE under this alternative. The total distance traveled on public roads by trucks carrying radioactive materials would be 7.6 million km (4.7 million mi).

Impacts of Incident-Free Transportation. The dose to transportation workers from all transportation activities entailed by this alternative has been estimated at 60 person-rem; the dose to the public, 70 person-rem. Accordingly, incident-free transportation of radioactive material associated with this alternative would result in 0.024 LCF among transportation workers and 0.035 LCF in the total affected population over the duration of the transportation activities. The estimated number of nonradiological fatalities from vehicular emissions associated with this alternative is 0.032.

Impacts of Accidents During Transportation (Consequences). The maximum foreseeable offsite transportation accident under this alternative (probability of occurrence: greater than 1 in 10 million per year) is a shipment of plutonium pits from one of DOE's storage locations to the pit conversion facility with a severity category VIII accident in a rural population zone under neutral (average) weather conditions. If this accident were to occur, it could result in a dose of 87 person-rem to the public for an LCF risk of 0.044 and 96 rem to the hypothetical MEI for an LCF risk of 0.096. (The MEI receives a larger dose than the population because it is unlikely that a person would be in position, and remain in position, to receive this hypothetical maximum dose.)

No fatalities would be expected to occur. The probability of more severe accidents, different weather conditions at the time of accident, or occurrence in a more densely populated area were also evaluated, and estimated to have a probability lower than 1 chance in 10 million per year. (See Appendix L.6.)

Impacts of Accidents During Transportation (Risks). The total transportation accident risks were estimated by summing the risks to the affected population from all hypothetical accidents. For Alternative 7, those risks are as follows: a radiological dose to the population of 8 person-rem, resulting in a total population risk of 0.004 LCF; and traffic accidents resulting in 0.083 fatality.

4.14.2.7 Environmental Justice

As discussed in other parts of Section 4.14.2, routine operations conducted under Alternative 7 would pose no significant health risks to the public. The likelihood of an LCF for the MEI residing near INEEL would be approximately 1 in 10 million (see Table 4–107); the likelihood for the MEI residing near SRS would be essentially zero. The number of LCFs expected among the general population residing near INEEL and SRS from accident-free operations would increase by approximately 0.011 and 1.4×10^{-5}, respectively.

Design basis accidents at the sites would not be expected to cause cancer fatalities among the public (see Section 4.14.2.5). A beyond-design-basis earthquake would be expected to result in LCFs among the general population (see Tables 4–44, 4–45, 4–109, and 4–110). However, it is highly unlikely that a beyond-design-basis earthquake would occur. Accidents at the sites pose no significant risks (when the probability of occurrence is considered) to the population residing within the area potentially affected by radiological contamination.

As described in Section 4.14.2.6, no radiological or nonradiological fatalities would be expected to result from accident-free transportation conducted under this alternative. Nor would radiological or nonradiological fatalities be expected to result from transportation accidents.

Thus, implementation of Alternative 7 would pose no significant risks to the public, nor would implementation of this alternative pose significant risks to groups within the public, including the risk of disproportionately high and adverse effects on minority and low-income populations.

4.15 [Section deleted because alternative deleted.]

4.16 ALTERNATIVE 8

Alternative 8 would involve constructing and operating the pit conversion and MOX facilities at INEEL and the immobilization facility at Hanford. The pit conversion facility would be located in the existing FPF building, and the MOX facility would be located in a new building. The immobilization facility would be located in the existing FMEF building in the 400 Area. Activities at INEEL would be the same as under Alternative 7.

4.16.1 Construction

4.16.1.1 Air Quality and Noise

Potential air quality impacts of construction under Alternative 8 at INEEL are the same as those for Alternative 7 (see Section 4.14.1.1). Noise impacts are the same as those for Alternative 7 at INEEL (see Section 4.14.1.1).

Sources of potential air quality impacts of construction under Alternative 8 at Hanford include emissions from fuel-burning construction equipment, soil disturbance by construction equipment and other vehicles, the operation of a concrete batch plant, trucks moving materials and wastes, and employee vehicles. Emissions from these sources are summarized in Appendix G.

A comparison of maximum air pollutant concentrations at Hanford, including the contribution from construction activities, with standards and guidelines is presented as Table 4–111. Concentrations of air pollutants, especially PM_{10} and total suspended particulates, would likely increase at the site boundary, but would not exceed the Federal or State ambient air quality standards. Occasional exceedances of the PM_{10} and total suspended particulates standards attributable to natural sources would be expected to continue. Air pollution impacts during construction would be mitigated by applying, as appropriate, standard dust control practices such as watering or sweeping of roads and watering of exposed areas.

Total vehicle emissions associated with activities at Hanford would likely decrease somewhat from current emissions during the planned construction period because of an expected decrease in overall site employment.

The location of these facilities at Hanford relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during construction would include heavy construction equipment, employee vehicles, and truck traffic. Traffic noise associated with the construction of these facilities would occur on the site and along offsite local and regional transportation routes used to bring construction materials and workers to the site. Given the distance to the site boundary (about 7.1 km [4.4 mi]), noise emissions from construction equipment would not be expected to annoy the public. These noise sources would be far enough away from offsite areas that the contribution to offsite noise levels would be small. Some noise sources could result in onsite impacts, such as the disturbance of wildlife. However, noise would be unlikely to affect federally listed threatened or endangered species or their critical habitats, as none are known to occur on or in the immediate vicinity of the proposed site location (see Section 4.26). Traffic associated with the construction of these facilities would likely produce less than a 1-dB increase in noise levels along roads used to access the site, and thus would not result in any increased annoyance of the public.

Construction workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (OSHA 1997). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of standard silencing packages on

Table 4–111. Evaluation of Hanford Air Pollutant Concentrations Associated With Construction Under Alternative 8: Pit Conversion in FPF and MOX in New Construction at INEEL, and Immobilization in FMEF and HLWVF at Hanford

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m^3)[a]	SPD Increment (Fg/m^3)	Total Site Concentration (Fg/m^3)	Site as a Percent of Standard or Guideline
Criteria pollutants					
Carbon monoxide	8 hours	10,000	0.324	34.4	0.34
	1 hour	40,000	2.2	50.5	0.13
Nitrogen dioxide	Annual	100	0.025	0.275	0.28
PM_{10}	Annual	50	0.00405	0.022	0.044
	24 hours	150	0.158	0.928	0.62
Sulfur dioxide	Annual	50	0.00257	1.63	3.1
	24 hours	260	0.0286	8.94	3.4
	3 hours	1,300	0.194	29.8	2.3
	1 hour	660	0.583	33.5	5.1
Other regulated pollutants					
Total suspended particulates	Annual	60	0.00405	0.022	0.037
	24 hours	150	0.158	0.928	0.62
Hazardous and other toxic compounds					
Other toxics[b]	Annual	0.12	0	0.000006	0.005

[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: FMEF, Fuels and Materials Examination Facility; FPF, Fuel Processing Facility; HLWVF, high-level-waste vitrification facility; SPD, surplus plutonium disposition.

Source: EPA 1997a; WDEC 1994.

construction equipment, administrative controls, engineering controls, and personal hearing protection equipment.

4.16.1.2 Waste Management

At INEEL, construction impacts of this alternative would be the same as for Alternative 7. See Section 4.14.1.2 for a description of the impacts of this alternative on the waste management infrastructure at INEEL.

Table 4–112 compares the wastes generated during modification of the FMEF building at Hanford with the existing treatment, storage, and disposal capacity for the various waste types.

It is anticipated that no TRU waste, LLW, or mixed LLW would be generated during the 3-year modification period. In addition, no soil contaminated with hazardous or radioactive constituents should be generated during modification. However, if any were generated, the waste would be managed in accordance with site practice and applicable Federal and State regulations. Waste generation would be the same for the ceramic and glass immobilization technologies because the same size facility would be built under either scenario. For this SPD EIS, it is assumed that hazardous waste and nonhazardous waste would be treated, stored, and disposed of in accordance with current site practices.

Table 4–112. Potential Waste Management Impacts of Construction Under Alternative 8: Immobilization in FMEF and HLWVF at Hanford

Waste Type[a]	Estimated Additional Waste Generation (m^3/yr)	Estimated Additional Waste Generation as a Percent of[b]		
		Characterization or Treatment Capacity	Storage Capacity	Disposal Capacity
Hazardous	8	NA	NA	NA
Nonhazardous				
Liquid	5,200	2[c]	NA	2[d]
Solid	430	NA	NA	NA

[a] See definitions in Appendix F.8.

[b] Treatment capacities, and the disposal capacity for nonhazardous liquid waste, are compared with estimated additional annual waste generation. All other storage and disposal capacities are compared with total estimated additional waste generation assuming a 3-year modification period.

[c] Percent of capacity of the 400 Area sanitary sewer.

[d] Percent of capacity of the Energy Northwest (formerly Washington Public Power Supply System) Sewage Treatment Facility.

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility; NA, not applicable (i.e., it is assumed that the majority of the hazardous waste and nonhazardous solid waste would be treated and disposed of off the site by the construction contractor).

Hazardous wastes generated during modification of the FMEF building at Hanford would be typical of those generated during modification of an industrial facility. Any hazardous wastes generated during modification would be packaged in DOT-approved containers and shipped off the site to permitted commercial recycling, treatment, and disposal facilities. The additional waste load generated during the modification period should not have a major impact on the Hanford hazardous waste management system.

Nonhazardous solid wastes generated during modification of the FMEF building at Hanford would be packaged in conformance with standard industrial practice and shipped to offsite commercial facilities for recycling or disposal. The additional waste load generated during the modification period should not have a major impact on the nonhazardous solid waste management system at Hanford.

To be conservative, it was assumed that all nonhazardous liquid wastes generated during modification of the FMEF building at Hanford would be managed on the site at the Energy Northwest (formerly WPPSS) Sewage Treatment Facility, even though it is likely that much of this waste would be collected in portable toilets and would be managed at offsite facilities. Nonhazardous liquid waste generated during modification is estimated to be 2 percent of the 235,000-m^3/yr (307,000-yd^3/yr) capacity of the 400 Area sanitary sewer, 2 percent of the 235,000-m^3/yr (307,000-yd^3/yr) capacity of the Energy Northwest Sewage Treatment Facility, and within the 138,000-m^3/yr (181,000-yd^3/yr) excess capacity of the Energy Northwest Sewage Treatment Facility (Mecca 1997). Therefore, management of these wastes at Hanford should not have a major impact on the nonhazardous liquid waste treatment system during the modification period.

4.16.1.3 Socioeconomics

Construction-related employment requirements for Alternative 8 would be as indicated in Table 4–113.

At its peak in 2003, construction of the pit conversion and MOX facilities at INEEL under this alternative would require 866 construction workers and generate another 884 indirect jobs in the region. The total employment requirement of 1,750 direct and indirect jobs represents only about 1.0 percent of the total projected INEEL workforce, and thus would have no major impact on the REA. It should also have little effect on community services provided within the INEEL REA. In fact, it should help offset the approximately 13 percent reduction in INEEL's total workforce (i.e., from 8,291 to 7,250 workers) projected for the years 1997–2005.

Table 4–113. Construction Employment Requirements for Alternative 8: Pit Conversion in FPF and MOX in New Construction at INEEL, and Immobilization in FMEF and HLWVF at Hanford

Year	Pit Conversion	MOX	Immobilization	Total
2001	100	0	0	100
2002	154	441	207	802
2003	94	772	376	1,242
2004	0	508	414	922
2005	0	221	226	447
2006	0	208	0	208

Key: FMEF, Fuels and Materials Examination Facility; FPF, Fuel Processing Facility; HLWVF, high-level-waste vitrification facility.
Source: DOE 1999c; UC 1998f, UC 1999a, 1999b.

At its peak in 2004, construction of the immobilization facility at Hanford would require 414 construction workers and generate another 425 indirect jobs in the region. The total employment requirement of 839 direct and indirect jobs represents 0.2 percent of the total projected REA workforce, and thus should have no major impacts on the REA. This requirement should also have little effect on community services currently offered in the ROI. In fact, it should help offset the roughly 15 percent reduction in Hanford employment (i.e., from 12,882 to 11,000 workers) projected for the years 1997–2005.

4.16.1.4 Human Health Risk

Radiological Impacts. No radiological risk would be incurred by members of the public from construction activities. A summary of radiological impacts of construction activities on workers at risk is presented in Table 4–114. According to recent radiation surveys (Mitchell et al. 1997; Antonio 1998) conducted in the INEEL INTEC area and the Hanford 400 Area, construction workers at INEEL could receive small doses above natural background radiation levels as a result of other ongoing or past activities; no doses above natural background levels would be expected at Hanford. Construction worker exposures would be limited to ensure that doses are kept as low as is reasonably achievable, and workers may be monitored (badged) as appropriate.

Table 4–114. Potential Radiological Impacts on Construction Workers of Alternative 8: Pit Conversion in FPF and MOX in New Construction at INEEL, and Immobilization in FMEF and HLWVF at Hanford

Impact	Pit Conversion[a]	MOX[b]	INEEL Total	Immobilization[c]
Total dose (person-rem/yr)	0.55	1.4	2.0	0
Annual latent fatal cancers[d]	2.2×10^{-4}	5.5×10^{-4}	7.7×10^{-4}	0
Average worker dose (mrem/yr)	4.7[e]	4.7[e]	4.7[f]	0
Annual latent fatal cancer risk	1.9×10^{-6}	1.9×10^{-6}	1.9×10^{-6}	0

[a] An estimated average of 116 workers would be associated with annual construction and modification operations.

[b] An estimated average of 292 workers would be associated with annual construction operations.

[c] An estimated average of 244 workers would be associated with annual construction and modification operations. The number would be the same for immobilization in either ceramic or glass.

[d] 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, per ICRP 1991.

[e] Value is based on the number of expected construction workdays per year and an 8-hr workday.

[f] Represents an average of doses for both facilities.

Key: FMEF, Fuels and Materials Examination Facility; FPF, Fuel Processing Facility; HLWVF, high-level-waste vitrification facility.

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: Antonio 1998; ICRP 1991; Mitchell et al. 1997; NAS 1990.

Hazardous Chemical Impacts. The probability of excess latent cancer incidence associated with exposure to benzene released as a result of construction activities at the INEEL under this alternative has been estimated to be much less than 1 chance in 1 million over the lifetime of the maximally exposed member of the public. The probability of excess latent cancer incidence associated with exposure to benzene released as a result of construction activities at Hanford under this alternative has been estimated at 5 chances in 100 million (5×10^{-11}) over the lifetime of the maximally exposed member of the public.

4.16.1.5 Facility Accidents

The construction of surplus plutonium disposition facilities at INEEL and Hanford could result in worker injuries or fatalities. DOE-required industrial safety programs would be in place to reduce the risks. Given the estimated 3,721 person-years of construction labor and standard industrial accident rates, approximately 370 cases of nonfatal occupational injury or illness and 0.52 fatality could be expected (DOL 1997a, 1997b). As all construction would be in nonradiological areas, no radiological accidents should occur.

4.16.1.6 Environmental Justice

As discussed in the other parts of Section 4.16.1, construction under Alternative 8 would pose no significant health risks to the public. The risks would be negligible regardless of the racial or ethnic composition or the economic status of the population. Therefore, construction activities under Alternative 8 at INEEL and Hanford would have no significant impacts on minority or low-income populations.

4.16.2 Operations

4.16.2.1 Air Quality and Noise

Potential air quality impacts of the operation of facilities under Alternative 8 at INEEL are the same as those for Alternative 7 (see Section 4.14.2.1). Noise impacts are the same as those for Alternative 7 at INEEL (see Section 4.14.2.1).

Potential air quality impacts of the operation of the immobilization facility under Alternative 8 at Hanford were analyzed using ISCST3. Operational impacts would result from process emissions, emergency diesel generator testing, trucks moving materials and wastes, and employee vehicles. Emissions from these sources are summarized in Appendix G.

A comparison of maximum air pollutant concentrations, including the contribution from the immobilization facility, with standards and guidelines is presented as Table 4–115. Concentrations for immobilization in the ceramic and glass forms are the same. Concentrations of air pollutants would likely increase at the site boundary, but would not exceed the Federal or State ambient air quality standards as a result of Hanford activities. Occasional exceedances of the PM_{10} and total suspended particulates standards attributable to natural sources would be expected to continue. Air pollution impacts during operation would be mitigated; for example, HEPA filtration has been included in the design of the facility.

For a discussion of how the operation of the immobilization facility at Hanford would affect the ability to continue to meet NESHAPs limits regarding airborne radiological emissions, see Section 4.32.1.4. There are no other NESHAPs limits applicable to operation of this facility.

Table 4–115. Evaluation of Hanford Air Pollutant Concentrations Associated With Operations Under Alternative 8: Pit Conversion in FPF and MOX in New Construction at INEEL, and Immobilization in FMEF and HLWVF at Hanford

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m^3)[a]	SPD Increment (Fg/m^3)	Total Site Concentration (Fg/m^3)	Site as a Percent of Standard or Guideline
Criteria pollutants					
Carbon monoxide	8 hours	10,000	0.271	34.4	0.34
	1 hour	40,000	1.84	50.1	0.13
Nitrogen dioxide	Annual	100	0.0376	0.288	0.29
PM_{10}	Annual	50	0.00265	0.021	0.041
	24 hours	150	0.0295	0.799	0.53
Sulfur dioxide	Annual	50	0.00249	1.63	3.1
	24 hours	260	0.0277	8.94	3.4
	3 hours	1,300	0.188	29.8	2.3
	1 hour	660	0.564	33.5	5.1
Other regulated pollutants					
Total suspended particulates	Annual	60	0.00265	0.021	0.034
	24 hours	150	0.0295	0.799	0.53
[Text deleted.]					

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

Key: FMEF, Fuels and Materials Examination Facility; FPF, Fuel Processing Facility; HLWVF, high-level-waste vitrification facility; SPD, surplus plutonium disposition.

Note: No nonradiological hazardous or other toxic compounds would be emitted from these processes.

Source: EPA 1997a; WDEC 1994.

The increases in concentrations of nitrogen dioxide, PM_{10}, and sulfur dioxide from the operation of the immobilization facility would be a small fraction of the PSD Class II area increments as summarized in Table 4–116.

Table 4–116. Evaluation of Hanford Air Pollutant Increases Associated With Operations Under Alternative 8: Pit Conversion in FPF and MOX in New Construction at INEEL, and Immobilization in FMEF and HLWVF at Hanford

Pollutant	Averaging Period	Increase in Concentration (Fg/m^3)	PSD Class II Area Allowable Increment (Fg/m^3)	Percent of Increment
Nitrogen dioxide	Annual	0.0376	25	0.15
PM_{10}	Annual	0.00265	17	0.016
	24 hours	0.0295	30	0.098
Sulfur dioxide	Annual	0.00249	20	0.012
	24 hours	0.0277	91	0.03
	3 hours	0.188	512	0.037

Key: FMEF, Fuels and Materials Examination Facility; FPF, Fuel Processing Facility; HLWVF, high-level-waste vitrification facility; PSD, prevention of significant deterioration.

Source: EPA 1997b.

Total vehicle emissions associated with activities at Hanford would likely decrease somewhat because of an expected decrease in overall site employment during this timeframe.

The location of the facility at Hanford relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during operations would include new or existing sources (e.g., cooling systems, vents, motors, material-handling equipment), employee vehicles, and truck traffic. Traffic noise associated with operation of this facility would occur on the site and along offsite local and regional transportation routes used to bring materials and workers to the site. Given the distance to the site boundary (about 7.1 km [4.4 mi]), noise emissions from equipment would not likely annoy the public. These noise sources would be far enough away from offsite areas that their contribution to offsite noise levels would be small. Some noise sources could have onsite impacts, such as the disturbance of wildlife. However, noise would be unlikely to affect federally listed threatened or endangered species or their critical habitats, as none are known to occur on or in the immediate vicinity of the proposed site location (see Section 4.26). Noise from traffic associated with operation of this facility would likely produce less than a 1-dB increase in traffic noise levels along roads used to access the site, and thus would not result in any increased annoyance of the public.

Operations workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (OSHA 1997). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of administrative controls, engineering controls, and personal hearing protection equipment.

The combustion of fossil fuels associated with Alternative 8 would result in the emission of carbon dioxide, one of the atmospheric gases that are believed to influence the global climate. Annual carbon dioxide emissions from this alternative would represent less than 2×10^{-4} percent of the 1995 annual U.S. emissions of carbon dioxide from fossil fuel combustion and industrial processes, and therefore would not appreciably affect global concentrations of this pollutant.

