DOE/EIS-0283-S2
July 2012


Savannah River Site – South Carolina


Sequoyah Nuclear Plant – Tennessee

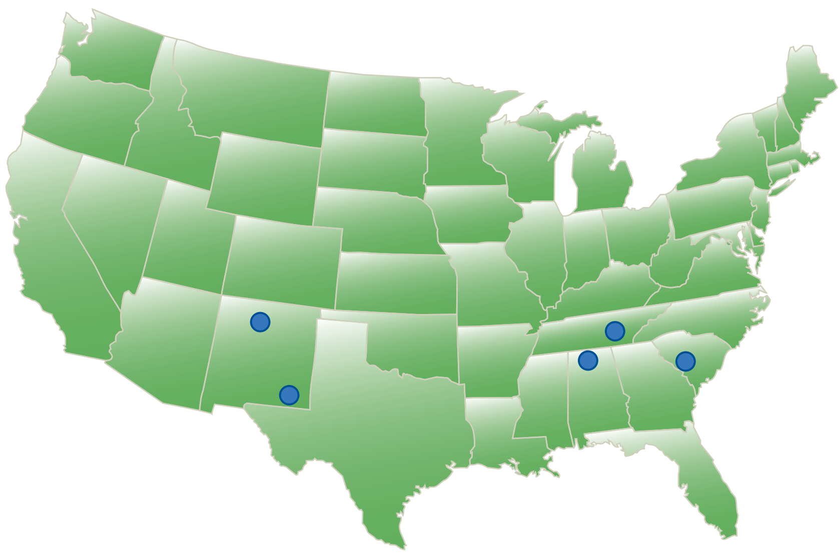

Browns Ferry Nuclear Plant – Alabama

Waste Isolation Pilot Plant – New Mexico


Los Alamos National Laboratory – New Mexico

Draft Surplus Plutonium Disposition Supplemental Environmental Impact Statement

Summary



National Nuclear Security Administration
U.S. Department of Energy
Office of Fissile Materials Disposition
and
Office of Environmental Management
Washington, DC

AVAILABILITY OF THE
DRAFT SURPLUS PLUTONIUM DISPOSITION
SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
(SPD Supplemental EIS)

To submit comments on this *SPD Supplemental EIS*, or to request a copy, please contact:

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Locations: South Carolina, New Mexico, Alabama, and Tennessee

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This document is available on the *SPD Supplemental EIS* website (http://nnsa.energy.gov/nepa/spdsupplementaleis), the DOE NEPA website (http://energy.gov/nepa/nepa-documents), and the Savannah River Operations Office website (http://www.srs.gov/general/pubs/envbul/nepa1.htm) for viewing and downloading.

Abstract: On March 28, 2007, DOE published a Notice of Intent (NOI) in the *Federal Register* (72 FR 14543) to prepare the *SPD Supplemental EIS* to evaluate the potential environmental impacts at the Savannah River Site (SRS) in South Carolina of disposition pathways for surplus weapons-usable plutonium (referred to as "surplus plutonium") originally planned for immobilization. The proposed actions and alternatives included construction and operation of a new vitrification capability in K-Area, processing in H-Canyon/HB-Line and the Defense Waste Processing Facility (DWPF), and fabricating mixed oxide (MOX) fuel in the MOX Fuel Fabrication Facility (MFFF) currently under construction in F-Area. Before the *Draft SPD Supplemental EIS* was issued, DOE decided to modify the scope of this *SPD Supplemental EIS* and evaluate additional alternatives. Therefore, on July 19, 2010 and again on January 12, 2012, DOE issued amended NOIs (75 FR 41850 and 77 FR 1920) announcing its intent to modify the scope of this *SPD Supplemental EIS* and to conduct additional public scoping.

The public scoping periods extended from March 28, 2007, through May 29, 2007; July 19, 2010 through September 17, 2010; and January 12, 2012 through March 12, 2012. Scoping meetings were conducted on April 17, 2007, in Aiken, South Carolina; April 19, 2007, in Columbia, South Carolina; August 3, 2010, in Tanner, Alabama; August 5, 2010, in Chattanooga, Tennessee; August 17, 2010, in North Augusta, South Carolina; August 24, 2010, in Carlsbad, New Mexico; August 26, 2010, in Santa Fe, New Mexico; and February 2, 2012, in Pojoaque, New Mexico. A summary of the comments received during the public scoping periods is provided in Chapter 1 of this *SPD Supplemental EIS* and available on the project website at http://nnsa.energy.gov/nepa/spdsupplementaleis.

DOE has revised the scope of this *SPD Supplemental EIS* to refine the quantity and types of surplus plutonium, evaluate additional alternatives (including additional pit disassembly and conversion options), no longer

consider in detail one of the alternatives identified in the 2007 NOI (ceramic can-in-canister immobilization), and revise DOE's preferred alternative. In this *SPD Supplemental EIS*, DOE describes the environmental impacts of alternatives for disposition of 13.1 metric tons (14.4 tons) of surplus plutonium for which DOE has not made a disposition decision, including 7.1 metric tons (7.8 tons) of plutonium from pits that were declared excess to national defense needs after publication of the 2007 NOI, and 6.0 metric tons (6.6 tons) of surplus non-pit plutonium. The analyses also encompass potential use of MOX fuel in reactors at the Sequoyah and Browns Ferry Nuclear Plants of the Tennessee Valley Authority (TVA).

In this *SPD Supplemental EIS*, DOE evaluates the No Action Alternative and four action alternatives for disposition of 13.1 metric tons (14.4 tons) of surplus plutonium: (1) Immobilization to DWPF Alternative – glass can-in-canister immobilization of both surplus non-pit and disassembled and converted pit plutonium and subsequent filling of the canister with high-level radioactive waste (HLW) at DWPF at SRS; (2) MOX Fuel Alternative – fabrication of the disassembled and converted pit plutonium and much of the non-pit plutonium into MOX fuel at MFFF, for use in domestic commercial nuclear power reactors to generate electricity, and disposition of the surplus non-pit plutonium that is not suitable for MFFF as transuranic waste at the existing Waste Isolation Pilot Plant (WIPP), a deep geologic repository in southeastern New Mexico; (3) H-Canyon/HB-Line to DWPF Alternative – processing the surplus non-pit plutonium in the existing H-Canyon/HB-Line at SRS with subsequent disposal as HLW (i.e., vitrification in the existing DWPF), and fabrication of the pit plutonium into MOX fuel at MFFF; and (4) WIPP Alternative – processing the surplus non-pit plutonium in the existing H-Canyon/HB-Line for disposal as transuranic waste at WIPP, and fabrication of the pit plutonium into MOX fuel at MFFF. Under all alternatives, DOE would also disposition as MOX fuel, 34 metric tons (37.5 tons) of surplus plutonium in accordance with previous decisions. The 34 metric tons (37.5 tons) of plutonium would be fabricated into MOX fuel at MFFF, for use at domestic commercial nuclear power reactors. Within each action alternative, DOE also evaluates options for pit disassembly and conversion to, among other things, disassemble nuclear weapons pits and convert the plutonium metal to an oxide form for disposition. Under three of the options, DOE would not build a stand-alone Pit Disassembly and Conversion Facility in F-Area at SRS, which DOE had previously decided to construct (65 FR 1608).

Preferred Alternative: The MOX Fuel Alternative is DOE's Preferred Alternative for surplus plutonium disposition. DOE's preferred option for pit disassembly and the conversion of surplus plutonium metal, regardless of its origins, to feed for MFFF is to use some combination of facilities at Technical Area 55 at Los Alamos National Laboratory and K-Area, H-Canyon/HB-Line, and MFFF at SRS, rather than to construct a new stand-alone facility. This would likely require the installation of additional equipment and other modifications to some of these facilities. DOE's preferred alternative for disposition of surplus plutonium that is not suitable for MOX fuel fabrication is disposal at WIPP. The TVA does not have a preferred alternative at this time regarding whether to pursue irradiation of MOX fuel in TVA reactors and which reactors might be used for this purpose.

Public Involvement: Comments on this *Draft SPD Supplemental EIS* should be submitted within 60 days of the publication of the U.S. Environmental Protection Agency's Notice of Availability in the *Federal Register* to ensure consideration in preparation of the *Final SPD Supplemental EIS*. DOE will consider comments received after the 60-day comment period to the extent practicable. Written comments may be submitted to Sachiko McAlhany via postal mail to the address provided above, via email to spdsupplementaleis@saic.com, or by toll-free fax to 1-877-865-0277. Public hearings on this *Draft SPD Supplemental EIS* will be held during the comment period. The dates, times, and locations of these hearings will be published in a DOE *Federal Register* notice and will also be announced by other means, including the project website, newspaper advertisements, and notification to persons on the mailing list. Information on this *SPD Supplemental EIS* can be found on the project website at http://nnsa.energy.gov/nepa/spdsupplementaleis.

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ACRONYMS AND ABBREVIATIONS

ALARA	as low as reasonably achievable
ARIES	Advanced Recovery and Integrated Extraction System
CFR	*Code of Federal Regulations*
DOE	U.S. Department of Energy
DWPF	Defense Waste Processing Facility
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
FFTF	Fast Flux Test Facility
FR	*Federal Register*
GWSB	Glass Waste Storage Building
HLW	high-level radioactive waste
LANL	Los Alamos National Laboratory
LCF	latent cancer fatality
LEU	low-enriched uranium
LLW	low-level radioactive waste
MEI	maximally exposed individual
MFFF	Mixed Oxide Fuel Fabrication Facility
MLLW	mixed low-level radioactive waste
MOX	mixed oxide
NEPA	National Environmental Policy Act
NNSA	National Nuclear Security Administration
NOI	Notice of Intent
NRC	U.S. Nuclear Regulatory Commission
Pantex	Pantex Plant
PDC	Pit Disassembly and Conversion Project
PDCF	Pit Disassembly and Conversion Facility
PF-4	Plutonium Facility
PMDA	Agreement Between the Government of the United States of America and the Government of the Russian Federation Concerning the Management and Disposition of Plutonium Designated As No Longer Required for Defense Purposes and Related Cooperation
POC	Pipe Overpack Container
ROD	Record of Decision
ROI	region of influence
SRS	Savannah River Site
TA-55	Technical Area 55
TRU	transuranic
TRUPACT-II	Transuranic Package Transporter Model 2
TVA	Tennessee Valley Authority
WIPP	Waste Isolation Pilot Plant
WSB	Waste Solidification Building
ZPPR	Zero Power Physics Reactor

CONVERSIONS

METRIC TO ENGLISH			ENGLISH TO METRIC		
Multiply	**by**	**To get**	**Multiply**	**by**	**To get**
Area					
Square meters	10.764	Square feet	Square feet	0.092903	Square meters
Square kilometers	247.1	Acres	Acres	0.0040469	Square kilometers
Square kilometers	0.3861	Square miles	Square miles	2.59	Square kilometers
Hectares	2.471	Acres	Acres	0.40469	Hectares
Concentration					
Kilograms/square meter	0.16667	Tons/acre	Tons/acre	0.5999	Kilograms/square meter
Milligrams/liter	1 [a]	Parts/million	Parts/million	1 [a]	Milligrams/liter
Micrograms/liter	1 [a]	Parts/billion	Parts/billion	1 [a]	Micrograms/liter
Micrograms/cubic meter	1 [a]	Parts/trillion	Parts/trillion	1 [a]	Micrograms/cubic meter
Density					
Grams/cubic centimeter	62.428	Pounds/cubic feet	Pounds/cubic feet	0.016018	Grams/cubic centimeter
Grams/cubic meter	0.0000624	Pounds/cubic feet	Pounds/cubic feet	16,018.5	Grams/cubic meter
Length					
Centimeters	0.3937	Inches	Inches	2.54	Centimeters
Meters	3.2808	Feet	Feet	0.3048	Meters
Kilometers	0.62137	Miles	Miles	1.6093	Kilometers
Radiation					
Sieverts	100	Rem	Rem	0.01	Sieverts
Temperature					
Absolute					
Degrees C + 17.78	1.8	Degrees F	Degrees F - 32	0.55556	Degrees C
Relative					
Degrees C	1.8	Degrees F	Degrees F	0.55556	Degrees C
Velocity/Rate					
Cubic meters/second	2,118.9	Cubic feet/minute	Cubic feet/minute	0.00047195	Cubic meters/second
Grams/second	7.9366	Pounds/hour	Pounds/hour	0.126	Grams/second
Meters/second	2.237	Miles/hour	Miles/hour	0.44704	Meters/second
Volume					
Liters	0.26418	Gallons	Gallons	3.7854	Liters
Liters	0.035316	Cubic feet	Cubic feet	28.316	Liters
Liters	0.001308	Cubic yards	Cubic yards	764.54	Liters
Cubic meters	264.17	Gallons	Gallons	0.0037854	Cubic meters
Cubic meters	35.314	Cubic feet	Cubic feet	0.028317	Cubic meters
Cubic meters	1.3079	Cubic yards	Cubic yards	0.76456	Cubic meters
Cubic meters	0.0008107	Acre-feet	Acre-feet	1,233.49	Cubic meters
Weight/Mass					
Grams	0.035274	Ounces	Ounces	28.35	Grams
Kilograms	2.2046	Pounds	Pounds	0.45359	Kilograms
Kilograms	0.0011023	Tons (short)	Tons (short)	907.18	Kilograms
Metric tons	1.1023	Tons (short)	Tons (short)	0.90718	Metric tons
ENGLISH TO ENGLISH					
Acre-feet	325,850.7	Gallons	Gallons	0.000003046	Acre-feet
Acres	43,560	Square feet	Square feet	0.000022957	Acres
Square miles	640	Acres	Acres	0.0015625	Square miles

a. This conversion is only valid for concentrations of contaminants (or other materials) in water.

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}
deca-	D	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}

SUMMARY

S.1 Introduction

In keeping with U.S. nonproliferation policies and commitments[1] to reduce the availability of material that is readily usable in nuclear weapons, the U.S. Department of Energy (DOE), including the semiautonomous National Nuclear Security Administration (NNSA), is engaged in a program to disposition U.S. surplus weapons-usable plutonium (referred to in this supplemental environmental impact statement as "surplus plutonium"). Surplus plutonium includes pit[2] and non-pit[3] plutonium that is no longer needed for U.S. national security or programmatic purposes. DOE has previously analyzed and made decisions on disposition paths for most of the plutonium the United States has declared as surplus.

On March 28, 2007, DOE published a Notice of Intent (NOI) in the *Federal Register* (72 FR 14543) to prepare this *Surplus Plutonium Disposition Supplemental Environmental Impact Statement (SPD Supplemental EIS)*[4] to evaluate the potential environmental impacts at the Savannah River Site (SRS) of alternative disposition pathways for surplus plutonium originally planned for immobilization in the Record of Decision (ROD) (65 FR 1508) for the *Surplus Plutonium Disposition Environmental Impact Statement (SPD EIS)* (DOE 1999). The proposed actions and alternatives included construction and operation of a new vitrification capability in K-Area, processing in H-Canyon/HB-Line and the Defense Waste Processing Facility (DWPF), and fabricating mixed oxide (MOX) fuel in the MOX Fuel Fabrication Facility (MFFF) currently under construction in F-Area at SRS.

> **Weapons-usable plutonium** is plutonium in forms that can be readily converted for use in nuclear weapons. Weapons-grade, fuel-grade, and power-reactor-grade plutonium are all weapons-usable plutonium.
>
> **Surplus plutonium** has no identified programmatic use and does not fall into one of the categories of national security reserves.