4.16.2.2 Waste Management

At INEEL, impacts of operations for this alternative would be the same as for Alternative 7. See Section 4.14.2.2 for a description of the impacts of this alternative on the waste management infrastructure at INEEL.

Table 4–117 compares the existing site treatment, storage, and disposal capacities with the expected waste generation rates from operating surplus plutonium disposition facilities at Hanford. Although HLW would be used in the immobilization process, no HLW would be generated by surplus plutonium disposition facilities. Waste generation at Hanford should be the same for the ceramic and glass immobilization technologies.

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. According to 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. 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, in order to be conservative, it is assumed the TRU waste would be stored on the site until 2016. 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 Hanford will be evaluated in the *Hanford Site Solid (Radioactive and Hazardous) Waste Program EIS* that is being prepared by the DOE Richland Operations Office (DOE 1997b).

Table 4–117. Potential Waste Management Impacts of Operations Under Alternative 8: Immobilization in FMEF and HLWVF at Hanford

Waste Type[a]	Estimated Additional Waste Generation (m^3/yr)	Estimated Additional Waste Generation as a Percent of[b]		
		Characterization or Treatment Capacity	Storage Capacity	Disposal Capacity
TRU[c]	95	5	6	1 of WIPP
LLW	80	NA	NA	<1
Mixed LLW	1	<1	<1	<1
Hazardous	75	NA	NA	NA
Nonhazardous				
Liquid	40,000	17[d]	NA	17[e]
Solid	340	NA	NA	NA

[a] See definitions in Appendix F.8.

[b] Treatment capacities, and the disposal capacity for nonhazardous liquid waste, are compared with estimated additional annual waste generation. All other storage and disposal capacities are compared with total estimated additional waste generation assuming a 10-year operation period.

[c] Includes mixed TRU waste. Facilities are not expected to generate remotely handled TRU waste.

[d] Percent of capacity of the 400 Area sanitary sewer.

[e] Percent of capacity of the Energy Northwest (formerly Washington Public Power Supply System) Sewage Treatment Facility.

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility; LLW, low-level waste; NA, not applicable (i.e., the majority of this waste is not routinely treated, stored, or disposed of on the site); TRU, transuranic.

TRU wastes would be treated, packaged, and certified to WIPP waste acceptance criteria at the new facilities. 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.

TRU waste generated at the immobilization facility at Hanford is estimated to be 5 percent of the 1,820-m^3/yr (2,380-yd^3/yr) capacity of the Waste Receiving and Processing Facility. A total of 950-m^3 (1,240-yd^3) TRU waste would be generated over the 10-year operation period. If all the TRU waste were stored on the site, this would be 6 percent of the 17,000-m^3 (22,200-yd^3) storage capacity available at Hanford. Assuming that the waste were stored in 208-l (55-gal) drums that could be stacked two high, and allowing a 50 percent factor for aisle space, a storage area of about 0.14 ha (0.35 acre) would be required. Therefore, impacts of the management of additional quantities of TRU waste at Hanford should not be major. Impacts from the treatment of TRU waste to WIPP waste acceptance criteria are described in the WM PEIS (DOE 1997d).

The 1,810 m^3 (2,367 yd^3) of TRU wastes generated at INEEL and Hanford would be 1 percent of the 143,000-m^3 (187,000-yd^3) contact-handled TRU waste that DOE plans to dispose of at WIPP and 1 percent of the current 168,500-m^3 (220,400-yd^3) limit for WIPP (DOE 1997e:3-3). Impacts of disposal of TRU waste at WIPP are described in the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997e).

At Hanford, LLW would be packaged, certified, and accumulated at the immobilization facility before transfer for additional treatment and disposal in existing onsite facilities. A total of 800-m^3 (1,050-yd^3) LLW would be generated over the operations period. LLW generated at surplus plutonium disposition facilities is estimated to be less than 1 percent of the 1.74 million-m^3 (2.28 million-yd^3) 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 disposal land usage factor for Hanford published in the *Storage and Disposition Final PEIS* (DOE 1996a:E-9), 600 m^3 (780 yd^3) of waste would require 0.23 ha (0.57 acre) of disposal space at Hanford. Therefore, impacts of the management of this additional LLW at Hanford should not be major.

At Hanford, mixed LLW would be stabilized, packaged, and stored on the site for treatment and disposal in a manner consistent with the site treatment plan. Mixed LLW generated at the immobilization facility is estimated to be less than 1 percent of the 1,820-m^3/yr (2,380-yd^3/yr) capacity of the Waste Receiving and Processing Facility, less than 1 percent of the 16,800-m^3 (22,000-yd^3) capacity of the Central Waste Complex, and less than 1 percent of the 14,200-m^3 (18,600-yd^3) planned disposal capacity of 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. If all TRU waste and mixed LLW generated at surplus plutonium disposition facilities at Hanford were processed in the Waste Receiving and Processing Facility, this additional waste would be 5 percent of the 1,820-m^3/yr (2,380-yd^3/yr) capacity of that facility.

At Hanford, any hazardous wastes generated during operation of the immobilization facility would be packaged in DOT-approved containers and shipped off the site to permitted commercial recycling, treatment, and disposal facilities. The additional waste load generated during the operations period should not have a major impact on Hanford hazardous waste management system.

Nonhazardous solid waste would be packaged and transported 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 for offsite disposal. It is unlikely that this additional waste load would have a major impact on the nonhazardous solid waste management system at Hanford.

At Hanford, nonhazardous wastewater generated by the immobilization facility would be treated if necessary before being discharged to the 400 Area sanitary sewer system, which connects to the Energy Northwest (formerly WPPSS) Sewage Treatment Facility. Nonhazardous liquid waste generated by the immobilization facility at Hanford is estimated to be 17 percent of the 235,000-m^3/yr (307,000-yd^3/yr) capacity of the 400 Area sanitary sewer, 17 percent of the 235,000-m^3/yr (307,000-yd^3/yr) capacity of the Energy Northwest Sewage Treatment Facility, and within the 138,000-m^3/yr (181,000-yd^3/yr) excess capacity of the Energy Northwest Sewage Treatment Facility (Mecca 1997). Therefore, management of nonhazardous liquid waste at Hanford should not have a major impact on the treatment system.

4.16.2.3 Socioeconomics

After construction, startup, and testing of the pit conversion and the MOX facilities at INEEL in 2007 under Alternative 8, an estimated 743 new workers would be required to operate them (DOE 1999c; UC 1998f). This employment level should generate another 1,990 indirect jobs within the region. As this total employment requirement of 2,733 direct and indirect jobs represents about 1.6 percent of the total projected REA workforce, it should have no major impact on the REA. It should also have a negligible effect on community services provided within the INEEL ROI. In fact, it should help to offset the 13 percent decline in INEEL's total workforce (i.e., from 8,291 to 7,250 workers) projected for the years 1997–2010.

After construction, startup, and testing of the immobilization facility at Hanford in 2006 under Alternative 8, an estimated 335 new workers would be required to operate it (UC 1999a, 1999b). This level of employment should generate another 848 related jobs in the region. The total employment requirement of 1,183 direct and indirect jobs represents less than 0.3 percent of the projected REA workforce, and should have no major impact on the REA. Some of the new jobs created under this alternative would be filled from the ranks of the unemployed, currently 11 percent of the REA's population.

In the ROI, however, this employment requirement could have minor impacts on community services, for it should coincide with an overall increase in site employment in connection with construction of the tank waste remediation system. Assuming that 91 percent of the new employees associated with this alternative resided in the ROI, an increase of 1,077 new jobs in the projected workforce would precipitate an overall population increase of approximately 1,998 persons. This increase, in conjunction with the population growth forecast by the State of Washington, would engender increased construction of local housing units. Given the current population-to-student ratio in the ROI, a population increase of this size would be expected to include 413 new students, and local school districts would have to increase the number of classrooms to accommodate them.

Community services in the ROI would be expected to change to reflect the population growth as follows: 26 teachers would be added to maintain the current student-to-teacher ratio of 16:1; 3 police officers would be added to maintain the current officer-to-population ratio of 1.5:1,000; 7 firefighters would be added to maintain the current firefighter-to-population ratio of 3.4:1,000; and 3 physicians would be added to maintain the current physician-to-population ratio of 1.4:1,000. Thus, an additional 38 positions would have to be created to maintain community services at current levels. The ratio of hospital beds to population in the ROI would remain at 2.1 beds per 1,000 persons. However, average school enrollment would increase to 93.3 percent from the current rate of 92.5 percent unless additional classrooms were built. None of the projected changes should have a major impact on the level of community services currently being offered in the ROI.

4.16.2.4 Human Health Risk

During normal operations, there would be both radiological and hazardous chemical releases to the environment, and also direct in-plant exposures. The resulting doses to, and potential health effects on, the public and workers under Alternative 8 would be as follows.

Radiological Impacts. Table 4–118 reflects the potential radiological impacts on three individual receptor groups at INEEL and Hanford: the population living within 80 km (50 mi) in the year 2010, the maximally exposed member of the public, and the average exposed member of the public. The table depicts the projected aggregate LCF risk to these groups from 10 years of incident-free operation. To put operational doses into perspective, comparisons with doses from natural background radiation are also provided in the table.

Given incident-free operation of all three facilities, the total population dose in the year 2010 would be 2.2 person-rem at INEEL and 7.8×10^{-3} person-rem at Hanford. The corresponding number of LCFs in the population from 10 years of operation would be 0.011 around INEEL and 3.9×10^{-5} around Hanford. The total dose to the maximally exposed member of the public from annual operation of the pit conversion and MOX facilities at INEEL would be 0.018 mrem. From 10 years of operation, the corresponding LCF risk to this individual would be 9.1×10^{-8}. The impacts on the average individual would be lower. The dose to the maximally exposed member of the public from annual operation of the immobilization facility at Hanford would be 1.1×10^{-4} mrem. From 10 years of operation, the corresponding LCF risk to this individual would be 5.5×10^{-10}. The impacts on the average individual would be lower.

Estimated impacts resulting from "Total Site" operations are given in the Cumulative Impacts section of this SPD EIS (see Section 4.32). Within that section, projected incremental impacts associated with the operation of the proposed surplus plutonium disposition facilities are added to the impacts of other past, present, and reasonably foreseeable future actions at or near the candidate sites. These impacts are then compared against applicable regulatory standards established by DOE, EPA, and NRC (such as DOE Order 5400.5, the CAA [NESHAPs], the SDWA, and 10 CFR 20).

Doses to involved workers from normal operations are given in Table 4–119; these workers are defined as those directly associated with process activities. Under this alternative, the annual average dose to pit conversion and MOX facility workers would be 500 mrem and 65 mrem, respectively; to immobilization facility workers;

750 mrem. The annual dose received by the total site workforce for each of these facilities has been estimated at 170, 22, and 242 person-rem, respectively. The risks and numbers of LCFs among the

Table 4–118. Potential Radiological Impacts on the Public of Operations Under Alternative 8: Pit Conversion in FPF and MOX in New Construction at INEEL, and Immobilization in FMEF and HLWVF at Hanford

Impact	Pit Conversion	MOX[a]	INEEL Total	Immobilization Ceramic	Immobilization Glass
Population within 80 km for year 2010					
Dose (person-rem)	2.2	0.037	2.2	7.8×10^{-3}	7.1×10^{-3}
Percent of natural background[b]	3.3×10^{-3}	5.6×10^{-5}	3.3×10^{-3}	6.7×10^{-6}	6.1×10^{-6}
10-year latent fatal cancers	0.011	1.9×10^{-4}	0.011	3.9×10^{-5}	3.6×10^{-5}
Maximally exposed individual					
Annual dose (mrem)	0.015	3.2×10^{-3}	0.018	1.1×10^{-4}	9.7×10^{-5}
Percent of natural background[b]	4.2×10^{-3}	8.8×10^{-4}	5.1×10^{-3}	3.7×10^{-5}	3.2×10^{-5}
10-year latent fatal cancer risk	7.5×10^{-8}	1.6×10^{-8}	9.1×10^{-8}	5.5×10^{-10}	4.9×10^{-10}
Average exposed individual within 80 km[c]					
Annual dose (mrem)	0.012	2.1×10^{-4}	0.012	2.0×10^{-5}	1.8×10^{-5}
10-year latent fatal cancer risk	6.0×10^{-8}	1.0×10^{-9}	6.1×10^{-8}	1.0×10^{-10}	9.0×10^{-11}

[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. 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 INEEL (182,800) and Hanford (387,800) in 2010.

Key: FMEF, Fuels and Materials Examination Facility; FPF, Fuel Processing Facility; HLWVF, high-level-waste vitrification facility.

Source: Appendix J.

different workers from 10 years of operation are included in Table 4–119. Doses to individual workers would be kept to minimal levels by instituting badged monitoring, administrative limits, and ALARA programs (which would include worker rotations).

Table 4–119. Potential Radiological Impacts on Involved Workers of Operations Under Alternative 8: Pit Conversion in FPF and MOX in New Construction at INEEL, and Immobilization in FMEF and HLWVF at Hanford

Impact	Pit Conversion	MOX	INEEL Total	Immobilization (Ceramic or Glass)
Number of badged workers	341	331	672	323
Total dose (person-rem/yr)	170	22	192	242
10-year latent fatal cancers	0.68	0.088	0.77	0.97
Average worker dose (mrem/yr)	500	65	286[a]	750
10-year latent fatal cancer risk	2.0×10^{-3}	2.6×10^{-4}	1.1×10^{-3}	3.0×10^{-3}

[a] Represents an average of the doses for both facilities.

Key: FMEF, Fuels and Materials Examination Facility; FPF, Fuel Processing Facility; HLWVF, high-level-waste vitrification facility.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995d and NRC 1999a). 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 1994a). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1999c; UC 1998f, 1998g, 1999a, 1999b.

Hazardous Chemical Impacts. No hazardous chemicals would be released as a result of operations at INEEL under this alternative; thus, no cancer or adverse, noncancer health effects would occur. No carcinogenic chemicals would be released as a result of operations.

No hazardous chemicals would be released as a result of operations at Hanford under this alternative; thus, no cancer or adverse noncancer health effects would occur.

4.16.2.5 Facility Accidents

The potential consequences of postulated bounding facility accidents from operation of the pit conversion and MOX facilities at INEEL are equivalent to those included in Alternative 7 (see Tables 4–109 and 4–110), and the potential consequences from operation of the immobilization facility at Hanford, equivalent to those included in Alternative 2 (see Tables 4–31 and 4–32). More details on the method of analysis, assumptions, and specific accident scenarios are presented in the discussion of Alternative 2 in Section 4.3.2.5.

Public. The most severe consequences of a design basis accident for the pit conversion facility in FPF and the MOX facility at INEEL are discussed in Section 4.14.2.5. A nuclear criticality of 10^{19} fissions in the immobilization facility at Hanford would result in an MEI dose of 3.4×10^{-3} rem, corresponding to an LCF probability of 1.7×10^{-6}. Among the general population in the environs of Hanford, an estimated 2.7×10^{-3} LCF could occur as a result of this criticality accident. The frequency of such an accident at Hanford is estimated to be between 1 in 10,000 and 1 in 1,000,000 per year.

A beyond-design-basis earthquake at Hanford could result in total collapse of the immobilization facility, with up to an estimated 7.1 LCFs (as described in Section 4.3.2.5). It should be emphasized that a seismic event of sufficient magnitude to collapse these facilities would likely cause the collapse of other DOE facilities, and would almost certainly cause widespread failure of homes, office buildings, and other structures in the surrounding area. The overall impact of such an event must therefore be seen in the context not only of the potential radiological impacts of these other facilities, but of hundreds, possibly thousands, of immediate fatalities from falling debris. The frequency of an earthquake of this magnitude at Hanford is estimated to be between 1 in 100,000 and 1 in 10,000,000 per year.

The beyond-design-basis accident at INEEL would be equivalent to that discussed in Section 4.14.2.5.

Noninvolved Worker. Consistent with the analysis presented in the *Storage and Disposition Final PEIS*, the noninvolved worker is a hypothetical individual working on the site but not involved in the proposed action, and assumed to be 1,000 m (3,281 ft) from the location of the accident or at the site boundary, whichever is closer, and downwind from that location. The consequences for this worker were estimated to be highest for the criticality at the MOX facility. The consequences of such an accident would include an LCF probability of 3.0×10^{-4}.

Maximally Exposed Involved Worker. 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 either be able to evacuate immediately or would not be affected by the events. Explosions could result in immediate injuries from flying debris, as well as the uptake of plutonium and uranium particulates through inhalation. If a criticality occurred, workers within tens of meters could receive very high to fatal radiation exposures from the initial 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 accident. The design basis and beyond-design-basis earthquakes would also have substantial consequences, ranging from workers being killed by debris from collapsing equipment and structures to high radiation exposures and uptakes of radionuclides. For most accidents, immediate emergency response actions should reduce the consequences to workers near the accident. As discussed in the Emergency Preparedness sections of Chapter 3, each candidate site has an established emergency management program that would be activated in the event of an accident. Based on the decisions made in the SPD EIS ROD, site emergency management programs would be modified to consider new accidents not in the current program.

Nonradiological Accidents. Surplus plutonium disposition operation activities at INEEL and Hanford could result in worker injuries and fatalities. DOE-required industrial safety programs would be in place to reduce the risks. Given the estimated employment of 11,115 person-years of labor and the standard DOE occupational accident rates, approximately 400 cases of nonfatal occupational injury or illness and 0.30 fatality could be expected for the duration of operations.

4.16.2.6 Transportation

Operational transportation impacts may be divided into two parts: impacts due to incident-free transportation and those due to transportation accidents. They may be further divided into nonradiological and radiological impacts. Nonradiological impacts are specifically vehicular, such as vehicular emissions and traffic accidents. Radiological impacts are those related to the dose received by transportation workers and the public during normal operations and in the case of accidents in which the radioactive materials being shipped may be released. For more detailed information on the transportation analysis performed for this SPD EIS, see Appendix L.

Under Alternative 8, transportation to and from INEEL would include the shipment of plutonium pits and clean plutonium metal via SST/SGT from sites throughout the DOE complex to the pit conversion facility.[22] During dismantlement of the pits, some HEU would be recovered. The pit conversion facility would ship HEU via

[22] Work is currently under way to repackage all pits at Pantex from the AL–R8 container into the AL–R8 SI container for long-term storage. The AL–R8 is not an offsite shipping container as was the AT–400A analyzed in the SPD Draft EIS. Therefore, if the decision were made to site the pit conversion facility at a site other than Pantex, the surplus pits would have to be taken out of the AL–R8 SI and placed in a yet-to-be-developed shipping container. This operation would also require the replacement of some pit-holding fixtures to meet transportation requirements. Under such alternatives, this change would result in a total repackaging exposure of 208 person-rem to Pantex personnel. An increase in worker doses of this magnitude could result in an increase in the expected number of LCFs of 8.3×10^{-2} over the life of the program.

SST/SGT to ORR for storage.[23] After conversion, the plutonium in the pit conversion facility would be in the form of plutonium dioxide. This material would be transferred through a secure tunnel to the MOX facility at INEEL for fabrication into MOX fuel pellets.

MOX fuel fabrication also requires uranium dioxide. Quantifying the uranium dioxide transportation requirements for this SPD EIS involved selecting representative sites for the source of the depleted uranium hexafluoride and the conversion facility. A DOE enrichment facility near Portsmouth, Ohio, was chosen as a representative site for the source of the depleted uranium hexafluoride, and the nuclear fuel fabrication facility in Wilmington, North Carolina, as representative of a uranium conversion facility. These sites were also used as representative sites in the *Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement* (DOE 1996e). It is assumed that depleted uranium hexafluoride needed for MOX fuel would be shipped via commercial truck to the uranium conversion facility, where it would be converted into uranium dioxide (see Section 4.3.2.6). After conversion, the depleted uranium dioxide would be shipped via commercial truck from the conversion facility to the MOX facility at INEEL. This material would be blended with plutonium dioxide at the MOX facility, fabricated into MOX fuel pellets, and placed in MOX fuel rods. After fabrication, the MOX fuel rods would be shipped to a domestic reactor site, where they would be placed in fuel assemblies and irradiated. Shipments of unirradiated MOX fuel rods would be made in an SST/SGT because unirradiated MOX fuel in large enough quantities is subject to the same security concerns as pure weapons-grade plutonium. It is assumed in this transportation analysis that all MOX fuel is shipped from the MOX facility to the most distant reactor site, North Anna.