Then on July 19, 2010, DOE issued an amended NOI (75 FR 41850) announcing its intent to modify the scope of this *SPD Supplemental EIS* and to conduct additional public scoping. Under the revised scope, DOE would refine the quantity and types of surplus plutonium, evaluate additional alternatives, and no longer consider in detail one of the alternatives identified in the 2007 NOI (i.e., ceramic can-in-canister immobilization). In addition, DOE had identified in the 2007 NOI a glass can-in-canister immobilization approach as its Preferred Alternative for the non-pit plutonium then under consideration; the 2010 amended NOI explained that DOE would evaluate a glass can-in-canister immobilization alternative in this *SPD Supplemental EIS*, but that DOE did not have a preferred alternative.

On January 12, 2012, DOE issued a second amended NOI (77 FR 1920) announcing its intent to further modify the scope of this *SPD Supplemental EIS* to evaluate additional options for pit disassembly and conversion of plutonium metal to oxide including potential use of the Plutonium Facility (PF-4) at the Los Alamos National Laboratory (LANL), and to conduct additional public scoping. In addition, DOE identified the MOX Fuel Alternative as DOE's Preferred Alternative.

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[1] *On September 1, 2000, the Agreement Between the Government of the United States and the Government of the Russian Federation Concerning the Management and Disposition of Plutonium Designated as No Longer Required for Defense Purposes and Related Cooperation (referred to as "the PMDA") (USA and Russia 2000) was signed. The PMDA (and its 2010 Protocol) calls for each country to dispose of at least 34 metric tons (37.5 tons) of excess weapons-grade plutonium by fabrication into MOX fuel and irradiation in reactors in each country.*

[2] *The plutonium was made by the United States in nuclear reactors for use in nuclear weapons. A pit is the central core of a primary assembly in a nuclear weapon and is typically composed of plutonium-239 metal, enriched uranium, or both, and other materials.*

[3] *Non-pit plutonium may exist in metal or oxide form, and may be combined with other materials that were used in the process of manufacturing plutonium for use in nuclear weapon or related research and development activities.*

[4] *In the NOI (72 FR 14543), the title was given as the* Supplemental Environmental Impact Statement for Surplus Plutonium Disposition at the Savannah River Site.

This *SPD Supplemental EIS* updates the previous DOE National Environmental Policy Act (NEPA) analyses (described in Appendix A, Section A.1, of this *SPD Supplemental* EIS) to consider options for pit disassembly and conversion of plutonium metal to oxide. It also analyzes the use of fuel fabricated from surplus plutonium in Tennessee Valley Authority (TVA) reactors and other domestic commercial nuclear power reactors to generate electricity. This *SPD Supplemental EIS* also evaluates alternatives for the disposition of 13.1 metric tons (14.4 tons) of surplus plutonium for which DOE has not yet made a disposition decision.

S.2 Purpose and Need for Agency Action

DOE's purpose and need for action remains, as stated in the *SPD EIS* (DOE 1999:1-3), to reduce the threat of nuclear weapons proliferation worldwide by conducting disposition of surplus plutonium in the United States in an environmentally sound manner, ensuring that it can never again be readily used in nuclear weapons.

TVA is a cooperating agency on this *SPD Supplemental EIS* because it is considering the use of MOX fuel, produced as part of DOE's Surplus Plutonium Disposition Program, in its nuclear power reactors. TVA provides electrical power to the people of the Tennessee Valley region, including almost all of Tennessee and parts of Alabama, Mississippi, Kentucky, Virginia, North Carolina, and Georgia. TVA's Sequoyah and Browns Ferry Nuclear Plants, located near Soddy-Daisy, Tennessee, and Athens, Alabama, respectively, currently are, and will continue to be, major assets among TVA's energy generation resources in meeting the demand for power in the region. Consistent with DOE's purpose and need, TVA's purpose for considering use of MOX fuel derived from DOE's Surplus Plutonium Disposition Program is the possible procurement of MOX fuel for use in these reactors.

> A **cooperating agency** participates in the preparation of an EIS because of its jurisdiction by law or special expertise with respect to any environmental impact involved in a proposal (or a reasonable alternative) (40 CFR 1501.6, 1508.5).

S.3 Proposed Action

DOE proposes to disposition an additional 13.1 metric tons (14.4 tons) of surplus plutonium for which it has not previously made a disposition decision; to provide the appropriate capability to disassemble surplus pits and convert surplus plutonium to a form suitable for disposition; and to provide for the use of MOX fuel in TVA's and other domestic commercial nuclear power reactors.

Figure S–1 shows the major Surplus Plutonium Disposition Program activities. Facilities at E-, F-, H-, K-, and S-Areas at SRS in South Carolina; at Technical Area 55 (TA-55) at LANL in New Mexico; at the Waste Isolation Pilot Plant (WIPP) in New Mexico; and at the Browns Ferry and Sequoyah Nuclear Plants and other domestic commercial nuclear power reactors that could irradiate MOX fuel. **Figures S–2** and **S–3** show the locations of SRS and LANL and the applicable operations areas at these sites. **Figures S–4, S–5,** and **S–6** show the locations of WIPP, Browns Ferry Nuclear Plant, and Sequoyah Nuclear Plant, respectively.

S.4 Disposition Paths Identified for Surplus Plutonium

To date, the United States has declared as excess to U.S. defense needs a total of 61.5 metric tons (67.8 tons) of plutonium. This quantity includes both pit and non-pit plutonium. Based on a series of NEPA reviews described in Appendix A, Section A.1, of this *SPD Supplemental EIS*, DOE has determined disposition paths for most of this surplus plutonium.

Plutonium with Identified Disposition Paths

Figure S–7 summarizes the various plutonium disposition paths decided to date for 45.3 metric tons (50.0 tons) of surplus plutonium.

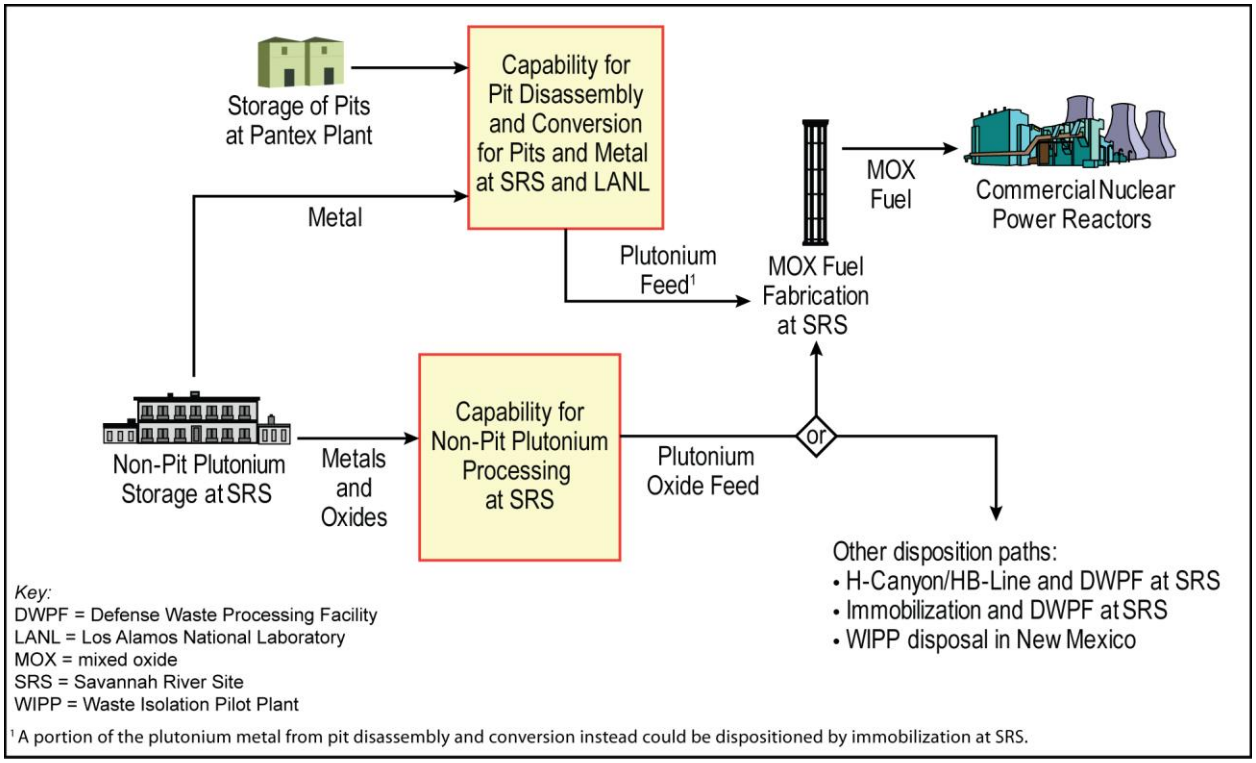

Figure S–1 Surplus Plutonium Disposition Program Activities

In the 2000 ROD (65 FR 1608) and 2003 amended ROD (68 FR 20134) for the *SPD EIS*, DOE decided to fabricate 34 metric tons (37.5 tons) of surplus plutonium into MOX fuel at the MFFF being constructed at SRS. DOE is not revisiting those decisions. In 2012, DOE issued an interim action determination to prepare 2.4 metric tons (2.6 tons) of plutonium metal and oxide as feed material for the MFFF using H-Canyon/HB-Line (DOE 2012a). This material is a subset of the 6.5 metric tons (7.2 tons) of non-pit metal and oxides that DOE decided to prepare as MOX fuel in 2003 (68 FR 20134). Seven metric tons (7.7 tons) of surplus plutonium are contained in used fuel (also known as spent fuel) and are, therefore, already in a proliferation-resistant form. Following appropriate NEPA reviews as described in Appendix A, Section A.1, of this *SPD Supplemental EIS*, DOE has already disposed of 3.2 metric tons (3.5 tons) of surplus plutonium scrap and residues at WIPP as transuranic (TRU) waste. In 2008 and 2009, DOE completed interim action determinations concluding that 0.6 metric tons (0.7 tons) of surplus non-pit plutonium could be disposed of through H-Canyon/HB-Line and DWPF (DOE 2008a, 2009); in 2011, DOE amended this determination to add WIPP as a disposal alternative for about 85 kilograms (187 pounds) of these 0.6 metric tons (0.7 tons) (DOE 2011a). Also in 2011, DOE decided to use H-Canyon/HB-Line to prepare 0.5 metric tons (0.6 tons) of surplus plutonium for disposal at WIPP (DOE 2011b). Thus, DOE has determined that a total of 1.1 metric tons (1.2 tons) of surplus plutonium could be dispositioned through H-Canyon/HB-Line to DWPF and WIPP.

Plutonium with No Identified Disposition Path

Figure S–7 shows the surplus plutonium for which DOE has not made a disposition decision. Of this material, DOE previously set aside for programmatic use 4 metric tons (4.4 tons) of surplus plutonium in the form of Zero Power Physics Reactor (ZPPR) fuel at its Idaho National Laboratory. DOE no longer has a programmatic use for this material. DOE is considering using a portion (about 0.4 metric tons [0.44 tons]) of the material for a different programmatic use. While the bulk of the ZPPR fuel currently stored at the Idaho National Laboratory has been declared excess, specific disposition proposals remain to be developed.