Immobilization at Hanford under this alternative would require that surplus nonpit plutonium in various forms be shipped from current storage locations (i.e., SRS, Hanford, INEEL, LLNL, LANL, and RFETS) to the immobilization facility at Hanford. Even though these materials are not clean plutonium metal or pits, the quantity of the plutonium contained in them would require that they be treated as materials that could be used in nuclear weapons, and thus that shipments be made in SST/SGTs.

Under the preferred technology alternative for immobilization, the surplus plutonium would be immobilized in a ceramic matrix in small cans at the immobilization facility, placed in HLW canisters, and transported via specially designed trucks to HLWVF in 200 Area. This intrasite transportation—from 400 Area to 200 Area—could require the temporary shutdown of roads on Hanford. It would, however, provide for all the necessary security and for reduced risk to the public; SST/SGTs would not be required.

Use of the preferred ceramic (versus glass) matrix for immobilization would also require a small amount of depleted uranium dioxide (i.e., less than 10 t [11 tons] per year). It is assumed that this depleted uranium dioxide would be produced and shipped in the same manner as the depleted uranium dioxide needed by the MOX facility.

After the immobilized plutonium was encased by HLW at HLWVF, it would be shipped to a potential geologic repository for ultimate disposition. Because HLW would be displaced by the cans of immobilized plutonium suspended in the HLW canister, additional canisters—to accommodate the displaced HLW—would be required over the life of the immobilization program. According to estimates, up to 145 additional canisters of HLW would be needed to meet the demands of surplus plutonium disposition under Alternative 8. The *Yucca Mountain Draft EIS* evaluates different options for the shipment of these canisters to a potential geologic repository using either trucks or trains. The analysis revealed that shipment by train would pose the lower risk. However, no ROD has yet been issued regarding these shipments. To bound the risks associated with these additional shipments, this SPD EIS conservatively assumes that all of these shipments would be made by truck, one canister per truck.

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[23] Classified nuclear material parts would also result from pit disassembly. Although current plans are to store these parts at the pit conversion facility, this SPD EIS analyzes the possible transport of these nuclear material parts to LANL. Therefore, the transportation impacts are slightly overstated.

Every alternative considered in this SPD EIS would require routine transportation of wastes from the proposed disposition facilities to treatment, storage, or disposal facilities on the sites. This transportation would be handled in the same manner as other site waste shipments, and as shown in Sections 4.16.1.2 and 4.16.2.2, would involve no major increase in the amounts of waste already being managed at these sites. The shipments would pose no greater risks than the ordinary waste shipments at these sites as analyzed in the WM PEIS.

In all, approximately 2,400 shipments of radioactive materials would be carried out by DOE under this alternative. The total distance traveled on public roads by trucks carrying radioactive materials would be 6.4 million km (3.9 million mi).

Impacts of Incident-Free Transportation. The dose to transportation workers from all transportation activities entailed by this alternative has been estimated at 30 person-rem; the dose to the public, 40 person-rem. Accordingly, incident-free transportation of radioactive material associated with this alternative would result in 0.012 LCF among transportation workers and 0.020 LCF in the total affected population over the duration of the transportation activities. The estimated number of nonradiological fatalities from vehicular emissions associated with this alternative is 0.024.

Impacts of Accidents During Transportation (Consequences). The maximum foreseeable offsite transportation accident under this alternative (probability of occurrence: greater than 1 in 10 million per year) is a shipment of plutonium pits from one of DOE's storage locations to the pit conversion facility with a severity category VIII accident in a rural population zone under neutral (average) weather conditions. If this accident were to occur, it could result in a dose of 87 person-rem to the public for an LCF risk of 0.044 and 96 rem to the hypothetical MEI for an LCF risk of 0.096. (The MEI receives a larger dose than the population because it is unlikely that a person would be in position, and remain in position, to receive this hypothetical maximum dose.) No fatalities would be expected to occur. The probability of more severe accidents, different weather conditions at the time of accident, or occurrence in a more densely populated area were also evaluated, and estimated to have a probability lower than 1 chance in 10 million per year. (See Appendix L.6.)

Impacts of Accidents During Transportation (Risks). The total transportation accident risks were estimated by summing the risks to the affected population from hypothetical accidents. For Alternative 8, those risks are as follows: a radiological dose to the population of 7 person-rem, resulting in a total population risk of 0.003 LCF; and traffic accidents resulting in 0.065 fatality.

4.16.2.7 Environmental Justice

As discussed in other parts of Section 4.16.2, routine operations conducted under Alternative 8 would pose no significant health risks to the public. The likelihood of an LCF for the MEI residing near INEEL would be approximately 1 in 10 million (see Table 4–118); the likelihood for the MEI residing near Hanford would be essentially zero. The number of LCFs expected among the general population residing near INEEL and Hanford from accident-free operations would increase by approximately 0.011 and 3.9×10^{-5}, respectively.

Design basis accidents at the sites would not be expected to cause cancer fatalities among the public (see Section 4.16.2.5). A beyond-design-basis earthquake would be expected to result in LCFs among the general population (see Tables 4–31, 4–32, 4–109, and 4–110). However, it is highly unlikely that a beyond-design-basis earthquake would occur. Accidents at the sites pose no significant risks (when the probability of occurrence is considered) to the population residing within the area potentially affected by radiological contamination.

As described in Section 4.16.2.6, no radiological or nonradiological fatalities would be expected to result from accident-free transportation conducted under this alternative. Nor would radiological or nonradiological fatalities be expected to result from transportation accidents.

Thus, implementation of Alternative 8 would pose no significant risks to the public, nor would implementation of this alternative pose significant risks to groups within the public, including the risk of disproportionately high and adverse effects on minority and low-income populations.

4.17 ALTERNATIVE 9

Alternative 9 would involve constructing and operating the pit conversion and MOX facilities in Zone 4 West at Pantex and the immobilization facility in a new building in F-Area at SRS. Activities at SRS would be the same as under Alternative 6A.

4.17.1 Construction

4.17.1.1 Air Quality and Noise

Sources of potential air quality impacts of construction under Alternative 9 at Pantex include emissions from fuel-burning construction equipment, soil disturbance by construction equipment and other vehicles, the operation of a concrete batch plant, trucks moving materials and wastes, and employee vehicles. Emissions from these sources are summarized in Appendix G.

A comparison of maximum air pollutant concentrations, including the contribution from Pantex construction activities, with standards and guidelines is presented as Table 4–120. Concentrations of air pollutants, especially PM_{10} and total suspended particulates, would likely increase at the site boundary. The modeling results indicate that total suspended particulate matter concentrations could exceed the State 1-hr ambient air quality standard. Actual short-term concentrations of particulate matter are expected to be lower than those estimated because the concentrations were based on very conservative emission factors for heavy construction activities. Concentrations of other air pollutants would not exceed the Federal or State ambient air quality standards. The concentrations of toxic air pollutants such as benzene show little change from No Action (see the discussion of these concentrations in Section 4.2.1.3). Air pollution impacts during construction would be mitigated by applying, as appropriate, standard dust control practices such as watering or sweeping of roads and watering of exposed areas.

Total vehicle emissions associated with activities at Pantex would likely decrease somewhat from current emissions because of an expected decrease in overall site employment during this timeframe.

The location of these facilities at Pantex relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during construction would include heavy construction equipment, employee vehicles, and truck traffic. Traffic noise associated with the construction of these facilities would occur on the site and along offsite local and regional transportation routes used to bring construction materials and workers to the site. Given the distance to the site boundary (about 1.6 km [1.0 mi]), noise emissions from construction equipment would not be expected to annoy the public. These noise sources would be far enough away from offsite areas that the contribution to offsite noise levels would be small. Some noise sources could result in onsite impacts, such as the disturbance of wildlife. However, noise would be unlikely to affect federally listed threatened or endangered species or their critical habitats, as none are known to occur on or in the immediate vicinity of the proposed site location (see Section 4.26). Traffic associated with the construction of these facilities would likely produce less than a 2-dB increase in traffic noise levels along roads used to access the site, and thus would not result in increased annoyance of the public.

Construction workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (OSHA 1997). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of standard silencing packages on construction equipment, administrative controls, engineering controls, and personal hearing protection equipment.

Table 4–120. Evaluation of Pantex Air Pollutant Concentrations Associated With Construction Under Alternative 9: Pit Conversion and MOX in New Construction at Pantex, and Immobilization in New Construction and DWPF at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m^3)[a]	SPD Increment (Fg/m^3)	Total Site Concentration (Fg/m^3)	Site as a Percent of Standard or Guideline
Criteria pollutants					
Carbon monoxide	8 hours	10,000	6.03	626	6.3
	1 hour	40,000	37.6	3,030	7.6
Nitrogen dioxide	Annual	100	0.675	2.62	2.6
PM_{10}	Annual	50	0.503	9.29	19
	24 hours	150	11.5	101	67
Sulfur dioxide	Annual	80	0.0501	0.0501	0.063
	24 hours	365	0.602	0.602	0.17
	3 hours	1,300	2.63	2.63	0.2
	30 minutes	1,048	10.7	10.7	1
Other regulated pollutants					
Total suspended particulates	3 hours	200	100	100[b]	50
	1 hour	400	409	410[b]	102
Hazardous and other toxic compounds					
Other toxics[c]	Annual	3[d]	0.0000162	0.0547	1.8
	1 hour	75[d]	0.0162	19.4	26

[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 are not listed for existing sources in the source document. Only the contribution from sources associated with the alternative are represented.

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

[Text deleted.]

[d] Texas Natural Resource Conservation Commission effects-screening levels are "tools" used by the Toxicology and Risk Assessment Staff to evaluate impacts of air pollutant emissions. They are not ambient air standards. If ambient levels of air contaminants exceed the screening levels, it does not necessarily indicate a problem, but would trigger a more in-depth review. The levels are set where no adverse effect is expected.

Key: DWPF, Defense Waste Processing Facility; SPD, surplus plutonium disposition.

Source: EPA 1997a; TNRCC 1997a, 1997b.

Potential air quality impacts of construction under Alternative 9 at SRS are the same as those for Alternative 6A (see Section 4.10.1.1). Noise impacts are the same as those for Alternative 6A at SRS (see Section 4.10.1.1).

4.17.1.2 Waste Management

At SRS, construction impacts of this alternative would be the same as for Alternative 6A. See Section 4.10.1.2 for a description of the impacts of this alternative on the waste management infrastructure at SRS.

Table 4–121 compares the wastes generated during the construction of surplus plutonium disposition facilities at Pantex with the existing treatment, storage, and disposal capacity for the various waste types. It is anticipated that no TRU waste, LLW, or mixed LLW would be generated during the 3-year construction period. In addition, no soil contaminated with hazardous or radioactive constituents should be generated during construction. However, if any were generated, the waste would be managed in accordance with site

Table 4–121. Potential Waste Management Impacts of Construction at Pantex Under Alternative 9: Pit Conversion and MOX in New Construction at Pantex, and Immobilization in New Construction and DWPF at SRS

Waste Type[a]	Estimated Additional Waste Generation (m^3/yr)	Estimated Additional Waste Generation as a Percent of[b]		
		Characterization or Treatment Capacity	Storage Capacity	Disposal Capacity
Hazardous	69	NA	NA	NA
Nonhazardous				
Liquid	25,000	NA	NA	3[c]
Solid	8,700	NA	NA	NA

[a] See definitions in Appendix F.8.

[b] Treatment capacities, and the disposal capacity for nonhazardous liquid waste, are compared with estimated additional annual waste generation. All other storage and disposal capacities are compared with total estimated additional waste generation assuming a 3-year construction period.

[c] Percent of capacity of the Wastewater Treatment Facility.

Key: DWPF, Defense Waste Processing Facility; NA, not applicable (i.e., it is assumed that the majority of the hazardous waste and nonhazardous solid waste would be treated and disposed of off the site by the construction contractor).

practice and applicable Federal and State regulations. For this SPD EIS, it is assumed that hazardous waste and nonhazardous waste would be treated, stored, and disposed of in accordance with current site practices.

Hazardous wastes generated during the construction of surplus plutonium disposition facilities at Pantex would be typical of those generated during the construction of an industrial facility. Any hazardous wastes generated during construction would be packaged in DOT-approved containers and shipped off the site to permitted commercial recycling, treatment, and disposal facilities. The additional waste load generated during construction should not have a major impact on the Pantex hazardous waste management system.

Nonhazardous solid wastes generated during the construction of surplus plutonium disposition facilities at Pantex would be packaged in conformance with standard industrial practice and shipped to offsite commercial facilities for recycling or disposal. The additional waste load generated during construction should not have a major impact on the nonhazardous solid waste management system at Pantex.

To be conservative, it was assumed that all nonhazardous liquid wastes generated during construction of the pit conversion and MOX facilities at Pantex would be managed on the site by the Wastewater Treatment Facility, even though it is likely that much of this waste would be collected in portable toilets and would be managed at offsite facilities. Nonhazardous liquid waste generated during the construction of these facilities is estimated to be 3 percent of the 946,250-m^3/yr (1,237,700-yd^3/yr) capacity of the Wastewater Treatment Facility, and within the 473,125-m^3/yr (618,848-yd^3/yr) excess capacity of the Pantex Wastewater Treatment Plant (M&H 1997:29). Therefore, management of these wastes at Pantex should not have a major impact on the nonhazardous liquid waste treatment system during construction.

4.17.1.3 Socioeconomics

Construction-related employment requirements for Alternative 9 would be as indicated in Table 4–122.

At its peak in 2003, construction of the new pit conversion and MOX facilities at Pantex under this alternative would require 1,048 construction workers and generate another 884 indirect jobs in the region. As this total employment requirement of 1,932 direct and indirect jobs represents only about 0.8 percent of the projected REA workforce, it should have no major impact on the REA. Moreover, it should have little effect on community services provided within the ROI. In fact, it should help offset the nearly 40 percent reduction in Pantex employment (i.e., from 2,944 to 1,750 workers) projected for the years 1997–2005.

Table 4–122. Construction Employment Requirements for Alternative 9: Pit Conversion and MOX in New Construction at Pantex, and Immobilization in New Construction and DWPF at SRS

Year	Pit Conversion	MOX	Immobilization	Total
2001	297	0	0	297
2002	451	441	506	1,398
2003	276	772	920	1,968
2004	0	508	1,014	1,522
2005	0	221	552	773
2006	0	208	0	208

Key: DWPF, Defense Waste Processing Facility.
Source: DOE 1999c; UC 1998e, UC 1999c, 1999d.

Employment requirements for construction of a new immobilization facility at SRS under Alternative 9 would be the same as those for Alternative 6A (see Section 4.10.1.3).

4.17.1.4 Human Health Risk

Radiological Impacts. No radiological risk would be incurred by members of the public from construction activities. A summary of radiological impacts of construction activities on workers at risk is presented in Table 4–123. According to a recent radiation survey (DOE 1997f) conducted in the Zone 4 area at Pantex, construction workers would not be expected to receive any additional radiation exposure above natural background levels in the area. Data indicate, however, that a construction worker in F-Area at SRS could be exposed to radiation deriving from other activities, past or present, at the site. Regardless of location, construction worker exposures would be limited to ensure that doses are kept as low as is reasonably achievable, and workers would be monitored (badged) as appropriate.

Table 4–123. Potential Radiological Impacts on Construction Workers of Alternative 9: Pit Conversion and MOX in New Construction at Pantex, and Immobilization in New Construction and DWPF at SRS

Impact	Pit Conversion[a]	MOX[b]	Pantex Total	Immobilization[c]
Total dose (person-rem/yr)	0	0	0	1.5
Annual latent fatal cancers[d]	0	0	0	6.0×10^{-4}
Average worker dose (mrem/yr)	0	0	0[e]	4
Annual latent fatal cancer risk	0	0	0	1.6×10^{-6}

[a] An estimated average of 342 workers would be associated with annual construction operations.
[b] An estimated average of 292 workers would be associated with annual construction operations.
[c] An estimated average of 374 workers would be associated with annual construction operations at the new facility location adjacent to APSF, if built. The number would be the same for immobilization in either ceramic or glass.
[d] 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, per ICRP 1991.
[e] Represents an average of the doses for both facilities.

Key: APSF, Actinide Processing and Storage Facility; DWPF, Defense Waste Processing Facility.

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 will be reduced to levels that are as low as is reasonably achievable.

Source: DOE 1997f; ICRP 1991; NAS 1990; UC 1998e, 1998h, 1999c, 1999d.

Hazardous Chemical Impacts. The probability of excess latent cancer incidence associated with exposure to benzene released as a result of construction activities at Pantex under this alternative has been estimated to be much less than 1 chance in 1 million over the lifetime of the maximally exposed member of the public.

4.17.1.5 Facility Accidents

The construction of surplus plutonium disposition facilities at Pantex and SRS could result in worker injuries or fatalities. DOE–required industrial safety programs would be in place to reduce the risks. Given the estimated 6,166 person-years of construction labor and standard industrial accident rates, approximately 610 cases of nonfatal occupational injury or illness and 0.86 fatality could be expected (DOL 1997a, 1997b). As all construction would be in nonradiological areas, no radiological accidents should occur.

4.17.1.6 Environmental Justice

As discussed in the other parts of Section 4.17.1, construction under Alternative 9 would pose no significant health risks to the public. The risks would be negligible regardless of the racial or ethnic composition or the economic status of the population. Therefore, construction activities under Alternative 9 at Pantex and SRS would have no significant impacts on minority or low-income populations.

4.17.2 Operations

4.17.2.1 Air Quality and Noise

Potential air quality impacts of the operation of facilities under Alternative 9 at Pantex were analyzed using ISCST3. Operational impacts would result from process emissions, emergency diesel generator testing, trucks moving materials and wastes, and employee vehicles. Emissions from these sources are summarized in Appendix G.

A comparison of maximum air pollutant concentrations, including the contribution from surplus plutonium disposition facilities, with standards and guidelines is presented as Table 4–124. Concentrations of air pollutants would likely increase at the site boundary, but would not exceed the Federal or State ambient air quality standards. Air pollution impacts during operation would be mitigated; for example, HEPA filtration has been included in the design of these facilities.

For a discussion of how the operation of the pit conversion and MOX facilities at Pantex would affect the ability to continue to meet NESHAPs limits regarding airborne radiological emissions, see Section 4.32.3.4. There are no other NESHAPs limits applicable to these facilities.

The increases in air pollutant concentrations from operation of these facilities for nitrogen dioxide, PM_{10}, and sulfur dioxide are a small fraction of the prevention of significant deterioration Class II area increments as summarized in Table 4–125.

Total vehicle emissions associated with activities at Pantex would likely decrease somewhat from current emissions because of an expected decrease in overall site employment during this timeframe.

The location of these facilities at Pantex relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during operations would include new or existing sources (e.g., cooling systems, vents, motors, material-handling equipment), employee vehicles, and truck traffic. Traffic noise associated with operation of these facilities would occur on the site and along offsite local and regional transportation routes used to bring materials and workers to the site. Given the

Table 4–124. Evaluation of Pantex Air Pollutant Concentrations Associated With Operations Under Alternative 9: Pit Conversion and MOX in New Construction at Pantex, and Immobilization in New Construction and DWPF at SRS

Pollutant	Averaging Period	Most Stringent Standard or Guideline (Fg/m^3)[a]	SPD Increment (Fg/m^3)	Total Site Concentration (Fg/m^3)	Site as a Percent of Standard or Guideline
Criteria pollutants					
Carbon monoxide	8 hours	10,000	0.705	620	6.2
	1 hour	40,000	3.84	3,000	7.5
Nitrogen dioxide	Annual	100	0.0736	2.02	2
PM_{10}	Annual	50	0.00531	8.8	18
	24 hours	150	0.0577	89.5	60
Sulfur dioxide	Annual	80	0.00265	0.00265	0.0033
	24 hours	365	0.0315	0.0315	0.0086
	3 hours	1,300	0.137	0.137	0.011
	30 minutes	1,048	0.551	0.551	0.053
Other regulated pollutants					
Total suspended particulates	3 hours	200	0.244	0.244[b]	0.12
	1 hour	400	0.796	0.796[b]	0.20
[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 are not listed for existing sources in the source document. Only the contribution from sources associated with the alternative are represented.