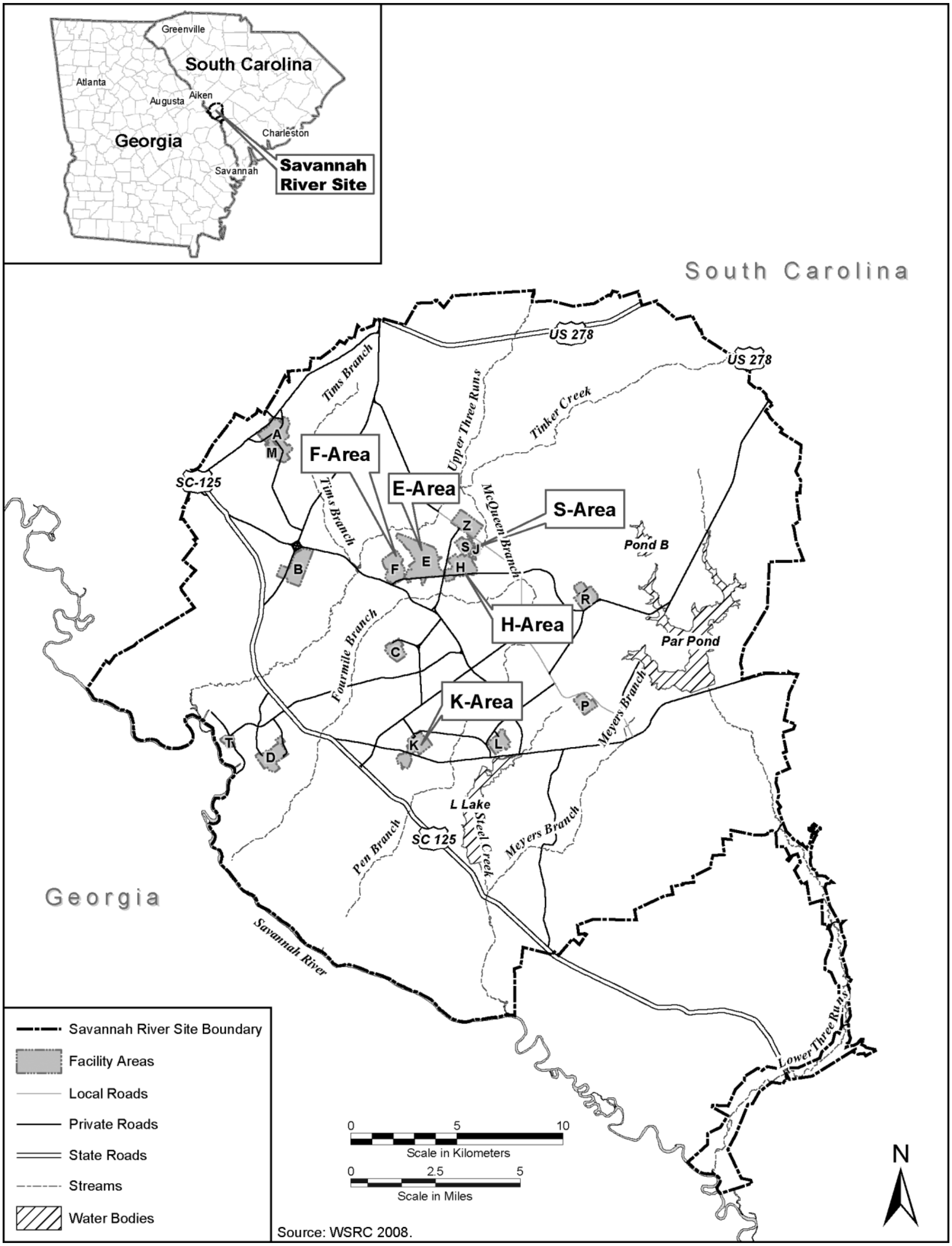

Figure S–2 Savannah River Site Location and Operations Areas

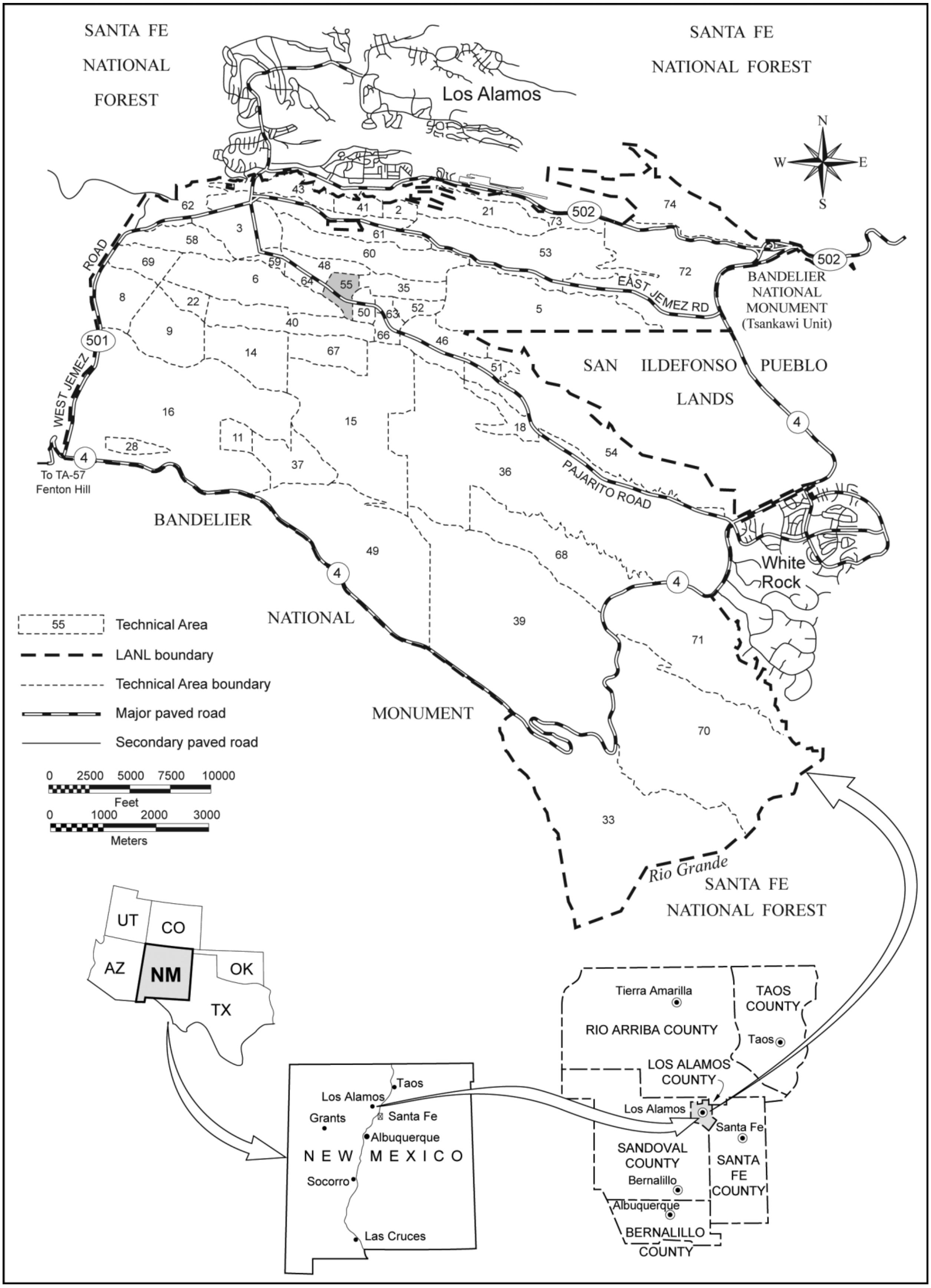

Figure S–3 Los Alamos National Laboratory Location and Technical Areas

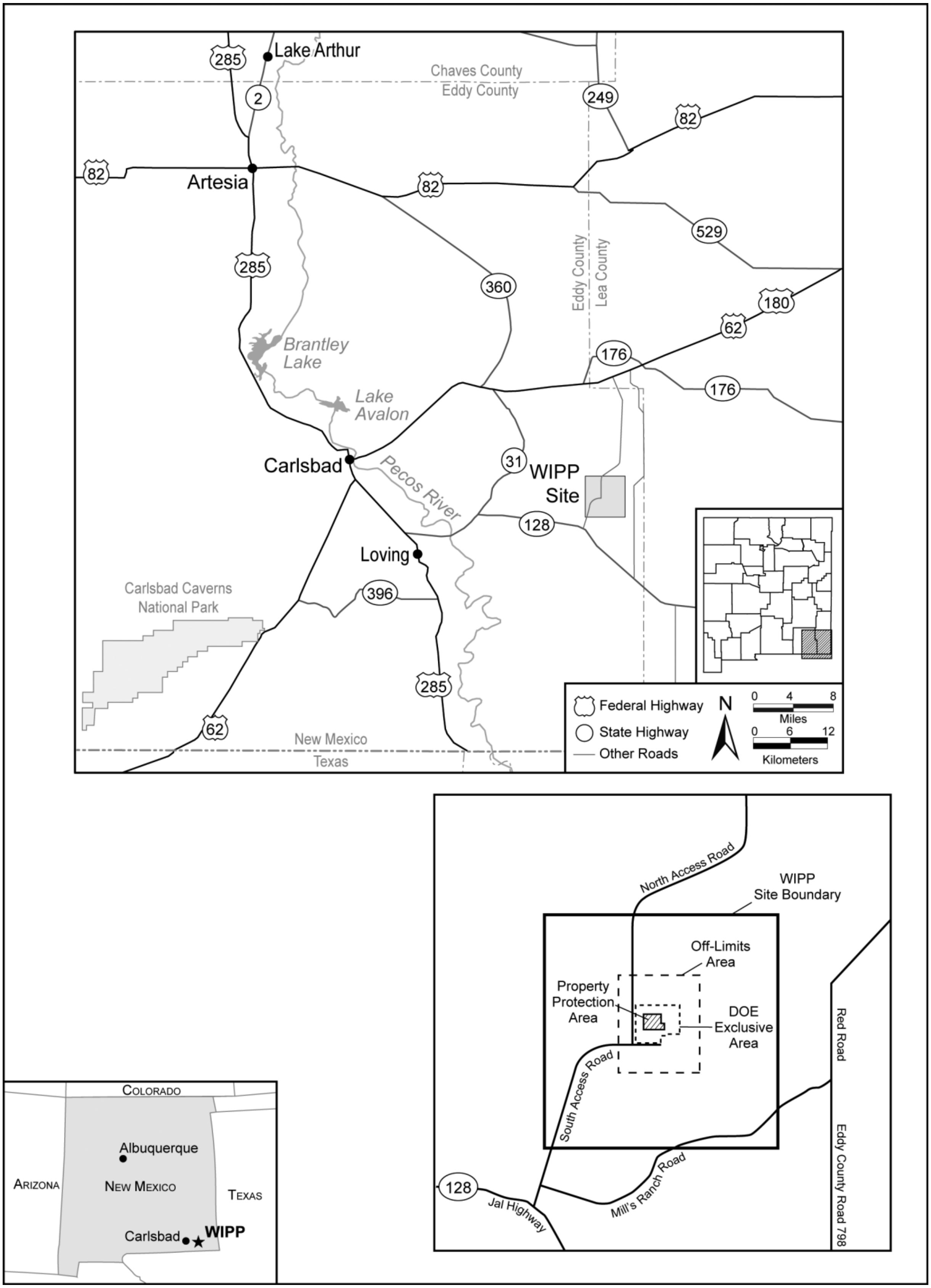

Figure S–4 Waste Isolation Pilot Plant Location

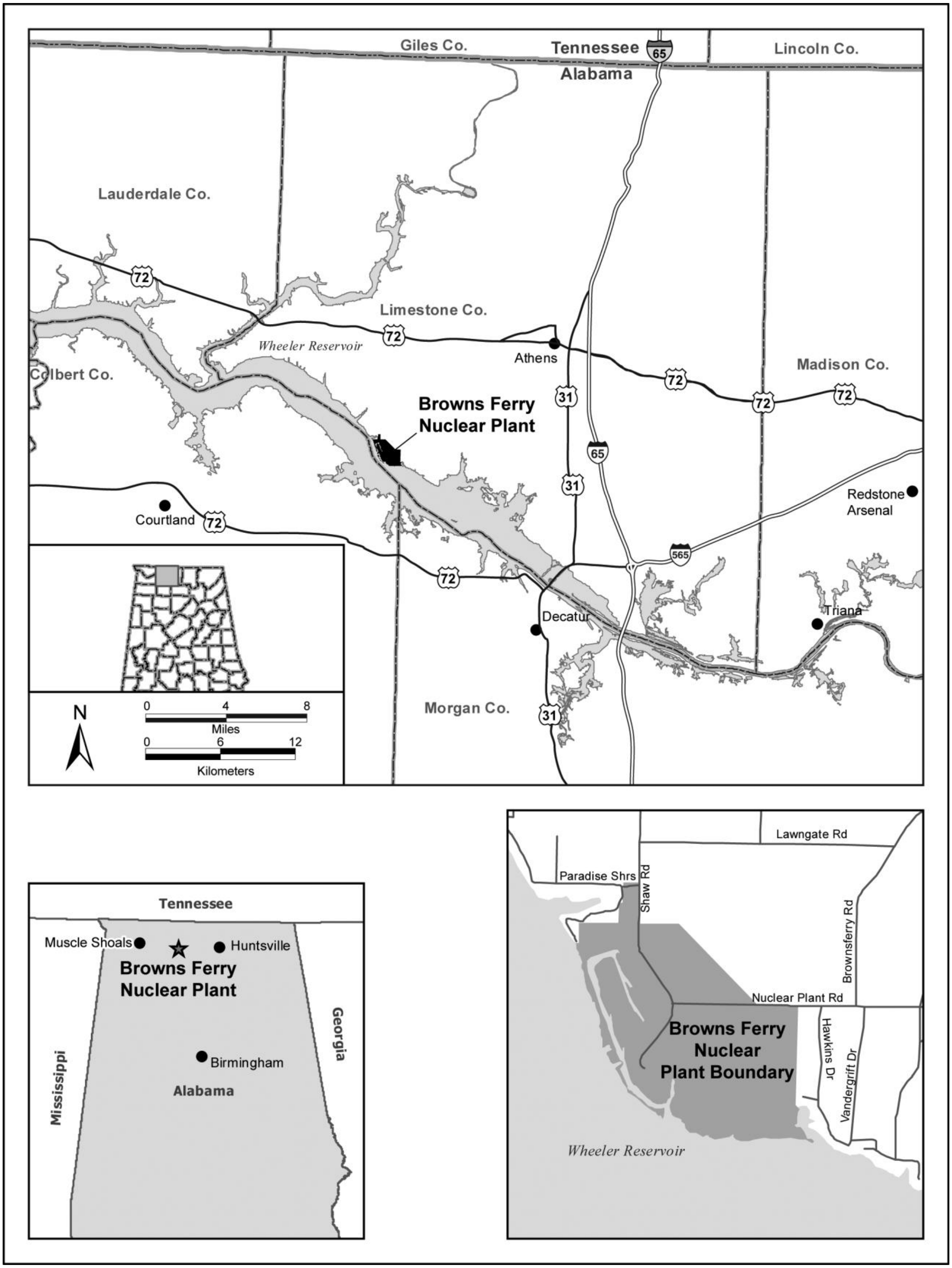

Figure S–5 Browns Ferry Nuclear Plant Location

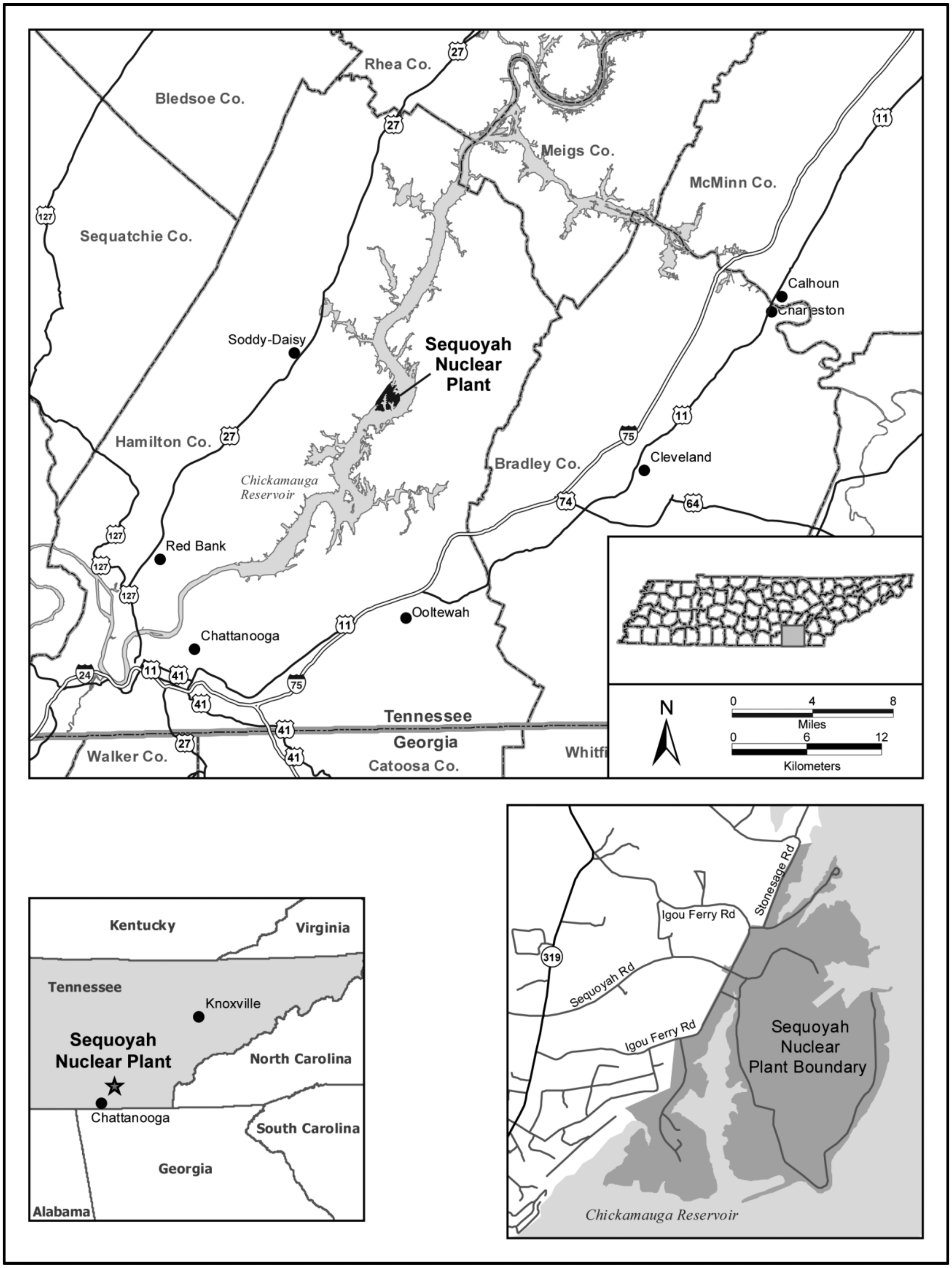

Figure S–6 Sequoyah Nuclear Plant Location

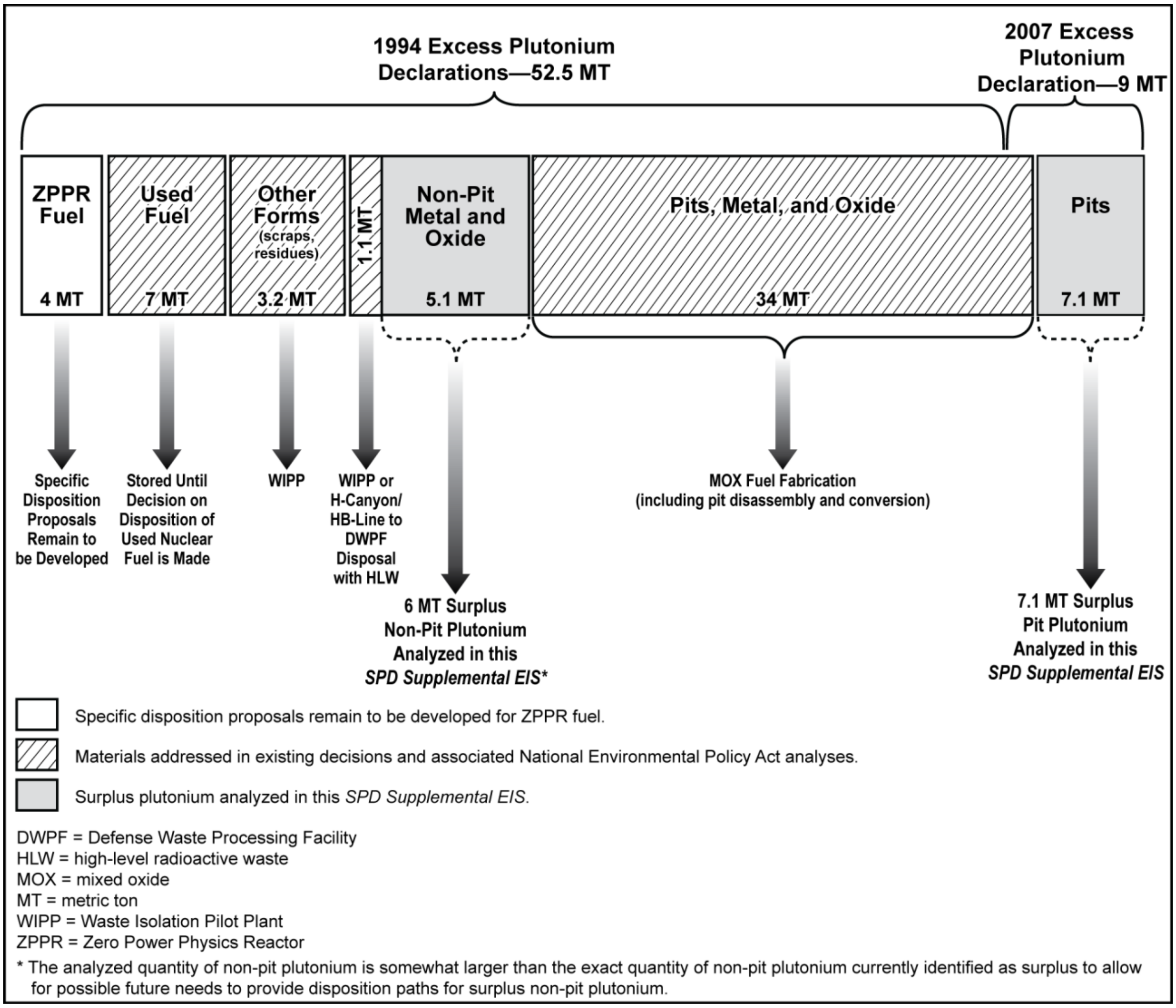

Figure S–7 Disposition Paths for Surplus Plutonium

Therefore, DOE currently proposes to make decisions regarding the disposition of 13.1 metric tons (14.4 tons) of surplus plutonium (i.e., 7.1 metric tons [7.8 tons] of pit plutonium[5] and 6 metric tons [6.6 tons] of non-pit plutonium[6]). The 6 metric tons (6.6 tons) of non-pit plutonium includes a limited quantity of additional plutonium (0.9 metric tons [1.0 ton]), to allow for the possibility that DOE may, in the future, identify additional quantities of surplus plutonium that could be processed for disposition through the facilities and capabilities analyzed in this *SPD Supplemental EIS*. For example, future sources of additional surplus plutonium could include plutonium quantities recovered from foreign locations through NNSA's Global Threat Reduction Initiative[7] or future quantities of plutonium declared excess to U.S. defense needs.

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[5] *The 34 metric tons (37.5 tons) previously identified for MOX fuel fabrication included an allowance of 1.9 metric tons (2.1 tons) for future declarations. DOE later determined, as shown in Figure S–7, that 1.9 metric tons (2.1 tons) from the 9 metric tons (9.9 tons) of pit plutonium in the 2007 declaration qualified for inclusion within the 34 metric tons (37.5 tons) identified for MOX fabrication, leaving 7.1 metric tons (7.8 tons) of pit plutonium to be dispositioned.*

[6] *The analyzed quantity of non-pit plutonium is somewhat larger than the exact quantity of non-pit plutonium currently identified as surplus (6 metric tons [6.6 tons] compared to 5.1 metric tons [5.6 tons]) to allow for possible future needs to provide disposition paths for surplus non-pit plutonium. This quantity also includes 0.7 metric tons (0.77 tons) of unirradiated Fast Flux Test Facility fuel.*