[Text deleted.]

Key: DWPF, Defense Waste Processing Facility; SPD, surplus plutonium disposition.

Note: No nonradiological hazardous or other toxic compounds would be emitted from these processes.

Source: EPA 1997a; TNRCC 1997a, 1997b.

Table 4–125. Evaluation of Pantex Air Pollutant Increases Associated With Operations Under Alternative 9: Pit Conversion and MOX in New Construction at Pantex, and Immobilization in New Construction and DWPF at SRS

Pollutant	Averaging Period	Increase in Concentration (Fg/m^3)	PSD Class II Area Allowable Increment (Fg/m^3)	Percent of Increment
Nitrogen dioxide	Annual	0.0736	25	0.29
PM_{10}	Annual	0.00531	17	0.031
	24 hours	0.0577	30	0.19
Sulfur dioxide	Annual	0.00265	20	0.013
	24 hours	0.0315	91	0.035
	3 hours	0.137	512	0.027

Key: DWPF, Defense Waste Processing Facility; PSD, prevention of significant deterioration.

Source: EPA 1997b.

distance to the site boundary (about 1.6 km [1.0 mi]), noise emissions from equipment would not likely annoy the public. These noise sources would be far enough away from offsite areas that their contribution to offsite noise levels would be small. Some noise sources could have onsite impacts, such as the disturbance of wildlife. However, noise would be unlikely to affect federally listed threatened or endangered species or their critical habitats, as none are known to occur on or in the immediate vicinity of the proposed site location (see Section 4.26). Noise from traffic associated with operation of these facilities would likely produce less than a 2-dB increase in traffic noise levels along roads used to access the site, and thus would not result in any increased annoyance of the public.

Operations workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulations (OSHA 1997). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These include the use of administrative controls, engineering controls, and personal hearing protection equipment.

Potential air quality impacts of the operation of the new immobilization facility under Alternative 9 at SRS are the same as those for Alternative 6A (see Section 4.10.2.1). Noise impacts are the same as those for Alternative 6A at SRS (see Section 4.10.2.1).

The combustion of fossil fuels associated with Alternative 9 would result in the emission of carbon dioxide which is one of the atmospheric gases that are believed to influence the global climate. Annual carbon dioxide emissions from this alternative represent less than 2×10^{-4} percent of the 1995 annual U.S. emissions of carbon dioxide from fossil fuel combustion and industrial processes, and therefore would not appreciably affect global concentrations of this pollutant.

4.17.2.2 Waste Management

At SRS, impacts of operations for this alternative would be the same as for Alternative 6A. See Section 4.10.2.2 for a description of the impacts of this alternative on the waste management infrastructure at SRS.

Table 4–126 compares the existing site treatment, storage, and disposal capacities with the expected waste generation rates from operating surplus plutonium disposition facilities at Pantex. No HLW would be generated by the facilities.

Table 4–126. Potential Waste Management Impacts of Operations at Pantex Under Alternative 9: Pit Conversion and MOX in New Construction at Pantex, and Immobilization in New Construction and DWPF at SRS

Waste Type[a]	Estimated Additional Waste Generation (m^3/yr)	Estimated Additional Waste Generation as a Percent of[b]		
		Characterization or Treatment Capacity	Storage Capacity	Disposal Capacity
TRU[c]	86	NA	NA	1 of WIPP
LLW	150	20	63	<1 of NTS
Mixed LLW	4	NA	NA	NA
Hazardous	5	1	NA	NA
Nonhazardous				
Liquid	51,000	NA	NA	5[d]
Solid	2,200	NA	NA	NA

[a] See definitions in Appendix F.8.

[b] Treatment capacities, and the disposal capacity for nonhazardous liquid waste, are compared with estimated additional annual waste generation. All other storage and disposal capacities are compared with total estimated additional waste generation assuming a 10-year operation period.

[c] Includes mixed TRU waste. Facilities are not expected to generate remotely handled TRU waste.

[d] Percent of capacity of the Wastewater Treatment Facility.

Key: DWPF, Defense Waste Processing Facility; LLW, low-level waste; NA, not applicable (i.e., the majority of this waste is not routinely treated, stored, or disposed of on the site); NTS, Nevada Test Site; TRU, transuranic; WIPP, Waste Isolation Pilot Plant.

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. According to 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. 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, in order to be conservative, it is assumed the TRU waste would be stored on the site until 2016. 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 and storage of radioactive, hazardous, mixed, and nonhazardous wastes at Pantex are described in the *Pantex Sitewide EIS* (DOE 1996c).

TRU wastes would be treated, packaged, and certified to WIPP waste acceptance criteria at the new facilities. Drum-gas testing, real-time radiography, and loading the TRU Waste Package Transporter (TRUPACT) for shipment to WIPP would occur at new facilities at Pantex.

TRU waste generated at the pit conversion and MOX facilities at Pantex, is estimated to be a total of 860 m^3 (1,120 yd^3) over the 10-year operation period. Because TRU waste is not currently generated or stored at Pantex, storage space would be provided in the pit conversion and MOX facilities. Assuming that the waste were stored in 208-l (55-gal) drums that could be stacked two high, and allowing a 50 percent factor for aisle space, storage areas of approximately 260 m^2 (2,800 ft^2) would be required in the pit conversion facility, and 960 m^2 (10,300 ft^2) would be required in the MOX facility. This would be 1.5 percent of the 17,345 m^2 (186,700 ft^2) of floor space available in the pit conversion facility, and 4.3 percent of the 22,350 m^2 (240,573 ft^2) of floor space in the MOX facility. Therefore, impacts of the management of TRU waste at Pantex should not be major.

The 1,810 m^3 (2,367 yd^3) of TRU wastes generated at Pantex and SRS would be 1 percent of the 143,000-m^3 (187,000-yd^3) contact-handled TRU waste that DOE plans to dispose of at WIPP and 1 percent of the current 168,500-m^3 (220,400-yd^3) limit for WIPP (DOE 1997e:3-3). Impacts of disposal of TRU waste at WIPP are described in the *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997e).

LLW generated at Pantex would be treated, packaged, certified, and accumulated at the pit conversion and MOX facilities before transfer for additional treatment and disposal in onsite and offsite facilities. LLW generated at the pit conversion facility is estimated to be 20 percent of the 750-m^3/yr (980-yd^3/yr) capacity of the planned Hazardous Waste Treatment and Processing Facility. Waste would be stored on the site on an interim basis before being shipped for offsite disposal. If the shipment of LLW to offsite disposal were delayed, about 1,500 m^3 (1,960 yd^3) of LLW may need to be stored at Pantex. This is about 63 percent of the approximately 2,400-m^3 (3,100-yd^3) of existing storage capacity at Pantex. Assuming that the waste were stored in 208-l (55-gal) drums that could be stacked two high, and allowing a 50 percent factor for aisle space, a storage area of about 0.22 ha (0.54 acre) is required. Therefore, impacts of the storage of additional quantities of LLW at Pantex should not be major.

LLW from Pantex is currently shipped to NTS for disposal. The 1,500 m^3 (1,960 yd^3) of additional LLW from operation of the pit conversion and MOX facilities at Pantex would be 8 percent of the 20,000-m^3 (26,000-yd^3) LLW disposed of 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 disposal land usage factor for NTS published in the *Storage and Disposition Final PEIS* (DOE 1996a:E-9), the additional LLW from Pantex would require 0.25 ha (0.62 acre) of disposal space at NTS or a similar facility. Therefore, impacts of the management of this additional LLW at NTS 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 1996d).

Mixed LLW would be stabilized, packaged, and stored on the site for treatment and disposal in a manner consistent with the site treatment plan for Pantex. Pantex currently ships mixed LLW to Envirocare of Utah and Diversified Scientific Services, Inc., of Tennessee. These facilities or other treatment or disposal facilities that meet DOE criteria would be used to manage the 40 m^3 (52 yd^3) of waste that would be generated. Therefore, the management of this additional waste at Pantex should not have a major impact on the mixed LLW management system.

Any hazardous wastes generated during operation at Pantex would be packaged in DOT-approved containers and shipped off the site to permitted commercial recycling, treatment, and disposal facilities. Because these wastes would be 1 percent of the 750-m^3/yr (980-yd^3/yr capacity of the planned Hazardous Waste Treatment and Processing Facility, the additional waste load generated during the operations period should not have a major impact on the Pantex hazardous waste management system. If all LLW and hazardous wastes generated at the pit conversion and MOX facilities at Pantex were processed in the planned Hazardous Waste Treatment and Processing Facility, this additional waste would be 21 percent of the 750-m^3/yr (980-yd^3/yr) capacity of that facility.

Nonhazardous solid waste would be packaged and transported 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 for offsite disposal. It is unlikely that this additional waste load would have a major impact on the nonhazardous solid waste management system at Pantex.

Nonhazardous wastewater generated by the pit conversion and MOX facilities would be treated if necessary before being discharged to the Pantex Wastewater Treatment Facility. Nonhazardous liquid waste generated by surplus plutonium disposition facilities at Pantex is estimated to be 5 percent of the 946,250-m^3/yr (1,237,700-yd^3/yr) capacity of the Wastewater Treatment Facility, and within the 473,125-m^3/yr (618,848-yd^3/yr) excess capacity of the Wastewater Treatment Facility (M&H 1997:29). Therefore, management of nonhazardous liquid waste at Pantex should not have a major impact on the treatment system.

4.17.2.3 Socioeconomics

After construction, startup, and testing of the pit conversion and MOX facilities at Pantex in 2007 under Alternative 9, an estimated 785 new workers would be required to operate them (DOE 1999c; UC 1998e). This level of employment would be expected to generate another 2,659 indirect jobs within the region. The total employment requirement of 3,444 direct and indirect jobs in 2007 represents 1.3 percent of the projected workforce in the REA, and thus should have no major impact on the REA. It should also have little effect on community services within the Pantex ROI. In fact, it should help offset the 40 percent reduction in the Pantex labor force (i.e., from 2,944 to 1,750 workers) projected for the years 1997–2010.

Employment requirements for operation of the immobilization facility at SRS under Alternative 9 would be the same as those for Alternative 6A (see Section 4.10.2.3).

4.17.2.4 Human Health Risk

During normal operations, there would be both radiological and hazardous chemical releases to the environment, and also direct in-plant exposures. The resulting doses to, and potential health effects on, the public and workers under Alternative 9 would be as follows.

Radiological Impacts. Table 4–127 reflects the potential radiological impacts on three individual receptor groups at Pantex and SRS: the population living within 80 km (50 mi) in the year 2010, the maximally exposed

Table 4–127. Potential Radiological Impacts on the Public of Operations Under Alternative 9: Pit Conversion and MOX in New Construction at Pantex, and Immobilization in New Construction and DWPF at SRS

Impact	Pit Conversion	MOX[a]	Pantex Total	Immobilization Ceramic	Immobilization Glass
Population within 80 km for year 2010					
Dose (person-rem)	0.58	0.027	0.61	2.8×10^{-3}	2.6×10^{-3}
Percent of natural background[b]	5.8×10^{-4}	2.7×10^{-5}	6.1×10^{-4}	1.2×10^{-6}	1.1×10^{-6}
10-year latent fatal cancers	2.9×10^{-3}	1.3×10^{-4}	3.0×10^{-3}	1.4×10^{-5}	1.3×10^{-5}
Maximally exposed individual					
Annual dose (mrem)	0.062	0.015	0.077	2.8×10^{-5}	2.6×10^{-5}
Percent of natural background[b]	0.019	4.5×10^{-3}	0.024	9.5×10^{-6}	8.8×10^{-6}
10-year latent fatal cancer risk	3.1×10^{-7}	7.5×10^{-8}	3.9×10^{-7}	1.4×10^{-10}	1.3×10^{-10}
Average exposed individual within 80 km[c]					
Annual dose (mrem)	1.9×10^{-3}	8.8×10^{-5}	2.0×10^{-3}	3.6×10^{-6}	3.3×10^{-6}
10-year latent fatal cancer risk	9.5×10^{-9}	4.4×10^{-10}	9.9×10^{-9}	1.8×10^{-11}	1.6×10^{-11}

[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. 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 approximately 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 Pantex (299,000) and the SRS APSF (approximately 790,000), if built, in 2010.

Key: APSF, Actinide Packaging and Storage Facility; DWPF, Defense Waste Processing Facility.

Source: Appendix J.

member of the public, and the average exposed member of the public. The table depicts the projected aggregate LCF risk to these groups from 10 years of incident-free operation. To put operational doses into perspective, comparisons with doses from natural background radiation are also provided in the table.

Given incident-free operation of all three surplus plutonium disposition facilities, the total population dose in the year 2010 would be 0.61 person-rem at Pantex and 2.8×10^{-3} person-rem at SRS. The corresponding number of LCFs in the population from 10 years of operation would be 3.0×10^{-3} around Pantex and 1.4×10^{-5} around SRS. The total dose to the maximally exposed member of the public from annual operation of the pit conversion and MOX facilities at Pantex would be 0.077 mrem. From 10 years of operation, the corresponding LCF risk to this individual would be 3.9×10^{-7}. The impacts on the average individual would be lower. The dose to the maximally exposed member of the public from annual operation of the immobilization facility at SRS would be 2.8×10^{-5} mrem. From 10 years of operation, the corresponding LCF risk to this individual would be 1.4×10^{-10}. The impacts on the average individual would be lower.

Estimated impacts resulting from "Total Site" operations are given in the Cumulative Impacts section of this SPD EIS (see Section 4.32). Within that section, projected incremental impacts associated with the operation of the proposed surplus plutonium disposition facilities are added to the impacts of other past, present, and reasonably foreseeable future actions at or near the candidate sites. These impacts are then compared against applicable regulatory standards established by DOE, EPA, and NRC (such as DOE Order 5400.5, the CAA [NESHAPs], the SDWA, and 10 CFR 20).

Doses to involved workers from normal operations are given in Table 4–128; these workers are defined as those directly associated with process activities. Under this alternative, the annual average dose to pit conversion and MOX facility workers would be 500 mrem and 65 mrem, respectively; to immobilization facility workers, 750 mrem. The annual dose received by the total site workforce for each of these facilities has been estimated at 192, 22, and 242 person-rem, respectively. The risks and numbers of latent fatal cancers among the different workers from 10 years of operation are included in Table 4–128. Doses to individual workers would be kept to minimal levels by instituting badged monitoring, administrative limits, and ALARA programs (which would include worker rotations).

Table 4–128. Potential Radiological Impacts on Involved Workers of Operations Under Alternative 9: Pit Conversion and MOX in New Construction at Pantex, and Immobilization in New Construction and DWPF at SRS

Impact	Pit Conversion	MOX	Pantex Total	Immobilization (Ceramic or Glass)
Number of badged workers	383	331	714	323
Total dose (person-rem/yr)	192	22	214	242
10-year latent fatal cancers	0.77	0.088	0.86	0.97
Average worker dose (mrem/yr)	500	65	300[a]	750
10-year latent fatal cancer risk	2.0×10^{-3}	2.6×10^{-4}	1.2×10^{-3}	3.0×10^{-3}

[a] Represents an average of the doses for both facilities.

Key: DWPF, Defense Waste Processing Facility.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995d and NRC 1999a). 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 1994a). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1999c; UC 1998e, 1998h, 1999c, 1999d.

Hazardous Chemical Impacts. No hazardous chemicals would be released as a result of operations at Pantex under this alternative; thus, no cancer or adverse, noncancer health effects would occur. No carcinogenic chemicals would be released as a result of operations.

4.17.2.5 Facility Accidents

The potential consequences of postulated bounding facility accidents from operation of the pit conversion facility at Pantex are equivalent to those described for Alternative 4A (see Table 4–60) and the potential consequences from operation of the immobilization facility at SRS are equivalent to those included in Alternative 3 (see Tables 4–44 and 4–45). The potential impacts of such accidents from operation of the MOX facility at Pantex are presented in Table 4–129. Details on the method of analysis, assumptions and specific accident scenarios are presented in the discussion of Alternative 2 in Section 4.3.2.5.

Public. The most severe consequences of a design basis accident for the MOX facility would be a nuclear criticality. A nuclear criticality of 10^{19} fissions would result in an MEI dose of 0.047 rem at the MOX facility at Pantex, corresponding to an LCF probability of 2.3×10^{-5}. Among the general population in the environs of Pantex, an estimated 5.4×10^{-3} LCF could occur as a result of the MOX criticality accident. The frequency of such an accident at Pantex is estimated to be between 1 in 10,000 and 1 in 1,000,000 per year. The most severe consequences of a design basis accident for the pit conversion facility and the immobilization facility are discussed in Section 4.6.2.5 and 4.4.2.5, respectively.

A beyond-design-basis earthquake at Pantex could result in collapse of the pit conversion (as described in Section 4.6.2.5) and MOX facilities (as described below), and an estimated 5.1 LCFs among the general population. It should be emphasized that a seismic event of sufficient magnitude to collapse these facilities would likely cause the collapse of other DOE facilities, and would almost certainly cause widespread failure of homes, office buildings, and other structures in the surrounding area. The overall impact of such an event must therefore be seen in the context not only of the potential radiological impacts of these other facilities, but

Table 4–129. Accident Impacts of MOX Facility Under Alternative 9: Pit Conversion and MOX in New Construction at Pantex, and Immobilization in New Construction and DWPF at SRS

		Impacts on Noninvolved Worker		Impact at Site Boundary		Impacts on Population Within 80 km	
Accident	Frequency (per year)	Dose (rem)[a]	Probability of Cancer Fatality[b]	Dose (rem)[a]	Probability of Cancer Fatality[b]	Dose (person-rem)[a]	Latent Cancer Fatalities[c]
Criticality	Extremely unlikely	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	Extremely unlikely	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	Unlikely	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	Unlikely	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	Extremely unlikely	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	Unlikely	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	Beyond extremely unlikely	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	Extremely unlikely to beyond extremely unlikely	1.6×10^{2}	6.3×10^{-2}	2.5×10^{1}	1.2×10^{-2}	7.3×10^{3}	3.6
Aircraft crash[d]	Beyond extremely unlikely	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] For 95th percentile meteorological conditions. With the exception of doses due to criticality, the stated doses are from the inhalation of plutonium, and represent dose commitments that would be received over the lifetime of the impacted individual. See Appendix K.1.4.2 for a more detailed discussion of pathways.

[b] Increased likelihood (or probability) of cancer fatality for 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 for a hypothetical individual in the offsite population at the site boundary) if exposed to the indicated dose. The value that assumes that the accident has occurred.

[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. The value assumes that the accident has occurred.

[d] For the aircraft crash accident, the dose at 1,000 m (3,281 ft) is beyond the range of applicability of the standard probability coefficient for determining the likelihood of fatal cancer (i.e., 4×10^{-4} latent cancer fatality per rem). The standard coefficient would tend to overstate the cancer fatality risk at the stated dose. Also, the dose may be in the range where subacute injury is an additional concern.

Key: DWPF, Defense Waste Processing Facility.

Source: Calculated using the source terms in Table K–12 and the MACCS2 computer code.

of hundreds, possibly thousands, of immediate fatalities from falling debris. The frequency of an earthquake of this magnitude at Pantex is estimated to be between 1 in 100,000 and 1 in 10,000,000 per year.

A beyond-design-basis aircraft crash at Pantex, involving a large commercial or military jet aircraft was also evaluated based on public interest. This crash could result in penetration of the surplus plutonium disposition facilities by a crash-induced missile such as a jet turbine shaft causing a release of plutonium resulting in LCFs among the general population. Penetration of the MOX facility could result in 27 LCFs. Penetration of the pit conversion facility would be equivalent to the accident described in Section 4.6.2.5. Other possible consequences of such a crash include immediate fatality to the aircraft occupants, as well as serious injuries and fatalities to persons in the facility and the surrounding area who are hit by aircraft or building debris. The frequency of such an airplane crash is estimated to be less than 1 in 1,000,000 per year.

The beyond-design-basis accident at SRS would be equivalent to that discussed in Section 4.4.2.5.

Noninvolved Worker. Consistent with the analysis presented in the *Storage and Disposition Final PEIS*, the noninvolved worker is a hypothetical individual working on the site but not involved in the proposed action, and assumed to be 1,000 m (3,281 ft) from the location of the accident or at the site boundary, whichever is closer, and downwind from that location. For design basis accidents, the radiological consequences for this worker were estimated to be highest for the criticality at the MOX facility. The consequences of such an accident would include an LCF probability of 9.5×10^{-5}.