[7] *As analyzed in the* Environmental Assessment for the U.S. Receipt and Storage of Gap Material Plutonium *and* Finding of No Significant Impact *(DOE 2010).*

S.5 Issues Identified During the Scoping Period

Since announcement of this *SPD Supplemental EIS*, DOE has provided three opportunities for the public to provide scoping comments (2007 [72 FR 14543]; 2010 [75 FR 41850]; and 2012 [77 FR 1920]). The public scoping periods extended from March 28, 2007, through May 29, 2007; July 19, 2010 through September 17, 2010; and January 12, 2012 through March 12, 2012. Scoping meetings were conducted on April 17, 2007, in Aiken, South Carolina; April 19, 2007, in Columbia, South Carolina; August 3, 2010, in Tanner, Alabama; August 5, 2010, in Chattanooga, Tennessee; August 17, 2010, in North Augusta, South Carolina; August 24, 2010, in Carlsbad, New Mexico; August 26, 2010, in Santa Fe, New Mexico; and February 2, 2012, in Pojoaque, New Mexico. This section summarizes issues raised and comments received during the public scoping periods. A more detailed summary of the comments received during the public scoping periods is available on the project website at http://nnsa.energy.gov/nepa/spdsupplementaleis.

Comment Summary: One commentor recounted the history of the plutonium declared surplus during the Clinton Administration and requested that DOE reconcile the quantities of plutonium by form and proposed disposition pathway.

Response: The quantities of plutonium that are analyzed in this *SPD Supplemental EIS* are described in Section S.4 of this Summary. Figure S–7 summarizes the disposition paths for surplus plutonium.

Comment Summary: A comment was made that the proposed processing of some of the plutonium through H-Canyon/HB-Line as identified in the NOI should be considered a separate alternative.

Response: As described in Section S.8.3.4 of this Summary and Chapter 2, Section 2.3.4, of this *SPD Supplemental EIS*, a separate H-Canyon/HB-Line to DWPF Alternative is evaluated.

Comment Summary: Commentors variously supported or opposed the individual surplus plutonium disposition options constituting the proposed alternatives. Commentors asked DOE to reconsider previous decisions, including fabrication of 34 metric tons (37.5 tons) of surplus plutonium into MOX fuel, the Preferred Alternative (MOX Fuel Alternative), eliminating the ceramic immobilization disposition option, and eliminating the disassembly of pits at the Pantex Plant (Pantex). Some commentors supported the immobilization option, including extending it to the entire surplus plutonium inventory. A commentor asked that alternative approaches to surplus plutonium disposition be considered, including quicker, less costly methods.

Response: Although DOE has announced a Preferred Alternative (see Section S.10 of this Summary), DOE has not made a decision with respect to the surplus plutonium analyzed in this *Draft SPD Supplemental EIS* and could select one of the other alternatives or a combination of alternatives. Section S.8.3 describes the alternatives evaluated in this *SPD Supplemental EIS*, and Section S.9 describes the alternatives considered, but dismissed from detailed study. As summarized in Section S.9, the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement (Storage and Disposition PEIS)* (DOE 1996a) and the *SPD EIS* (DOE 1999) considered numerous alternatives for surplus plutonium disposition, including immobilization of the entire surplus plutonium inventory and pit disassembly and conversion at Pantex. Immobilization of the entire surplus plutonium inventory was evaluated in the *SPD EIS* (DOE 1999), and DOE selected the MOX approach for some of the material declared surplus for reasons set forth in the *SPD EIS* ROD (65 FR 1608). DOE is not revisiting the decisions announced in that ROD, or in the 2002 and 2003 amended RODs (67 FR 19432 and 68 FR 20134), other than the decision to construct and operate a stand-alone Pit Disassembly and Conversion Facility (PDCF). Although DOE is reconsidering the decision to build a PDCF at SRS and is looking at other options, including using PF-4 at LANL, DOE is not reconsidering its prior decision not to construct a pit disassembly and conversion capability at Pantex, an alternative considered in the *SPD EIS*.