Maximally Exposed Involved Worker. 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 either be able to evacuate immediately or would not be affected by the events. Explosions could result in immediate injuries from flying debris, as well as the uptake of plutonium and uranium particulates through inhalation. If a criticality occurred, workers within tens of meters could receive very high to fatal radiation exposures from the initial 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 accident. The design basis and beyond-design-basis earthquakes would also have substantial consequences, ranging from workers being killed by debris from collapsing equipment and structures to high radiation exposures and uptakes of radionuclides. For most accidents, immediate emergency response actions should reduce the consequences to workers near the accident. As discussed in the Emergency Preparedness sections of Chapter 3, each candidate site has an established emergency management program that would be activated in the event of an accident. Based on the decisions made in the SPD EIS ROD, site emergency management programs would be modified to consider new accidents not in the current program.

Nonradiological Accidents. Surplus plutonium disposition operations at Pantex and SRS could result in worker injuries and fatalities. DOE-required industrial safety programs would be in place to reduce the risks. Given the estimated employment of 11,535 person-years of labor and the standard DOE occupational accident rates, approximately 420 cases of nonfatal occupational injury or illness and 0.31 fatality could be expected for the duration of operations.

4.17.2.6 Transportation

Operational transportation impacts may be divided into two parts: impacts due to incident-free transportation and those due to transportation accidents. They may be further divided into nonradiological and radiological impacts. Nonradiological impacts are specifically vehicular, such as vehicular emissions and traffic accidents. Radiological impacts are those related to the dose received by transportation workers and the public during normal operations and in the case of accidents in which the radioactive materials being shipped may be released. For more detailed information on the transportation analysis performed for this SPD EIS, see Appendix L.

Under Alternative 9, transportation to and from Pantex would include the shipment of plutonium pits and clean plutonium metal via SST/SGT from sites throughout the DOE complex to the pit conversion facility.[24] During dismantlement of the pits, some HEU would be recovered. The pit conversion facility would ship HEU via SST/SGT to ORR for storage.[25] After conversion, the plutonium in the pit conversion facility would be in the form of plutonium dioxide. This material would be transferred through a secure tunnel to the MOX facility at Pantex for fabrication into MOX fuel pellets.

MOX fuel fabrication also requires uranium dioxide. Quantifying the uranium dioxide transportation requirements for this SPD EIS involved selecting representative sites for the source of the depleted uranium hexafluoride and the conversion facility. A DOE enrichment facility near Portsmouth, Ohio, was chosen as a representative site for the source of the depleted uranium hexafluoride, and the nuclear fuel fabrication facility in Wilmington, North Carolina, as representative of a uranium conversion facility. These sites were also used as representative sites in the *Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement* (DOE 1996e). It is assumed that depleted uranium hexafluoride needed for MOX fuel would be shipped via commercial truck to the uranium conversion facility, where it would converted into uranium dioxide (see Section 4.3.2.6). After conversion, the depleted uranium dioxide would be shipped via commercial truck from the conversion facility to the MOX facility at Pantex. This material would be blended with plutonium dioxide at the MOX facility, fabricated into MOX fuel pellets, and placed in MOX fuel rods. After fabrication, the MOX fuel rods would be shipped to a domestic reactor site, where they would be placed in fuel assemblies and irradiated. Shipments of unirradiated MOX fuel rods would be made in an SST/SGT because unirradiated MOX fuel in large enough quantities is subject to the same security concerns as pure weapons-grade plutonium. It is assumed in this transportation analysis that all MOX fuel is shipped from the MOX facility to the most distant reactor site, North Anna.

Immobilization at SRS under this alternative would require that surplus nonpit plutonium in various forms be shipped from current storage locations (i.e., SRS, Hanford, INEEL, LLNL, LANL, and RFETS) to the immobilization facility at SRS. Even though these materials are not clean plutonium metal or pits, the quantity of the plutonium contained in them would require that they be treated as materials that could be used in nuclear weapons, and thus that shipments be made in SST/SGTs.

Under the preferred technology alternative for immobilization, the surplus plutonium would be immobilized in a ceramic matrix in small cans at the immobilization facility, placed in HLW canisters, and transported via specially designed trucks to DWPF in S-Area. This intrasite transportation—from F-Area to S-Area—could require the temporary shutdown of roads on SRS. It would, however, provide for all the necessary security and for reduced risk to the public; SST/SGTs would not be required.

[24] Work is currently under way to repackage all pits at Pantex from the AL–R8 container into the AL–R8 SI container for long-term storage. This effort would be completed over 10 years, and the estimated dose to involved workers received from this repackaging activity would be about 104 person-rem. The SPD Draft EIS analyzed repackaging of the pits in an AT–400A container. The change to the AL–R8 SI changes the long-term storage period for pits from 50 to 30 years because of the need to replace a seal in the container after 30 years; the AT–400A does not require that activity. After seal replacement, the pits could continue to be stored for another 30 years.

[25] Classified nuclear material parts would also result from pit disassembly. Although current plans are to store these parts at the pit conversion facility, this SPD EIS analyzes the possible transport of these nuclear material parts to LANL. Therefore, the transportation impacts are slightly overstated.

Use of the preferred ceramic (versus glass) matrix for immobilization would also require a small amount of depleted uranium dioxide (i.e., less than 10 t [11 tons] per year). It is assumed that this depleted uranium dioxide would be produced and shipped in the same manner as the depleted uranium dioxide needed by the MOX facility.

After the immobilized plutonium was encased by HLW at DWPF, it would eventually be shipped to a potential geologic repository for ultimate disposition. Because HLW would be displaced by the cans of immobilized plutonium suspended in the HLW canister, additional canisters—to accommodate the displaced HLW—would be required over the life of the immobilization program. According to estimates, up to 145 additional canisters of HLW would be needed to meet the demands of surplus plutonium disposition under Alternative 9. The *Yucca Mountain Draft EIS* evaluates different options for the shipment of these canisters to a potential geologic repository using either trucks or trains. The analysis revealed that shipment by train would pose the lower risk. However, no ROD has yet been issued regarding these shipments. To bound the risks associated with these additional shipments, this SPD EIS conservatively assumes that all of these shipments would be made by truck, one canister per truck.

Every alternative considered in this SPD EIS would require routine transportation of wastes from the proposed disposition facilities to treatment, storage, or disposal facilities on the sites. This transportation would be handled in the same manner as other site waste shipments, and as shown in Sections 4.17.1.2 and 4.17.2.2, would involve no major increase in the amounts of waste already being managed at these sites. The shipments would pose no greater risks than the ordinary waste shipments at these sites as analyzed in the WM PEIS.

However, TRU waste generated at Pantex was not covered by the WM PEIS ROD as there was no such waste at Pantex at the time the ROD was issued, and none was likely to be generated in ongoing site operations. Location of the pit conversion facility at Pantex would result in the generation of TRU waste, as described in Section 4.17.2.2. Moreover, a fairly large increase in the amount of LLW at Pantex (i.e., 39 percent of the site's current storage capacity) could be expected under this alternative. Currently, this type of waste is shipped to the NTS for disposal. In order to account for the transportation of TRU waste from Pantex to WIPP, and LLW from Pantex to NTS, additional shipments are analyzed in this SPD EIS.

In all, approximately 2,000 shipments of radioactive materials would be carried out by DOE under this alternative. The total distance traveled on public roads by trucks carrying radioactive materials would be 4.8 million km (3.0 million mi).

Impacts of Incident-Free Transportation. The dose to transportation workers from all transportation activities entailed by this alternative has been estimated at 60 person-rem; the dose to the public, 69 person-rem. Accordingly, incident-free transportation of radioactive material associated with this alternative would result in 0.024 LCF among transportation workers and 0.034 LCF in the total affected population over the duration of the transportation activities. The estimated number of nonradiological fatalities from vehicular emissions associated with this alternative is 0.019.

Impacts of Accidents During Transportation (Consequences). The maximum foreseeable offsite transportation accident under this alternative (probability of occurrence: greater than 1 in 10 million per year) is a shipment of surplus nonpit plutonium from a DOE storage facility to SRS with a severity category VIII accident in a rural population zone under neutral (average) weather conditions. Because surplus nonpit plutonium shipments include plutonium oxide, an accident involving plutonium oxide is conservatively used to estimate the impacts of the maximum foreseeable accident. If this accident were to occur, it could result in a dose of 624 person-rem to the public for an LCF risk of 0.31 and 684 rem to the hypothetical MEI for an LCF risk of 0.68. (The MEI receives a larger dose than the population because it is unlikely that a person would be in position, and remain in position, to receive this hypothetical maximum dose.) No fatalities would be expected to occur. The probability of more severe accidents, different weather conditions at the time of accident, or occurrence in a more densely populated area were also evaluated, and estimated to have a probability lower than 1 chance in 10 million per year. (See Appendix L.6.)

Impacts of Accidents During Transportation (Risks). The total ground transportation accident risks were estimated by summing the risks to the affected population from all hypothetical accidents. For Alternative 9, those risks are as follows: a radiological dose to the population of 7 person-rem, resulting in a total population risk of 0.004 LCF; and traffic accidents resulting in 0.052 fatality.

4.17.2.7 Environmental Justice

As discussed in other parts of Section 4.17.2, routine operations conducted under Alternative 9 would pose no significant health risks to the public. The likelihood of an LCF for the MEI residing near Pantex would be approximately 1 in 3 million (see Table 4–127); the likelihood for the MEI residing near SRS would be essentially zero. The number of LCFs expected among the general population residing near Pantex and SRS from accident-free operations would increase by approximately 3.0×10^{-3} and 1.4×10^{-5}, respectively.

Design basis accidents at the sites would not be expected to cause cancer fatalities among the public (see Section 4.17.2.5). A beyond-design-basis earthquake would be expected to result in LCFs among the general population (see Tables 4–44, 4–45, 4–60, and 4–129). However, it is highly unlikely that a beyond-design-basis earthquake would occur. Accidents at the sites pose no significant risks (when the probability of occurrence is considered) to the population residing within the area potentially affected by radiological contamination.

As described in Section 4.17.2.6, no radiological or nonradiological fatalities would be expected to result from accident-free transportation conducted under this alternative. Nor would radiological or nonradiological fatalities be expected to result from transportation accidents.

Thus, implementation of Alternative 9 would pose no significant risks to the public, nor would implementation of this alternative pose significant risks to groups within the public, including the risk of disproportionately high and adverse effects on minority and low-income populations.

4.18 [Section deleted because alternative deleted.]

4.19 ALTERNATIVE 10

Alternative 10 would involve constructing and operating the pit conversion and MOX facilities in Zone 4 West at Pantex and the immobilization facility in the existing FMEF building in the 400 Area at Hanford. Activities at Pantex would be the same as under Alternative 9 and activities at Hanford would be the same as under Alternative 8.

4.19.1 Construction

4.19.1.1 Air Quality and Noise

Potential air quality and noise impacts of construction under Alternative 10 at Pantex are the same as those for Alternative 9 (see Section 4.17.1.1).

Potential air quality and noise impacts of construction under Alternative 10 at Hanford are the same as those for Alternative 8 (see Section 4.16.1.1).

4.19.1.2 Waste Management

At Pantex, construction impacts of this alternative would be the same as for Alternative 9. See Section 4.17.1.2 for a description of the impacts of this alternative on the waste management infrastructure at Pantex.

At Hanford, construction impacts of this alternative would be the same as for Alternative 8. See Section 4.16.1.2 for a description of the impacts of this alternative on the waste management infrastructure at Hanford.

4.19.1.3 Socioeconomics

Construction-related employment requirements for Alternative 10 would be as indicated in Table 4–130.

Table 4–130. Construction Employment Requirements for Alternative 10: Pit Conversion and MOX in New Construction at Pantex, and Immobilization in FMEF and HLWVF at Hanford

Year	Pit Conversion	MOX	Immobilization	Total
2001	297	0	0	297
2002	451	441	207	1,099
2003	276	772	376	1,424
2004	0	508	414	922
2005	0	221	226	447
2006	0	208	0	208

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility.
Source: DOE 1999c; UC 1998e, UC 1999a, 1999b.

Employment requirements for construction of the new pit conversion and MOX facilities at Pantex under this alternative would be the same as those for Alternative 9 (see Section 4.17.1.3).

Employment requirements for construction of the immobilization facility at Hanford under this alternative would be the same as those for Alternative 8 (see Section 4.16.1.3).

4.19.1.4 Human Health Risk

Radiological Impacts. No radiological risk would be incurred by members of the public from construction activities. According to recent radiation surveys (DOE 1997f; Antonio 1998) conducted in the Zone 4 area at Pantex and 400-Area at Hanford, construction workers would not be expected to receive any additional radiation exposure above natural background levels in those areas. Nonetheless, if deemed necessary, construction workers may be monitored (badged) as a precautionary measure.

Hazardous Chemical Impacts. The probability of excess latent cancer incidence associated with exposure to benzene released as a result of construction activities at Pantex under this alternative has been estimated to be much less than 1 chance in 1 million over the lifetime of the maximally exposed member of the public.

No hazardous chemicals would be released at Hanford under this alternative; thus, no cancer or adverse, noncancer health effects would occur.

4.19.1.5 Facility Accidents

The construction of surplus plutonium disposition facilities at Pantex and Hanford could result in worker injuries or fatalities. DOE-required industrial safety programs would be in place to reduce the risks. Given the estimated 4,397 person-years of construction labor and standard industrial accident rates, approximately 440 cases of nonfatal occupational injury or illness and 0.61 fatality could be expected (DOL 1997a, 1997b). As all construction would be in nonradiological areas, no radiological accidents should occur.

4.19.1.6 Environmental Justice

As discussed in the other parts of Section 4.19.1, construction under Alternative 10 would pose no significant health risks to the public. The risks would be negligible regardless of the racial or ethnic composition or the economic status of the population. Therefore, construction activities under Alternative 10 at Pantex and Hanford would have no significant impacts on minority or low-income populations.

4.19.2 Operations

4.19.2.1 Air Quality and Noise

Potential air quality and noise impacts of the operation of facilities under Alternative 10 at Pantex are the same as those for Alternative 9 (see Section 4.17.2.1).

Potential air quality and noise impacts of the operation of the immobilization facility under Alternative 10 at Hanford are the same as those for Alternative 8 (see Section 4.16.2.1).

The combustion of fossil fuels associated with Alternative 10 would result in the emission of carbon dioxide, which is one of the atmospheric gases that are believed to influence the global climate. Annual carbon dioxide emissions from this alternative represent less than 1×10^{-4} percent of the 1995 annual U.S. emissions of carbon dioxide from fossil fuel combustion and industrial processes.

4.19.2.2 Waste Management

At Pantex, impacts of operations for this alternative would be the same as for Alternative 9. See Section 4.17.2.2 for a description of the impacts of this alternative on the waste management infrastructure at Pantex.

At Hanford, impacts of operations for this alternative would be the same as for Alternative 8. See Section 4.16.2.2 for a description of the impacts of this alternative on the waste management infrastructure at Hanford.

4.19.2.3 Socioeconomics

Employment requirements for operation of the pit conversion and MOX facilities at Pantex under Alternative 10 would be the same as those for Alternative 9 (see Section 4.17.2.3).

Employment requirements for operation of the immobilization facility at Hanford under Alternative 10 would be the same as those for Alternative 8 (see Section 4.16.2.3).

4.19.2.4 Human Health Risk

During normal operations, there would be both radiological and hazardous chemical releases to the environment, and also direct in-plant exposures. The resulting doses to, and potential health effects on, the public and workers under Alternative 10 would be as follows.

Radiological Impacts. Table 4–131 reflects the potential radiological impacts on three individual receptor groups at Pantex and Hanford: the population living within 80 km (50 mi) in the year 2010, the maximally exposed member of the public, and the average exposed member of the public. The table depicts the projected aggregate LCF risk to these groups from 10 years of incident-free operation. To put operational doses into perspective, comparisons with doses from natural background radiation are also provided in the table.

Table 4–131. Potential Radiological Impacts on the Public of Operations Under Alternative 10: Pit Conversion and MOX in New Construction at Pantex, and Immobilization in FMEF and HLWVF at Hanford

Impact	Pit Conversion	MOX[a]	Pantex Total	Immobilization Ceramic	Immobilization Glass
Population within 80 km for year 2010					
Dose (person-rem)	0.58	0.027	0.61	7.8×10^{-3}	7.1×10^{-3}
Percent of natural background[b]	5.8×10^{-4}	2.7×10^{-5}	6.1×10^{-4}	6.7×10^{-6}	6.1×10^{-6}
10-year latent fatal cancers	2.9×10^{-3}	1.3×10^{-4}	3.0×10^{-3}	3.9×10^{-5}	3.6×10^{-5}
Maximally exposed individual					
Annual dose (mrem)	0.062	0.015	0.077	1.1×10^{-4}	9.7×10^{-5}
Percent of natural background[b]	0.019	4.5×10^{-3}	0.024	3.7×10^{-5}	3.2×10^{-5}
10-year latent fatal cancer risk	3.1×10^{-7}	7.5×10^{-8}	3.9×10^{-7}	5.5×10^{-10}	4.9×10^{-10}
Average exposed individual within 80 km[c]					
Annual dose (mrem)	1.9×10^{-3}	8.8×10^{-5}	2.0×10^{-3}	2.0×10^{-5}	1.8×10^{-5}
10-year latent fatal cancer risk	9.5×10^{-9}	4.4×10^{-10}	9.9×10^{-9}	1.0×10^{-10}	9.0×10^{-11}

[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. 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 Pantex (299,000) and Hanford (387,800) in 2010.

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility.

Source: Appendix J.

Given incident-free operation of all three facilities, the total population dose in the year 2010 would be 0.61 person-rem at Pantex and 7.8×10^{-3} person-rem at Hanford. The corresponding number of LCFs in the population from 10 years of operation would be 3.0×10^{-3} around Pantex and 3.9×10^{-5} around Hanford. The total dose to the maximally exposed member of the public from annual operation of the pit conversion and MOX facilities at Pantex would be 0.077 mrem. From 10 years of operation, the corresponding LCF risk to this individual would be 3.9×10^{-7}. The impacts on the average individual would be lower. The dose to the maximally exposed member of the public from annual operation of the immobilization facility at Hanford would be 1.1×10^{-4} mrem. From 10 years of operation, the corresponding LCF risk to this individual would be 5.5×10^{-10}. The impacts on the average individual would be lower.

Estimated impacts resulting from "Total Site" operations are given in the Cumulative Impacts section of this SPD EIS (see Section 4.32). Within that section, projected incremental impacts associated with the operation of the proposed surplus plutonium disposition facilities are added to the impacts of other past, present, and reasonably foreseeable future actions at or near the candidate sites. These impacts are then compared against applicable regulatory standards established by DOE, EPA, and NRC (such as DOE Order 5400.5, the CAA [NESHAPs], the SDWA, and 10 CFR 20).

Doses to involved workers from normal operations are given in Table 4–132; these workers are defined as those directly associated with process activities. Under this alternative, the annual average dose to pit conversion and MOX facility workers would be 500 mrem and 65 mrem, respectively; to immobilization facility workers, 750 mrem. The annual dose received by the total site workforce for each of the facilities has been estimated at 192, 22, and 242 person-rem, respectively. The risks and numbers of LCFs among the different workers from

10 years of operation are included in Table 4–132. Doses to individual workers would be kept to minimal levels by instituting badged monitoring, administrative limits, and ALARA programs (which would include worker rotations).

Table 4–132. Potential Radiological Impacts on Involved Workers of Operations Under Alternative 10: Pit Conversion and MOX in New Construction at Pantex, and Immobilization in FMEF and HLWVF at Hanford

Impact	Pit Conversion	MOX	Pantex Total	Immobilization (Ceramic or Glass)
Number of badged workers	383	331	714	323
Total dose (person-rem/yr)	192	22	214	242
10-year latent fatal cancers	0.77	0.088	0.86	0.97
Average worker dose (mrem/yr)	500	65	300[a]	750
10-year latent fatal cancer risk	2.0×10^{-3}	2.6×10^{-4}	1.2×10^{-3}	3.0×10^{-3}

[a] Represents an average of the doses for both facilities.

Key: FMEF, Fuels and Materials Examination Facility; HLWVF, high-level-waste vitrification facility.

Note: The radiological limit for an individual worker is 5,000 mrem/yr (DOE 1995d and NRC 1999a). 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 1994a). An effective ALARA program would ensure that doses are reduced to levels that are as low as is reasonably achievable.

Source: DOE 1999c; UC 1998e, 1998h, 1999a, 1999b.

Hazardous Chemical Impacts. No hazardous chemicals would be released as a result of operations at Pantex under this alternative; thus, no cancer or adverse, noncancer health effects would occur. No carcinogenic chemicals would be released as a result of operations.

No hazardous chemicals would be released as a result of operations at Hanford under this alternative; thus, no cancer or adverse noncancer health effects would occur.

4.19.2.5 Facility Accidents

The potential consequences of postulated bounding facility accidents from operation of the pit conversion facility at Pantex are equivalent to those included in Alternative 4A (see Table 4–60); potential consequences from operation of the MOX facilities at Pantex would be equivalent to those included in Alternative 9 (see Table 4–129); and potential consequences from operation of the immobilization facility at Hanford, equivalent to those included in Alternative 2 (see Tables 4–31 and 4–32). More details on the method of analysis, assumptions, and specific accident scenarios are presented in the discussion of Alternative 2 in Section 4.3.2.5.

Public. The most severe consequences of a design basis accident at the pit conversion facility are discussed in Section 4.6.2.5. The most severe design basis accident, a nuclear criticality, at the immobilization and MOX facilities are discussed in Sections 4.3.2.5 and 4.17.2.5, respectively.

The beyond-design-basis accidents at Pantex would be equivalent to those discussed in Section 4.17.2.5. The beyond-design-basis accident at Hanford would be equivalent to that discussed in Section 4.16.2.5.

Noninvolved Worker. Consistent with the analysis presented in the *Storage and Disposition PEIS*, the noninvolved worker is a hypothetical individual working on the site but not involved in the proposed action, and assumed to be 1,000 m (3,281 ft) from the location of the accident or at the site boundary, whichever is closer, and downwind from that location. The consequences for this worker were estimated to be highest for the criticality at the MOX facility. The consequences of such an accident would include an LCF probability of 9.5×10^{-5}.

Maximally Exposed Involved Worker. 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 either be able to evacuate immediately or would not be affected by the events. Explosions could result in immediate injuries from flying debris, as well as the uptake of plutonium and uranium particulates through inhalation. If a criticality occurred, workers within tens of meters could receive very high to fatal radiation exposures from the initial 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 accident. The design basis and beyond-design-basis earthquakes would also have substantial consequences, ranging from workers being killed by debris from collapsing equipment and structures to high radiation exposures and uptakes of radionuclides. For most accidents, immediate emergency response actions should reduce the consequences to workers near the accident. As discussed in the Emergency Preparedness sections of Chapter 3, each candidate site has an established emergency management program that would be activated in the event of an accident. Based on the decisions made in the SPD EIS ROD, site emergency management programs would be modified to consider new accidents not in the current program.

Nonradiological Accidents. Surplus plutonium disposition operations at Pantex and Hanford could result in worker injuries and fatalities. DOE-required industrial safety programs would be in place to reduce the risks. Given the estimated employment of 11,535 person-years of labor and the standard DOE occupational accident rates, approximately 420 cases of nonfatal occupational injury or illness and 0.31 fatality could be expected for the duration of operations.

4.19.2.6 Transportation

Operational transportation impacts may be divided into two parts: impacts due to incident-free transportation and those due to transportation accidents. They may be further divided into nonradiological and radiological impacts. Nonradiological impacts are specifically vehicular, such as vehicular emissions and traffic accidents. Radiological impacts are those related to the dose received by transportation workers and the public during normal operations and in the case of accidents in which the radioactive materials being shipped may be released. For more detailed information on the transportation analysis performed for this SPD EIS, see Appendix L.

Under Alternative 10, transportation to and from Pantex would include the shipment of plutonium pits and clean plutonium metal via SST/SGT from sites throughout the DOE complex to the pit conversion facility.[26] During dismantlement of the pits, some HEU would be recovered. The pit conversion facility would ship HEU via SST/SGT to ORR for storage.[27] After conversion, the plutonium in the pit conversion facility would be in the form of plutonium dioxide. This material would be transferred through a secure tunnel to the MOX facility at Pantex for fabrication into MOX fuel pellets.

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[26] Work is currently under way to repackage all pits at Pantex from the AL–R8 container into the AL–R8 SI container for long-term storage. This effort would be completed over 10 years, and the estimated dose to involved workers received from this repackaging activity would be about 104 person-rem. The SPD Draft EIS analyzed repackaging of the pits in an AT–400A container. The change to the AL–R8 SI changes the long-term storage period for pits from 50 to 30 years because of the need to replace a seal in the container after 30 years; the AT–400A does not require that activity. After seal replacement, the pits could continue to be stored for another 30 years.

[27] Classified nuclear material parts would also result from pit disassembly. Although current plans are to store these parts at the pit conversion facility, this SPD EIS analyzes the possible transport of these nuclear material parts to LANL. Therefore, the transportation impacts are slightly overstated.

MOX fuel fabrication also requires uranium dioxide. Quantifying the uranium dioxide transportation requirements for this SPD EIS involved selecting representative sites for the source of the depleted uranium hexafluoride and the conversion facility. A DOE enrichment facility near Portsmouth, Ohio, was chosen as a representative site for the source of the depleted uranium hexafluoride, and the nuclear fuel fabrication facility in Wilmington, North Carolina, as representative of a uranium conversion facility. These sites were also used as representative sites in the *Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement* (DOE 1996e). It is assumed that depleted uranium hexafluoride needed for MOX fuel would be shipped via commercial truck to the uranium conversion facility, where it would converted into uranium dioxide (see Section 4.3.2.6). After conversion, the depleted uranium dioxide would be shipped via commercial truck from the conversion facility to the MOX facility at Pantex. This material would be blended with plutonium dioxide at the MOX facility, fabricated into MOX fuel pellets, and placed in MOX fuel rods. After fabrication, the MOX fuel rods would be shipped to a domestic reactor site, where they would be placed in fuel assemblies and irradiated. Shipments of unirradiated MOX fuel rods would be made in an SST/SGT because unirradiated MOX fuel in large enough quantities is subject to the same security concerns as pure weapons-grade plutonium. It is assumed in this transportation analysis that all MOX fuel is shipped from the MOX facility to the most distant reactor site, North Anna.

Immobilization at Hanford under this alternative would require that surplus nonpit plutonium in various forms be shipped from current storage locations (i.e., SRS, Hanford, INEEL, LLNL, LANL, and RFETS) to the immobilization facility at Hanford. Even though these materials are not clean plutonium metal or pits, the quantity of the plutonium contained in them would require that they be treated as materials that could be used in nuclear weapons, and thus that shipments be made in SST/SGTs.

Under the preferred technology alternative for immobilization, the surplus plutonium would be immobilized in a ceramic matrix in small cans at the immobilization facility, placed in HLW canisters, and transported via specially designed trucks to HLWVF in 200 Area. This intrasite transportation—from 400 Area to 200 Area—could require the temporary shutdown of roads on Hanford. It would, however, provide for all the necessary security and for reduced risk to the public; SST/SGTs would not be required.

Use of the preferred ceramic (versus glass) matrix for immobilization would also require a small amount of depleted uranium dioxide (i.e., less than 10 t [11 tons] per year). It is assumed that this depleted uranium dioxide would be produced and shipped in the same manner as the depleted uranium dioxide needed by the MOX facility.

After the immobilized plutonium was encased by HLW at HLWVF, it would be shipped to a potential geologic repository for ultimate disposition. Because HLW would be displaced by the cans of immobilized plutonium suspended in the HLW canister, additional canisters—to accommodate the displaced HLW—would be required over the life of the immobilization program. According to estimates, up to 145 additional canisters of HLW would be needed to meet the demands of surplus plutonium disposition under Alternative 10. The *Yucca Mountain Draft EIS* evaluates different options for the shipment of these canisters to a potential geologic repository using either trucks or trains. The analysis revealed that shipment by train would pose the lower risk. However, no ROD has yet been issued regarding these shipments. To bound the risks associated with these additional shipments, this SPD EIS conservatively assumes that all of these shipments would be made by truck, one canister per truck.

Every alternative considered in this SPD EIS would require routine transportation of wastes from the proposed disposition facilities to treatment, storage, or disposal facilities on the sites. This transportation would be handled in the same manner as other site waste shipments, and as shown in Sections 4.19.1.2 and 4.19.2.2, would involve no major increase in the amounts of waste already being managed at these sites. The shipments would pose no greater risks than the ordinary waste shipments at these sites as analyzed in the WM PEIS.

However, TRU waste generated at Pantex was not covered by the WM PEIS ROD as there was no such waste at Pantex at the time the ROD was issued, and none was likely to be generated in 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 4.19.2.2. Moreover, a fairly large increase in the amount of LLW at Pantex (i.e., 39 percent of the site's current storage capacity) could be expected under this alternative. Currently, this type of waste is shipped to the NTS for disposal. In order to account for the transportation of TRU waste from Pantex to WIPP, and LLW from Pantex to NTS, additional shipments are analyzed in this SPD EIS.

In all, approximately 1,900 shipments of radioactive materials would be carried out by DOE under this alternative. The total distance traveled on public roads by trucks carrying radioactive materials would be 3.6 million km (2.2 million mi).

Impacts of Incident-Free Transportation. The dose to transportation workers from all transportation activities entailed by this alternative has been estimated at 29 person-rem; the dose to the public, 39 person-rem. Accordingly, incident-free transportation of radioactive material associated with this alternative would result in 0.012 LCF among transportation workers and 0.019 LCF in the total affected population over the duration of the transportation activities. The estimated number of nonradiological fatalities from vehicular emissions associated with this alternative is 0.012.

Impacts of Accidents During Transportation (Consequences). The maximum foreseeable offsite transportation accident under this alternative (probability of occurrence: greater than 1 in 10 million per year) is a shipment of surplus nonpit plutonium from a DOE storage facility to Hanford with a severity category VIII accident in a rural population zone under neutral (average) weather conditions. Because surplus nonpit plutonium shipments include plutonium oxide, an accident involving plutonium oxide is conservatively used to estimate the impacts of the maximum foreseeable accident. If this accident were to occur, it could result in a dose of 624 person-rem to the public for an LCF risk of 0.3 and 684 rem to the hypothetical MEI for an LCF risk of 0.68. (The MEI receives a larger dose than the population because it is unlikely that a person would be in position, and remain in position, to receive this hypothetical maximum dose.) No fatalities would be expected to occur. The probability of more severe accidents, different weather conditions at the time of accident, or occurrence in a more densely populated area were also evaluated, and estimated to have a probability lower than 1 chance in 10 million per year. (See Appendix L.6.)

Impacts of Accidents During Transportation (Risks). The total transportation accident risks were estimated by summing the risks to the affected population from all hypothetical accidents. For Alternative 10, those risks are as follows: a radiological dose to the population of 7 person-rem, resulting in a total population risk of 0.003 LCF; and traffic accidents resulting in 0.043 fatality.

4.19.2.7 Environmental Justice

As discussed in other parts of Section 4.19.2, routine operations conducted under Alternative 10 would pose no significant health risks to the public. The likelihood of an LCF for the MEI residing near Pantex would be approximately 1 in 3 million (see Table 4–131); the likelihood for the MEI residing near Hanford would be essentially zero. The number of LCFs expected among the general population residing near Pantex and Hanford from accident-free operations would increase by approximately 3.0×10^{-3} and 3.9×10^{-5}, respectively.

Design basis accidents at the sites would not be expected to cause cancer fatalities among the public (see Section 4.19.2.5). A beyond-design-basis earthquake would be expected to result in LCFs among the general population (see Tables 4–31, 4–32, 4–60, and 4–129). However, it is highly unlikely that a beyond-design-basis earthquake would occur. Accidents at the sites pose no significant risks (when the probability of occurrence is considered) to the population residing within the area potentially affected by radiological contamination.

As described in Section 4.19.2.6, no radiological or nonradiological fatalities would be expected to result from accident-free transportation conducted under this alternative. Nor would radiological or nonradiological fatalities be expected to result from transportation accidents.

Thus, implementation of Alternative 10 would pose no significant risks to the public, nor would implementation of this alternative pose significant risks to groups within the public, including the risk of disproportionately high and adverse effects on minority and low-income populations.

Chapter 5
Environmental Regulations, Permits, and Consultations

5.1 LAWS, REGULATIONS, EXECUTIVE ORDERS, AND DOE ORDERS

The major Federal laws, regulations, Executive orders, and other compliance actions that potentially apply to surplus plutonium disposition activities, depending on the various alternatives, are identified in Table 5–1.[1] There are a number of Federal environmental statutes dealing with environmental protection, compliance, or consultation that affect compliance at every U.S. Department of Energy (DOE) location. In addition, certain environmental requirements have been delegated to State authorities for enforcement and implementation. 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 legislation or future regulations, DOE recognizes that the regulatory environment is in transition, and subject to many changes, and that the construction, operation, and decommissioning of any surplus plutonium disposition facility must be conducted in compliance with all applicable regulations and standards.

The Atomic Energy Act of 1954 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. DOE regulations are generally found in Title 10 of the Code of Federal Regulations (CFR). For purposes of this *Surplus Plutonium Disposition Environmental Impact Statement* (SPD EIS), relevant 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, *National Environmental Policy Act Implementing Procedures;* and 10 CFR 1022, *Compliance with Floodplains/Wetlands Environmental Review Requirements*. 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). The new organization is by Series and is generally intended to include all DOE policies, orders, manuals, requirements documents, notices, and guides. Relevant DOE orders include those in the new Series 400, which deals with Work Process. Within this Series, DOE Order 420.1 addresses *Facility Safety*; 425.1A, *Startup and Restart of Nuclear Facilities*; 452.1A, *Nuclear Explosive and Weapons Surety Programs*; 452.2A, *Safety of Nuclear Explosives Operations*; 452.4, *Security and Control of Nuclear Explosives and Nuclear Weapons*; 460.1A, *Packaging and Transportation Safety*; 470.1, *Safeguards and Security Program*; and Manual 474.1, *Nuclear Materials Management and Safeguards System Reporting and Data Submission*. In addition, DOE (older number) Series 5400 addresses environmental, safety, and health programs for DOE operations.

5.2 REGULATORY ACTIVITIES

It is likely that new or modified permits would be needed before surplus plutonium disposition facilities could 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 would be obtained as required from appropriate Federal, State, and local agencies. Permits for constructing or operating surplus plutonium disposition facilities would not be obtained or modified before a Record of Decision was issued on this SPD EIS.

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[1] It should be noted that not all of these statutes, regulations, and orders apply to all aspects of the surplus plutonium disposition program and that the descriptions provided represent only a broad summary of each listed requirement.

5.2.1 Pit Conversion and Immobilization Facilities

The pit conversion and immobilization facilities would be designed, constructed, and operated in accordance with DOE regulations and requirements, although the facilities may, as a matter of policy, take into account any appropriate NRC standards. These facilities are categorized as nonreactor nuclear facilities. The major DOE design criteria may be found in DOE Order 6430.1A, *General Design Criteria*, and its successor Orders 420.1A, *Facility Safety*, and 430.1, *Life Cycle Asset Management*, which delineate applicable regulatory and industrial codes and standards for both conventional facilities designed to industrial standards and "special facilities" (defined as nonreactor nuclear facilities and explosive facilities). The design of the facilities would be accomplished in stages that allow for adequate review and assurance that all required standards are met. Prior to operation, the facilities would undergo cold and hot startup testing and an operational readiness review in accordance with the requirements of DOE Order 425.1. Startup of these facilities would require the approval of the Secretary of Energy.

While there are a number of areas or buildings that would be designed to conventional codes and standards, plutonium processing and storage areas, and other areas where quantities of plutonium or other special nuclear materials in excess of a minimum quantity could be present, would be required to meet the more stringent requirements for facility integrity and safeguards and security. Other applicable regulations and standards would be related to worker health and safety and environmental protection, such as DOE's radiation protection standards found in 10 CFR 835. In addition, Federal or State regulations implementing the Clean Water Act (CWA), Clean Air Act (CAA), and Resource Conservation and Recovery Act (RCRA) are applicable. These regulations are implemented through permits, and DOE would require evaluations to determine whether the pit conversion or immobilization facility emissions and activities would necessitate modification of any of these permits. Analyses in Chapter 4 have shown that there would be minimal impact from construction and operation of these facilities.

5.2.2 MOX Facility

The mixed oxide (MOX) fuel fabrication facility would be licensed to operate by the U.S. Nuclear Regulatory Commission (NRC) under its regulations in 10 CFR 70, *Domestic Licensing of Special Nuclear Material*. Because the facility would be located at a DOE site, however, certain DOE requirements affecting site interfaces and infrastructure would also be applicable. In addition, as would be the case regardless of where the facility was built, certain Federal or State regulations implementing the CWA, the CAA, and RCRA would be applicable. These regulations are implemented through permits. Evaluation would be required to determine whether MOX facility emissions and activities necessitated modification of any of these permits. Analyses in Chapter 4 have shown that there would be minimal impacts from construction and operation of the MOX facility.

MOX facility design and operating parameters would be imposed by requirements of 10 CFR 70. Facility robustness, and worker health and safety, for example, are all specified by 10 CFR 70. This regulation incorporates and refers the licensee to provisions of other NRC regulations such as those found in 10 CFR 20, *Protection Against Radiation*. Safety and environmental analyses would be required to support the license application for the MOX facility.

Integral to the National Environmental Policy Act (NEPA) process is consideration of how the proposed action might affect biotic, cultural, and Native American resources and of the need for mitigation of any potential impacts. Required consultations with agencies and recognized Native American groups have been initiated as part of the NEPA process for this SPD EIS.

5.2.3 Reactors

Nuclear power reactors undergo a lengthy licensing process under 10 CFR 50, *Domestic Licensing of Production and Utilization Facilities*, beginning before facility construction. 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 before a license is 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 before issuance of the license amendment. Minor license amendments can be processed fairly expeditiously, but more involved amendments can require multiple submittals before NRC is assured that the proposed action will not reduce the margin of safety of the plant. All submittals, except the portions that contain proprietary information, are available to the public.

The six reactors proposed to use MOX fuel have been operating for many years. Revisions to each of their operating licenses would be required prior to MOX fuel being brought to the reactor sites and loaded into the reactors. The regulatory process for requesting reactor license amendments to use MOX fuel would be the same as that for any 10 CFR 50 operating license amendment request. This process is initiated by the reactor licensee submitting an operating license amendment request in accordance with 10 CFR 50.90. The license amendment request would need to include a discussion of all potential impacts and changes in reactor operation that could be important to safety or the environment.

The need for modifications to site permits would be evaluated by the individual plants. The contractor team of Duke Engineering & Services, COGEMA Inc., and Stone & Webster has indicated that there would be minimal changes in effluents, emissions, and wastes (radiological or nonradiological).

5.3 CONSULTATIONS

Certain statutes and regulations require 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. The needed consultations must occur on a timely basis and are generally required before any land disturbance can begin. Most of these consultations are related to biotic, cultural, and Native American resources. Biotic resource consultations generally pertain to the potential for activities to disturb sensitive species or habitats. Cultural resource consultations relate to the potential for disruption of important cultural resources and archaeologic sites. Finally, Native American consultations are concerned with the potential for disturbance of ancestral Native American sites and the traditional practices of Native Americans.

DOE has initiated consultations with Federal and State agencies and federally recognized Native American groups regarding the potential for alternatives for surplus plutonium disposition to disturb sensitive resources. Table 5–2 presents a summary of the consultations initiated by DOE. 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. All agencies and Native American groups were also sent a copy of the SPD Draft EIS. Information from the agencies and Native American group responses has been incorporated into Chapters 3 and 4 as appropriate.

5.3.1 Native American Consultations

Upon publication of the SPD Draft EIS, DOE initiated the government-to-government consultation process with federally recognized Native American groups for the proposed action and alternatives discussed herein. The consultations were conducted consistent with the direction outlined in DOE Order 1230.2, *American Indian Tribal Government Policy*. A copy of the SPD Draft EIS was presented to each federally recognized tribe that has acknowledged potential concern for resources at the Hanford Site, Idaho National Engineering and Environmental Laboratory (INEEL), Pantex Plant, and Savannah River Site (SRS) during prior consultations initiated for compliance with statutes such as the National Historic Preservation Act (16 USC 470 et seq.) and the Native American Graves Protection and Repatriation Act (NAGPRA) (25 USC 3001).

The consultation process was initiated by DOE through a formal letter identifying the potential actions at the DOE site accompanied by a copy of the SPD Draft EIS. The letter requested a response from each Native American group regarding concerns, including any concerns under the American Indian Religious Freedom Act (42 USC 1996) and NAGPRA. Among the areas of specific concern that may be identified by Native American groups are religious and sacred places and resources, Native American human remains, associated funerary objects, unassociated funerary objects, sacred objects, and cultural patrimony objects. [Text deleted.] The intent of these consultations was to identify all potential Native American concerns associated with each action discussed in the SPD Draft EIS and to consider the results of the consultation processes in this SPD Final EIS.

Consultations were requested with the Native American groups listed in Table 5–2, which included four groups related to Hanford, one to INEEL, four to Pantex and six to SRS. Consultations with the Native American groups indicate that there are no significant concerns related to the proposed action and alternatives evaluated in this SPD EIS.

In the event of inadvertent discovery of potential important materials such as human remains, associated funerary objects, unassociated funerary objects, sacred objects, and cultural patrimony during construction and operation, another consultation process will be initiated. Each DOE site considered in this SPD EIS has plans and procedures that address inadvertent discoveries of cultural material. In each case, the ground-disturbing activities would be immediately suspended upon recognition of human remains or potential cultural materials. DOE would be notified and qualified cultural resource specialists would evaluate the materials to determine potential Native American origin. If the remains or materials are determined to be of potential Native American origin and within the criteria of applicable statutes such as NAGPRA, DOE would immediately initiate consultation with Native American groups with interest in the locations, as determined during the SPD Draft EIS consultation process described above. Based on the results of the consultations, DOE would take appropriate action prior to resuming ground-disturbing activities.

5.3.2 Archaeological and Historical Resources Consultations

Each DOE site evaluated in this SPD EIS has cultural (archaeological and historical) resource management plans that prescribe consultation processes for activities that have the potential to adversely affect sites and properties eligible for nomination, or listed, on the National Register of Historic Places. The management plans have been developed consistent with archaeological and historical resource laws (see Table 5–1) as implemented under 36 CFR 800, *Protection of Historic and Cultural Properties*.

Upon publication of the SPD Draft EIS, DOE initiated consultation with the State Historic Preservation Officers (SHPOs) of Idaho, Washington, and South Carolina as appropriate under each site's programmatic agreement and management plan (see Table 5–2). Consultation with the SHPO in Texas was not required because extensive surveys of Pantex have shown that significant cultural resources are not likely to be present, and both the Texas SHPO and the Advisory Council on Historic Preservation have agreed that additional archaeological surveys are not required. The intent of each consultation was to determine potential eligibility for nomination to the National Register of Historic Places of archaeological and historic resources that may be associated with the proposed actions and alternatives. As discussed in Section 5.3.1, DOE also initiated consultation with Native Americans. [Text deleted.] The consultation process was initiated by DOE through a formal letter to the appropriate SHPO identifying the potential actions at the DOE site accompanied by a copy of the SPD Draft EIS. In all cases, the consultation process was conducted in conformance with 36 CFR 800 requirements and programmatic agreements for the management of archaeological and historic resources and properties.

The letters sent by DOE solicited specific concerns the SHPOs may have about the DOE proposal. Consultations with the SHPOs indicate that only the South Carolina SHPO had significant concerns related to the proposed action and alternatives evaluated in this SPD EIS. The South Carolina SHPO response noted that if Alternative 3 (DOE's preferred alternative) is selected, further consultations would be required. In response to the SHPO's concerns about cultural resources present near the F-Area, additional surveys were performed. Investigations identified archaeological sites near this portion of F-Area that have been recommended to the South Carolina SHPO as eligible for nomination to the National Register. DOE currently plans to mitigate impact by avoiding these sites.

In the event that potential archaeological and historic materials are discovered during construction and operation, another consultation process will be initiated. Each DOE site considered in this SPD EIS has plans and procedures that address inadvertent discoveries of cultural material. In each case, the ground-disturbing activities would be immediately suspended upon recognition of human remains or potential archaeological and historical materials. DOE would be notified and qualified cultural resource specialists would evaluate the materials to identify and determine their potential archaeological and historical value under 36 CFR 800. If the materials are determined to be potentially eligible for nomination to the National Register of Historic places, DOE would immediately initiate an expedited formal consultation process with the appropriate SHPO, as appropriate under the programmatic agreement. Based on the results of the consultations, DOE would take appropriate action to ensure mitigation of any adverse effects to resources determined eligible for the National Register of Historic Places.

5.3.3 Endangered Species Act Consultation

Upon publication of the SPD Draft EIS, DOE conducted consultations with the appropriate regional and field offices of the U.S. Department of the Interior, Fish and Wildlife Service (USFWS) and the equivalent State agencies. The consultations were conducted to solicit input on the potential for impacts on ecological resources, especially Federal threatened, endangered, and other species of concern or their critical habitat and/or State-protected species. These consultations were conducted in accordance with Sections 7(a)-(d) of the Endangered Species Act of 1973 (16 USC Sections 1536(a)-(d)) and its implementing regulations under 50 CFR 402, *Interagency Cooperation-Endangered Species Act of 1973, As Amended*, and relevant State statutes and regulations (see Table 5–1).

The consultation process was initiated by DOE through formal letters that identified the potential actions at each DOE site and was accompanied by a copy of the SPD Draft EIS. Each letter also summarized the preliminary analysis of the potential impacts on ecological resources at each site, including any known Federal- or State-listed species with the potential for occurrence. As shown in Table 5–2, letters were sent to each respective USFWS regional or field office with primary jurisdiction over the four DOE surplus plutonium disposition candidate sites. The letters requested that the USFWS offices provide any available information on Federal threatened and endangered animal and plant species (listed or proposed) and their habitats in the vicinity of the specific project areas. Each office was also asked to identify any other issues or concerns that should be considered in this SPD EIS. A similar written request for comment was also sent to each equivalent State agency including: the Washington Department of Fish and Wildlife, Department of Ecology; Idaho Department of Fish and Game, Conservation Data Center; Texas Parks and Wildlife Department; and the South Carolina Department of Natural Resources, Lower Coastal Wildlife Diversity.

Of the four consultations initiated with the USFWS, three of the offices provided written responses, with the resulting information considered in the preparation of this SPD Final EIS. Additional species information was provided by the USFWS Moses Lake, Washington, and Charleston, South Carolina offices. The USFWS Charleston office also indicated in its response that the proposed facilities at SRS do not appear to present a substantial risk to federally protected ecological resources and that DOE has satisfied its obligations under Section 7 of the *Endangered Species Act*. The USFWS Boise, Idaho, office indicated that the information provided in the SPD Draft EIS was accurate. In the absence of receipt of a written response, telephone communication was initiated with the USFWS office in Arlington, Texas, with officials indicating that the office had no additional information to provide or comment on the SPD Draft EIS.

Three of the four State agencies contacted also provided written responses, with one agency (i.e., South Carolina Department of Natural Resources) verbally responding that it had no additional information to provide or other comment on the SPD Draft EIS. Additional information was provided by the Washington State Department of Fish and Wildlife and the Idaho Department of Fish and Game, which was considered in development of this SPD Final EIS.

Prior to any project implementation activities at any site, additional consultations with Federal and State agencies would be conducted, as appropriate. Additionally, site-specific surveys and assessments would be conducted, as necessary, to determine the potential for impacts to protected or other sensitive animal and plant species and sensitive habitats and to identify any required mitigation measures.

Table 5–1. Federal Environmental Statutes, Regulations, and Executive Orders

Statute, Regulation, Executive Order	Citation	Potential Requirements
	Air Quality and Noise	
Clean Air Act of 1970 (CAA)	42 USC 7401 et seq.	Requires sources to meet standards and obtain permits to satisfy: National Ambient Air Quality Standards (NAAQS), State implementation plans, Standards of Performance for New Stationary Sources, National Emission Standards for Hazardous Air Pollutants, and Prevention of Significant Deterioration (PSD). Public radiological dose limits for DOE facilities are outlined in 40 CFR 61.92, under the authority of this act.
National Ambient Air Quality Standards	42 USC 7409; 40 CFR 50	Establishes primary and secondary ambient air quality standards governing carbon monoxide, lead, nitrogen dioxide, ozone, sodium dioxide, and particulate matter with an aerodynamic diameter less than or equal to 10 microns.
Standards of Performance for New Stationary Sources	42 USC 7411; 40 CFR 60	Establishes control/emission standards and recordkeeping requirements for new or modified sources specifically addressed by a standard.
National Emission Standards for Hazardous Air Pollutants	42 USC 7412; 40 CFR 61, 63	Establishes emission levels for carcinogenic or mutagenic pollutants or operation requirements; may require a preconstruction approval, depending on the process being considered and the level of emissions that will result from the new or modified source.
Prevention of Significant Deterioration	42 USC 7470 et seq.; 40 CFR 51.166	Establishes requirements for the State implementation plans for PSD programs. Applies to areas that are in compliance with NAAQS. Requires comprehensive preconstruction review and the application of Best Available Control Technology to major stationary sources (emissions of 100 tons per year [tons/yr]) and major modifications; requires a preconstruction review of air quality impacts and the issuance of a construction permit from the responsible State agency setting forth emission limitations to protect the PSD increment.
Determining conformity of Federal actions to State or Federal implementation plans	40 CFR 93	Requires Federal facilities to demonstrate compliance with State or Federal implementation plans for applicable actions in nonattainment areas.
Executive Order 12843, Procurement Requirements and Policies for Federal Agencies for Ozone-Depleting Substances	April 21, 1993	Requires Federal agencies to minimize procurement of ozone-depleting substances and conform their practices to comply with Title VI of CAA Amendments regarding stratospheric ozone protection and to recognize the increasingly limited availability of Class I substances until final phaseout.
Noise Control Act of 1972	42 USC 4901 et seq.	Requires facilities to maintain noise levels that do not jeopardize the health and safety of the public.
	Water Resources	
Clean Water Act (CWA)	33 USC 1251 et seq.	Requires U.S. Environmental Protection Agency (EPA)- or State-issued permits and compliance with provisions of permits regarding discharge of effluents to waters of the United States.

Table 5–1. Federal Environmental Statutes, Regulations, and Executive Orders (Continued)

Statute, Regulation, Executive Order	Citation	Potential Requirements
		Water Resources (Continued)
National Pollutant Discharge Elimination System	33 USC 1342	Requires permit to discharge effluents (pollutants) and storm water to waters of the United States; permit modifications are required if discharge effluents are altered.
Wild and Scenic Rivers Act of 1968	16 USC 1271 et seq.	Requires consultation before construction of any new Federal project associated with a river designated as wild and scenic or under study in order to minimize and mitigate any adverse effects on the physical and biological properties of the river.
Safe Drinking Water Act of 1974	42 USC 300f et seq.; 40 CFR 141	Requires certification of any plant water treatment facility constructed on a site to ensure that the quality of public drinking water is protected and that maximum radioactive contaminant levels do not exceed 4 mrem dose equivalents.
Executive Order 11990, Protection of Wetlands	May 24, 1977	Requires Federal agencies to avoid the long- and short-term adverse impacts associated with the destruction or modification of wetlands.
Executive Order 11988, Floodplain Management	May 29, 1977	Directs Federal agencies to establish procedures to ensure that the potential effects of flood hazards and floodplain management are considered for any action undertaken in a floodplain and that floodplain impacts be avoided to the extent practical. Requires consultation if project impacts a floodplain.
Compliance with Floodplain/ Wetlands Environmental Review Requirements	10 CFR 1022	DOE's floodplain and wetlands environmental review requirements.
		Civilian Use of Nuclear Materials
Standards for Protection Against Radiation	10 CFR 20	Establishes standards for protection against ionizing radiation resulting from activities conducted by NRC licensees for both radiation workers and the public.
Domestic Licensing of Production and Utilization Facilities	10 CFR 50	Provides for the licensing of production and utilization facilities, which includes commercial nuclear power reactors. This part describes in detail the information needed to support an operational license application, a license amendment request, design criteria, enforcement actions, and other specifics of the licensing process.
Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions	10 CFR 51	Implements NRC's NEPA requirements.
Domestic Licensing of Special Nuclear Material	10 CFR 70	Establishes procedures and criteria for issuance of licenses to receive title to, own, possess, use, and initially transfer special nuclear material; and establishes and provides for the terms and conditions upon which NRC will issue such licenses.

Table 5–1. Federal Environmental Statutes, Regulations, and Executive Orders (Continued)

Statute, Regulation, Executive Order	Citation	Potential Requirements
	Waste Management and Pollution Prevention	
Resource Conservation and Recovery Act; Hazardous and Solid Waste Amendments of 1984 (RCRA)	42 USC 6901 et seq.	Requires notification and permits for operations involving hazardous waste treatment, storage, or disposal facilities; changes to site hazardous waste operations could require amendments to RCRA hazardous waste permits involving public hearings.
Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA); Superfund Amendments and Reauthorization Act of 1986	42 USC 9601 et seq.	Requires cleanup and notification if there is a release or threatened release of a hazardous substance; requires DOE to enter into Interagency Agreements with EPA and State to control the cleanup of each DOE site on the National Priorities List.
Nuclear Waste Policy Act of 1982	42 USC 10101 et seq.	Establishes a schedule for the siting, construction, and operation of a geologic repository that will provide a reasonable assurance that the public and the environment will be protected from the hazards posed by disposal of high-level radioactive waste (HLW) and spent nuclear fuel; establishes Federal responsibility and a Federal policy for the disposal of HLW and spent nuclear fuel; defines the relationship between Federal and State governments with respect to the disposal of HLW and spent nuclear fuel; and establishes a Nuclear Waste Fund.
Pollution Prevention Act of 1990	42 USC 13101 et seq.	Establishes a national policy that pollution should be reduced at the source and requires a toxic chemical source reduction and recycling report for an owner or operator of a facility required to file an annual toxic chemical release form under Section 313 of the Superfund Amendments and Reauthorization Act.
Toxic Substances Control Act of 1976 (TSCA)	15 USC 2601 et seq.	Requires compliance with inventory reporting and chemical control provisions of TSCA to protect the public from the risks of exposure to chemicals; TSCA imposes strict limitations on use and disposal of equipment contaminated with polychlorinated biphenyls.
Federal Facility Compliance Act of 1992	42 USC 6961	Waives sovereign immunity for Federal facilities under RCRA and requires DOE to develop plans and enter into agreements with States as to specific management actions for specific mixed waste streams.
Executive Order 12088, Federal Compliance with Pollution Control Standards	October 13, 1978	Requires Federal agency landlords to submit to the Office of Management and Budget an annual plan for the control of environmental pollution and to consult with EPA and State agencies regarding the best techniques and methods.

Table 5–1. Federal Environmental Statutes, Regulations, and Executive Orders (Continued)

Statute, Regulation, Executive Order	Citation	Potential Requirements
Waste Management and Pollution Prevention (Continued)		
Executive Order 12856, Federal Compliance with Right-To-Know Laws and Pollution Prevention Requirements	August 3, 1993	Requires Federal agencies to achieve 50 percent reduction of agency's total releases of toxic chemicals to the environment and offsite transfers, to prepare a written facility pollution prevention plan not later than 1995, and to publicly report toxic chemicals entering any waste stream from Federal facilities, including any releases to the environment, and to improve local emergency planning, response and accident notification.
[Text deleted.]		
Executive Order 12580, Superfund Implementation	January 23, 1987	Delegates to the heads of Executive departments and agencies the responsibility for undertaking remedial actions for releases, or threatened releases, that are not on the National Priorities List and removal actions other than emergencies where the release is from any facility under the jurisdiction or control of Executive departments and agencies.
Biotic Resources		
Fish and Wildlife Coordination Act	16 USC 661 et seq.	Requires consultation on the possible effects on wildlife of construction, modification, or control of bodies of water in excess of 10 acres in surface area.
Bald and Golden Eagle Protection Act of 1972	16 USC 668 et seq.	Requires consultations to determine if any protected birds are found to inhabit the area. If so, must obtain a permit prior to moving any nests due to construction or operation of disposition facilities.
Migratory Bird Treaty Act of 1918	16 USC 703 et seq.	Requires consultation to determine if there are any impacts on migrating bird populations due to construction or operation of disposition facilities. If so, must develop mitigation measures to avoid adverse effects.
Anadromous Fish Conservation Act of 1965	16 USC 757	Requires consultation to determine if there are any impacts on anadromous fish that spawn in fresh water or estuaries and migrate to ocean waters and on anadromous fishery resources that are subject to depletion from water resource development.
Wilderness Act of 1964	16 USC 1131 et seq.	Requires consultation with the Department of Commerce and the Department of Interior to minimize impacts.
Wild Free-Roaming Horses and Burros Act of 1971	16 USC 1331 et seq.	Requires consultation with the Department of Interior to minimize impacts.

Table 5–1. Federal Environmental Statutes, Regulations, and Executive Orders (Continued)

Statute, Regulation, Executive Order	Citation	Potential Requirements
Biotic Resources (Continued)		
Endangered Species Act of 1973	16 USC 1531 et seq.	Requires consultation to identify endangered or threatened species and their habitats, assess impacts thereon, obtain biological opinions and, if necessary, develop mitigation measures to reduce or eliminate adverse effects of construction or operation.
Cultural Resources		
Antiquities Act of 1906	16 USC 431 et seq.	Requires protection of historic, prehistoric, and paleontological objects in federal lands from appropriation, excavation, injury, and destruction without permission.
DOE American Indian Tribal Government Policy	DOE Order 1230.2	Establishes government-to-government protocols for DOE interactions with tribal governments.
National Historic Preservation Act of 1966	16 USC 470 et seq.	Requires consultation with the State Historic Preservation Office prior to undertaking construction to ensure that no historical resources will be affected.
Archaeological and Historical Preservation Act of 1974	16 USC 469	Requires obtaining authorization for any disturbance of archaeological resources.
Archaeological Resources Protection Act of 1979	16 USC 470aa et seq.	Requires obtaining authorization for any excavation or removal of archaeological resources.
American Indian Religious Freedom Act of 1978	42 USC 1996 et seq.	Requires consultation with local Native American tribes to ensure that their religious customs, traditions, and freedoms are preserved.
Native American Graves Protection and Repatriation Act of 1990	25 USC 3001 et seq.	Requires repatriation of cultural items to Native Americans.
Executive Order 13007, Indian Sacred Sites	May 24, 1996	Requires the protection and preservation of Native American religious practices.
Executive Order 11593, Protection and Enhancement of the Cultural Environment	May 13, 1971	Requires the preservation of historic and archaeological data that may be lost during construction activities.
Worker Safety and Health		
Occupational Safety and Health Act of 1970	5 USC 5108 et seq.	Requires compliance with all applicable worker safety and health regulations.
Hazard Communication	29 CFR 1910.1200	Ensures that workers are informed of, and trained to handle, all chemical hazards in the workplace.
Transportation		
Transportation regulations	49 CFR 171, 172, 173, 174, 176, 177, 178, 397	Establishes standards for materials transportation including: packaging, marking and labeling, placarding, monitoring, routes, accident reporting, and manifesting. Includes requirements for transport by rail, air, and public highway.

Table 5–1. Federal Environmental Statutes, Regulations, and Executive Orders (Continued)

Statute, Regulation, Executive Order	Citation	Potential Requirements
	Transportation (Continued)	
Packaging and Transportation of Radioactive Materials	10 CFR 71	Establishes requirements for packaging, preparation for shipment, and transportation of licensed radioactive material, and standards for approval of packaging and shipping procedures for fissile material and for a quantity of other licensed material in excess of a Type A quantity. This part establishes the certification process, including the required documentation for and testing of shipping containers, and quality assurance program that must be in place for vendors and users of approved shipping containers.
Hazardous Materials Transportation Act of 1974	49 USC 1801 et seq.	Requires compliance with hazardous materials and waste transportation requirements.
[Text deleted.]		
Regulations of the International Atomic Energy Agency	IAEA Safety Series 6	Establishes standards for radioactive materials transportation.
International Maritime Organization Regulations	International Maritime Dangerous Goods Code, 1994	Requires segregation of radioactive materials packages from other dangerous goods and other aspects of stowage.
	Other	
Atomic Energy Act of 1954	42 USC 2011 et seq.	Authorizes DOE to establish standards to protect health or minimize dangers to life or property for activities under DOE's jurisdiction.
Price Anderson Act	42 USC 2210	Allows DOE to indemnify its contractors if the contract involves the risk of public liability from a nuclear incident.
Department of Energy Orders	Parts 100–500	Establishes standards and requirements to ensure safe operation of facilities.
National Environmental Policy Act (NEPA)	42 USC 4321 et seq.	Requires Federal agency to prepare an environmental impact statement for any major Federal action with significant environmental impact.
NEPA Implementing Procedures	10 CFR 1021	Requires DOE to follow its own implementing regulations to ensure environmental quality.
Emergency Planning and Community Right-To-Know Act of 1986	42 USC 11001 et seq.	Requires the development of emergency response plans and reporting requirements for chemical spills and other emergency releases, and imposes right-to-know reporting requirements covering storage and use of chemicals that are reported on toxic chemical release forms.
Executive Order 11514, Protection and Enhancement of Environmental Quality	March 6, 1970	Requires Federal agencies to demonstrate leadership in achieving the environmental quality goals of NEPA; provides for DOE consultation with appropriate Federal, State, and local agencies in carrying out their activities as they affect the environment.

Table 5–1. Federal Environmental Statutes, Regulations, and Executive Orders (Continued)

Statute, Regulation, Executive Order	Citation	Potential Requirements
Other (Continued)		
Farmland Protection Policy Act of 1981	7 USC 4201 et seq.	Requires avoidance of any adverse effects to prime and unique farmlands.
Executive Order 12114, Environmental Effects Abroad of Major Federal Actions	January 4, 1979	Requires officials of Federal agencies having ultimate responsibility for authorizing and approving actions encompassed by this order to be informed of pertinent environmental considerations and to take such considerations into account, along with other pertinent considerations of national policy, in making decisions regarding such actions. While based on independent authority, this order furthers the purpose of NEPA.
Executive Order 12898, Federal Actions to Address Environmental Justice in Minority and Low-Income Populations	February 11, 1994	Requires Federal agencies to identify and address as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.
Executive Order 12656, Assignment of Emergency Preparedness Responsibilities	November 18, 1988	Assigns emergency preparedness responsibilities to Federal departments and agencies.

Table 5–2. Summary of Consultations Initiated by DOE

DOE Site	Subject	DOE Consultation Letter: Addressed To (Date of Letter)	DOE Consultation Letter: Page No.	Agency/Group Response: From (Date of Response or Last Contact)	Agency/Group Response: Page No.
Hanford	Cultural Resources	Mr. David Hansen State Historic Preservation Officer (October 30, 1998)	O–2	Mr. Robert Whitlam (March 2, 1999)	NA[a]
	Native American	Mr. Russell Jim Confederated Tribes and Bands of the Yakima Indian Nation (October 30, 1998)	O–4	Ms. Nancy Peters (March 5, 1999)	NA[b]
	Native American	Ms. Donna L. Powaukee Nez Perce Tribe (October 30, 1998)	O–6	Mr. Pat Sobotta (March 2, 1999)	NA[b]
	Native American	Ms. Lenora Seelatsee Wanapum Band (October 30, 1998)	O–8	Ms. Lenora Seelatsee (March 5, 1999)	NA[b]
	Native American	Mr. J.R. Wilkinson Confederated Tribes of the Umatilla Indian Reservation (October 30, 1998)	O–10	Mr. J.R. Wilkinson (March 2, 1999)	NA[b]
	EcologicalR esources	Mr. Richard Roy U.S. Fish and Wildlife Service (July 28, 1998)	O–12	Mr. Richard Roy (December 3, 1998)	O–14
	EcologicalR esources	Mr. Jay McConnaughey Washington Department of Fish and Wildlife (July 28, 1998)	O–16	Mr. Jay McConnaughey (December 7, 1998)	O–18
INEEL	Cultural Resources	Mr. Robert Yohe State Historic Preservation Officer (October 30, 1998)	O–21	Mr. Robert Yohe (March 2, 1999)	NA[a]
	Native American	Mr. Keith Tinno Fort Hall Reservation (October 30, 1998)	O–23	Mr. Jim Reed (March 2, 1999)	NA[b]
	EcologicalR esources	Ms. Susan Burch U.S. Fish and Wildlife Service (July 28, 1998)	O–25	Mr. Robert Kuesink (August 18, 1998)	O–27
	EcologicalR esources	Mr. George Stephens Idaho Department of Fish and Game (July 28, 1998)	O–29	Mr. George Stephens (August 12, 1998 and February 12, 1999)	O–31 O–32
Pantex	Native American	Mr. Virgil Franklin Sr. Cheyenne-Arapaho Tribe of Oklahoma (October 30, 1998)	O–33	Mr. Gordon Yellowman (March 2, 1999)	NA[b]
	Native American	Mr. Billy Evans Horse Kiowa Tribe of Oklahoma (October 30, 1998)	O–35	Mr. William Hensley (March 2, 1999)	NA[b]
	Native American	Mr. D.J. Mowatt Apache Tribe of Oklahoma (October 30, 1998)	O–37	Mr. D.J. Mowatt (March 2, 1999)	NA[b]
	Native American	Mr. Don Wauahdooah Comanche Tribe of Oklahoma (October 30, 1998)	O–39	Ms. Phyllis Attocknie (March 2, 1999)	NA[b]
	EcologicalR esources	Mr. Robert Short U.S. Fish and Wildlife Service (July 28, 1998)	O–41	Agency office had no comment based on personal communication with Mr. Clayton Napier (December 2, 1998)	NA[a]
	EcologicalR esources	Mr. Pat Martin Texas Parks and Wildlife Department (July 28, 1998)	O–43	Ms. Shannon Breslin (March 22, 1999)	O–45

Table 5–2. Summary of Consultations Initiated by DOE (Continued)

DOE Site	Subject	DOE Consultation Letter		Agency/Group Response	
		Addressed To (Date of Letter)	Page No.	From (Date of Response or Last Contact)	Page No.
SRS	Cultural Resources	Dr. Rodger Stroup State Historic Preservation Officer (October 30, 1998)	O–46	Ms. Nancy Brock (November 12, 1998)	O–48
	Native American	Mr. Tom Berryhill National Council of the Muskogee Creek (October 30, 1998)	O–49	Mr. Ken Childers (March 2, 1999)	NA[b]
	Native American	Ms. Nancy Carnley Ma Chis Lower Alabama Creek Indian Tribe (October 30, 1998)	O–51	Ms. Nancy Carnley (March 2, 1999)	NA[b]
	Native American	Miko Tony Hill Indian People's Muskogee Tribal Town Confederacy (October 30, 1998)	O–53	Miko Tony Hill (March 2, 1999)	NA[b]
	Native American	Ms. Virginia Montoya Pee Dee Indian Association (October 30, 1998)	O–55	Ms. Virginia Montoya (March 2, 1999)	NA[b]
	Native American	Mr. Al Rolland Yuchi Tribal Organization, Inc. (October 30, 1998)	O–57	Mr. Al Rolland (March 2, 1999)	NA[b]
	Native American	Mr. John Ross United Keetoowah Band (October 30, 1998)	O–59	Ms. Julie Moss (March 2, 1999)	NA[b]
	EcologicalR esources	Mr. Roger Banks U.S. Fish and Wildlife Service (July 28, 1998)	O–61	Mr. Edwin EuDaly (September 8, 1998)	O–63
	EcologicalR esources	Mr. Tom Murphy South Carolina Department of Natural Resources	O–67	Agency office had no comment based on personal communication with Mr. Tom Murphy (December 2, 1998)	NA[a]

[a] No written response was received. Response obtained via telephone conversation.
[b] No response was received.

siltstone A fine-grained, elastic (fragmented) sedimentary rock whose particles range from 1/6 to 1/256 millimeter in diameter.

sinter To form a homogenous mass by heating without melting.

sitewide environmental impact statement A legal document prepared in accordance with the requirements of Section 102(2)(C) of the National Environmental Policy Act that reflects an evaluation of the environmental impacts of proposed Government actions at a large, multiple-facility site.

solid waste Discarded solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities. Solid waste does not include solid or dissolved materials in domestic sewage; industrial discharges subject to permit under the Clean Water Act; or source, special nuclear, or byproduct material as defined by the Atomic Energy Act.

source term The estimated quantities of radionuclides or chemical pollutants released to the environment.

special nuclear materials As defined in Section 11 of the Atomic Energy Act, "(1) plutonium, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the NRC determines to be special nuclear material, or (2) any material artificially enriched by any of the foregoing."

Spent Fuel Standard A term, coined by the National Academy of Sciences and modified by DOE, denoting the main objective of alternatives for the disposition of surplus weapons-usable plutonium: that such plutonium be made roughly as inaccessible and unattractive for weapons use as the much larger and growing stock of plutonium in civilian spent nuclear fuel.

spent nuclear fuel Fuel that has been withdrawn from a nuclear reactor following irradiation, and whose constituents have not been separated.

stabilization Treatment, packaging, and removal of hazardous and radioactive materials in such a manner as to ensure that a facility is safe and environmentally secure.

stabilize To convert a compound, mixture, or solution to a nonreactive form.

staging An interim storage or gathering of items pending their use, transportation, consumption, or other disposition.

standby That condition in which a reactor facility is neither operable nor declared excess, and as authorized in writing, is being kept in readiness for possible future operation.

State Historic Preservation Officer That State officer charged with the identification and protection of prehistoric and historic resources in accordance with the National Historic Preservation Act.

steppe A semiarid, grass-covered, generally treeless plain.

steppe climate (semiarid climate) The type of climate in which precipitation is very slight but sufficient for the growth of short, sparse grass.

stored weapons standard A storage standard that invokes the high standards of security and accounting for the storage of intact nuclear weapons. Invocation of the standard for weapons-usable fissile materials implies maintenance thereof to the extent practical through the processes of dismantlement, storage, and disposition.

Superfund Amendments and Reauthorization Act of 1986 An environmental act that, in addition to certain freestanding provisions of law, extensively amends the Comprehensive Environmental Response, Compensation, and Liability Act (Superfund) and the Safe Drinking Water Act. The act's major goals are a stepped-up pace of cleanup, increased public participation, and more stringent and better-defined cleanup standards, emphasizing remedial actions. See also *Comprehensive Environmental Response, Compensation, and Liability Act of 1980; Safe Drinking Water Act, as amended.*

surface water Water on the Earth's surface, as distinguished from water in the ground (groundwater).

surplus fissile materials Weapons-usable fissile materials that have no identified programmatic use or do not fall into one of the categories of national security reserves.

Tertiary The first geologic period of the Cenozoic era, dating from 66 million to about 3 million years ago. During this period, mammals became the dominant life form.

threatened species As defined in the Endangered Species Act of 1973, "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range."

total effective dose equivalent The sum of the internal dose (committed effective dose equivalent) and the external dose (effective dose equivalent).

toxic air pollutants See *hazardous/toxic air pollutants.*

Toxic Substances Control Act of 1976 An act authorizing the U.S. Environmental Protection Agency to secure information on all new and existing chemical substances and to control any of these substances determined to cause an unreasonable risk to public health or the environment. This law requires that the health and environmental effects of all new chemicals be reviewed by the Agency before such chemicals are manufactured for commercial purposes.

transmissivity A measure of a water-bearing unit's capacity to transmit fluid, expressed as the product of the thickness and the average hydraulic conductivity of the unit. Also, the rate at which water is transmitted through a strip of an aquifer of a unit width under a unit hydraulic gradient at a prevailing temperature and pressure.

transuranic Of, relating to, or being any element whose atomic number is higher than that of uranium (that is, 92). All transuranic elements are produced artificially and are radioactive.

transuranic waste Waste containing more than 100 nanocuries per gram of alpha-emitting transuranic isotopes with half-lives greater than 20 years, except for (1) high-level waste; (2) waste that DOE has determined, with the concurrence of the U.S. Environmental Protection Agency, does not need the degree of isolation called for by 40 CFR 191; or (3) waste that the U.S. Nuclear Regulatory Commission has approved for disposal case by case in accordance with 10 CFR 61.

treatment An operation necessary to prepare material for storage, disposal, or transportation.

Triassic The first period of the Mesozoic era, dating from 245 to 208 million years ago.

tritium A radioactive isotope of the element hydrogen having two neutrons and one proton.

tritium recycling The recovery, purification, and reuse of tritium contained in tritium reservoirs within the nuclear weapons stockpile.

unconfined aquifer A permeable geologic unit having the following properties: a water-filled pore space (saturated), the capability to transmit significant quantities of water under ordinary differences in pressure, and an upper water boundary at atmospheric pressure.

uranium A heavy, silvery-white metallic element (atomic number: 92) with many radioactive isotopes. One isotope, uranium 235, is most commonly used as a fuel for nuclear fission; another, uranium 238, is transformed into fissionable plutonium 239 following its capture of a neutron in a nuclear reactor.

vadose zone A region in a porous medium in which the pore space is not filled with water (unsaturatured zone).

viewshed The extent of the area that may be viewed from a particular location. Viewsheds are generally bounded by topographic features such as hills or mountains.

Visual Resource Management A process devised by the Bureau of Land Management to assess analytically the aesthetic quality of a landscape, and consistent with the results of that analysis, to so design proposed activities as to minimize their visual impact on that landscape. The process consists of a rating of site visual quality followed by a measurement of the degree of contrast between proposed development activities and the existing landscape.

Visual Resource Management Class Any of the classifications of visual resources established through application of the Visual Resources Management process of the Bureau of Land Management. Four classifications are employed to describe different degrees of modification to landscape elements: Class I, areas where the natural landscape is preserved, including national wilderness areas and the wild sections of national wild and scenic rivers; Class II, areas with very limited land development activity, resulting in visual contrasts that are seen but do not attract attention; Class III, areas in which development may attract attention, but the natural landscape still dominates; Class IV, areas in which development activities may dominate the view and may be the major focus in the landscape.

visual resources Natural and cultural features by which the appearance of a particular landscape is defined.

vitrification A process by which glass (for example, borosilicate glass) is used to encapsulate or immobilize radioactive wastes.

volatile organic compounds A broad range of organic compounds, often halogenated, that vaporize at rather low ambient temperatures. Examples include certain solvents, paint thinners, degreasers (for example, benzene), chloroform, and methyl alcohol.

waste A discardable residue of a manufacturing or purification process.

Waste Isolation Pilot Plant A facility in southeastern New Mexico that is being developed as the national disposal site for transuranic and mixed transuranic waste.

waste minimization and pollution prevention An action that economically avoids or reduces the generation of waste and pollution by means of source reduction, reduction in the toxicity of hazardous waste and pollution, improvement in energy use, and recycling. These actions are consistent with the general goal of minimizing present and future threats to human health, safety, and the environment.

waste package The waste, waste container, and any absorbent that are intended for disposal as a unit. In the case of surface-contaminated, damaged, leaking, or breached waste packages, any overpack is considered the waste container, and the original container is considered part of the waste.

wastewater Water originating from human sanitary water use (domestic wastewater) and from a variety of industrial processes (industrial wastewater).

water quality standards and criteria Limits on the concentrations of specific constituents or on the characteristics of water, often based on water use classifications (for example, drinking water, recreation, propagation of fish and aquatic life, agricultural and industrial use). Water quality standards are legally enforceable, whereas water quality criteria are nonenforceable recommendations based on biotic impacts.

water table The boundary between the unsaturated zone and the deeper, saturated zone. The upper surface of an unconfined aquifer.

weapons-grade material Plutonium or highly enriched uranium, in metallic form, that was manufactured for weapons application. Weapons-grade plutonium contains less than 7 percent plutonium 240.

weapons-usable material Plutonium or highly enriched uranium in forms (for example, metals, oxides) that can be readily converted for use in nuclear weapons. Weapons-grade, fuel-grade, and power reactor–grade plutonium are all weapons usable.

wetland Land areas exhibiting hydric soil conditions, saturated or inundated soil during some portion of the year, and plant species tolerant of such conditions.

whole-body dose Dose of radiation resulting from the uniform exposure of all organs and tissues in a human body. See also *effective dose equivalent.*

Wild and Scenic Rivers Act The Act that established the National Wild and Scenic Rivers System with a view to preserving and protecting the free-flowing condition of selected rivers having outstanding natural, cultural, or recreational features. For federally owned land within the boundaries of rivers in the system, certain activities that would have a direct and adverse effect on river values may be controlled.

zooplankton A collective term for nonphotosynthetic organisms present in plankton.

6M A container, resembling a 55-gallon stainless steel drum, that is used by the U.S. Department of Energy for the shipment of radioactive material. This container is one unit of a containment package that includes an inner impact absorber material (Type B packaging), which protects another inner container (usually Type 2R) in which the radioactive material is placed.

Chapter 7
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Chapter 8
Distribution List

The U.S. Department of Energy is providing copies of the *Surplus Plutonium Disposition Final Environmental Impact Statement* to Federal, State, and local elected and appointed government officials and agencies; Native American groups; and other organizations and individuals listed below. Copies will be distributed in bulk to some individuals and organizations for further distribution (e.g., the State single points of contact for the National Environmental Policy Act [NEPA]). Copies will be provided to other organizations and individuals on request.

ELECTED OFFICIALS

Federal Elected Officials

- Senators and Representatives from the States of California, Georgia, Idaho, New Mexico, North Carolina, Oregon, South Carolina, Tennessee, Texas, Virginia, and Washington
- Congressional Committees:
  - Senate: Committee on Appropriations, Committee on Armed Services, and Energy and Natural Resources Committee
  - House of Representatives: Committee on Appropriations and Committee on National Security

State Elected Officials

- Governors from the States of California, Georgia, Idaho, New Mexico, North Carolina, Oregon, South Carolina, Tennessee, Texas, Virginia, and Washington
- State Senators and Representatives from the States of California, Georgia, Idaho, New Mexico, North Carolina, Oregon, South Carolina, Tennessee, Texas, Virginia, and Washington

Local Elected Officials

- Mayors, council members, etc., from areas near the Catawba Nuclear Station, Hanford Site, Idaho National Engineering and Environmental Laboratory, Lawrence Livermore National Laboratory, Los Alamos National Laboratory, McGuire Nuclear Station, North Anna Power Station, Oak Ridge National Laboratory, Pantex Plant, and Savannah

River
Site

APPOINTED OFFICIALS

Federal Appointed Officials

- Agencies that are members of the Interagency Working Group for Plutonium Disposition—Arms Control and Disarmament Agency, Central Intelligence Agency, Council on Environmental Quality, Defense Nuclear Facilities Safety Board, Department of Defense, National Security Council, Nuclear Regulatory Commission, Office of Management and Budget, State Department, and Environmental Protection Agency

- Other Federal agencies including: General Accounting Office, National Academy of Sciences, National Oceanic and Atmospheric Administration, National Science Foundation, U.S. Bureau of Indian Affairs, and U.S. National Park Service

State Appointed Officials

- NEPA single points of contact for the States of California, Georgia, Idaho, New Mexico, North Carolina, Oregon, South Carolina, Tennessee, Texas, Virginia, and Washington

- State agencies including: Commonwealth of Virginia, Office of Attorney General; Georgia Emergency Management Agency; South Carolina Nuclear Waste Program; Southern States Energy Board; State of Idaho's Idaho National Engineering and Environmental Laboratory Oversight Program; State of Texas' Division of Emergency Management; State of Texas' Office of the Attorney General; Texas Natural Resources Conservation Commission; State of Texas' Department of Health; State of Washington's Department of Ecology; State of Washington's Energy Office; Tennessee Department of Environment and Conservation/DOE

  Oversight Division; Virginia Department of Health, State Commissioner; Virginia State Corporation Commission, Division of Energy Regulation; and U.S. Nuclear Regulatory Commission, Region 2

NATIVE AMERICAN GROUPS

Federally recognized Native American tribes from the States of California, Georgia, Idaho, New Mexico, North Carolina, Oregon, South Carolina, Tennessee, Texas, Virginia, and Washington

DEPARTMENT OF ENERGY

Department of Energy Reading Rooms in the States of California, Idaho, New Mexico, North Carolina, Oregon, South Carolina, Tennessee, Texas, Virginia, Washington, and the District of Columbia

ORGANIZATIONS AND INDIVIDUALS

Organizations and individuals who have requested copies of the *Surplus Plutonium Disposition Final Environmental Impact Statement*

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