Comment Summary: Some commentors expressed concerns or requested that additional information be included in this *SPD Supplemental EIS* about consequences of potential accidents, security of nuclear materials, routine and accidental releases of radionuclides, worker safety, waste processing, synergistic effects of operating multiple facilities at SRS (i.e., cumulative impacts), dose calculation methods, transportation, the fate of waste vitrified at DWPF, and disposition of equipment after the surplus plutonium disposition activities are completed.

Response: This *SPD Supplemental EIS*, in Chapter 4 and supporting appendices, includes analyses and discussions of these issues.

Comment Summary: Commentors requested specific details about monitoring and emergency response plans.

Response: Some of the details requested, such as what radionuclides or other elements would be released from normal operations and DOE facility accidents, are included in the radiological analyses in Chapter 4, Section 4.1.2, and Appendices C and D of this *SPD Supplemental EIS*. Information about SRS, LANL, and TVA emergency response plans appear in Chapter 3 of this *SPD Supplemental EIS*. Other information about monitoring may be found in documents such as the SRS, LANL, and WIPP annual environmental reports (accessible at http://www.srs.gov/general/pubs/ERsum/index.html, http://www.lanl.gov/environment/all/esr.shtml, and http://wipp.energy.gov/Documents_Environmental.htm, respectively).

Comment Summary: Some commentors were concerned that DOE, rather than TVA, would make the decision to use MOX fuel at TVA's nuclear power reactors.

Response: The decision to use MOX fuel in the reactors at the Browns Ferry and/or Sequoyah Nuclear Plants would be made independently by TVA subject to license amendments by the U.S. Nuclear Regulatory Commission (NRC).

Comment Summary: Commentors requested that NRC's role in licensing the use of MOX fuel in commercial nuclear power reactors be explained.

Response: NRC regulations related to operation of commercial nuclear power reactors are described in Chapter 5, Section 5.3.3, of this *SPD Supplemental EIS*. Commercial nuclear power reactors undergo a rigorous licensing process under Title 10 of the *Code of Federal Regulations* (CFR), Part 50, "Domestic Licensing of Production and Utilization Facilities," or "Licenses, Certifications, and Approvals for Nuclear Power Plants" (10 CFR Part 52), beginning before facility construction and continuing throughout operation. Amendment to each reactor's operating licenses would be required prior to MOX fuel being brought to the reactor sites and loaded into the reactors. Public meetings are regularly held in conjunction with plant licensing, and opportunities would be available for public hearings before any license amendment is issued.

Comment Summary: DOE received a number of comments on the public outreach effort. Commentors expressed dissatisfaction with notification for the public scoping meetings, numbers of scoping meetings, time allocated to comment, and scoping materials. A commentor requested that meetings be planned in collaboration with interested parties.

Response: DOE provided notice of public scoping meetings near potentially affected sites using a variety of media, including the *Federal Register*, the project website, press announcements, advertisements in local newspapers, and bulk mailings to persons on the project mailing list. DOE believes that the format of the scoping meetings and length of the public scoping period were adequate. DOE also believes that there was an appropriate number of scoping meetings, which were held in eight locations across the country. Commentors were also provided the opportunity to submit comments via mail, fax, and email. Opportunities are available for individuals to be placed on the mailing list in order to receive updates and announcements related to this *SPD Supplemental EIS*. DOE has considered public comments in preparing the materials to be disseminated during the public hearings on this *Draft SPD Supplemental EIS*.

<u>Comment Summary</u>*:* Commentors were interested in the background and structure of DOE and its ability to execute whichever alternative is selected in the ROD.

<u>Response</u>*:* On August 4, 1977, President Carter signed the Department of Energy Organization Act, creating DOE from the Federal Energy Administration and the Energy Research and Development Administration. DOE's mission is to ensure the United States' security and prosperity by addressing the country's energy, environmental, and nuclear challenges through transformative science and technology solutions. NNSA was established by Congress in 2000 as a separately organized, semiautonomous agency within DOE, responsible for the management and security of the Nation's nuclear weapons, nuclear nonproliferation, and naval reactor programs. DOE/NNSA has been working toward dispositioning surplus plutonium for many years. As described in Appendix A, Section A.1, of this *SPD Supplemental EIS*, accomplishments to date include disposal of plutonium as TRU waste at WIPP; consolidation of surplus non-pit plutonium at SRS; and the ongoing construction of MFFF and the Waste Solidification Building (WSB). Surplus plutonium disposition activities are subject to the availability of funds appropriated by Congress.

<u>Comment Summary</u>*:* Commentors expressed concern over the MOX fuel fabrication program, including the lack of interest in MOX fuel of commercial nuclear power plant operators; cost and schedule; and tying U.S. disposition activities to the Russian government's nuclear activities.

<u>Response</u>*:* MOX fuel use in commercial reactors is a demonstrated technology that has been used worldwide for over 40 years. DOE continues to pursue potential domestic commercial nuclear power customers. MFFF will start up using existing surplus plutonium oxide supplies and will be built and operated as described in Appendix B, Section B.1.1.2, and Chapter 5, Section 5.3.2, of this *SPD Supplemental EIS*. The United States remains committed to the Agreement Between the Government of the United States of America and the Government of the Russian Federation Concerning the Management and Disposition of Plutonium Designated As No Longer Required for Defense Purposes and Related Cooperation (PMDA), under which both the United States and the Russian Federation have each agreed to dispose of at least 34 metric tons (37.5 tons) of excess weapons-grade plutonium in nuclear reactors to produce electricity. It is important that MFFF begin operations to demonstrate progress to the Russian government, meet U.S. legislative requirements, and reduce the quantity of surplus plutonium and the concomitant cost of secure storage.

<u>Comment Summary</u>*:* Commentors expressed concern about processing more plutonium through DWPF.

<u>Response</u>*:* As described in Appendix B, Section B.1.4.1, and analyzed in Appendix G of this *SPD Supplemental EIS*, DOE has analyzed the potential environmental impacts of increasing the plutonium loading in DWPF canisters.

<u>Comment Summary</u>: Commentors expressed concern about lead assembly testing at Duke Energy's Catawba Nuclear Station and the need to conduct lead assembly testing in the TVA reactors. A commentor stated that NRC regulations require reactor testing to the burn-up level being sought for licensing. MOX lead assemblies were only tested for two cycles at the Catawba Nuclear Station.

<u>Response</u>: Significant worldwide experience with the use of MOX fuel, coupled with lead assembly testing programs including the one at the Catawba Nuclear Station, indicates MOX fuel performance. MOX fuel lead assemblies were successfully tested in the Catawba Nuclear Station Unit 1 reactor. The four MOX fuel lead assemblies performed safely; no safety limits were exceeded. The need for future lead test assemblies based on the reactor's planned use of MOX fuel (burn up levels) will be determined by NRC as part of the fuel qualification and licensing process.

<u>Comment Summary</u>*:* Commentors expressed concern about human health risks and increased risk of accidents using a partial MOX fuel nuclear reactor core instead of a full uranium fuel core. Commentors

said that this *SPD Supplemental EIS* must analyze beyond-design-basis accidents, including accidents involving used fuel pools, and a "river tsunami accident" as a result of upstream dam failure at the TVA reactor sites. Commentors expressed concern that the accident at the Fukushima Daiichi Nuclear Power Station in Japan should be considered because the design of the reactors is similar to the design of the reactors at the Browns Ferry Nuclear Plant.

Response: Appendix I of this *SPD Supplemental EIS* describes the potential impacts, including differences associated with the two types of nuclear reactor cores, and summarizes the results of the more detailed human health risk analysis presented in Appendix J. Appendix J, Section J.3.3, includes an analysis of beyond-design-basis accidents for the TVA reactors. Used fuel pool accidents are not typically evaluated in detail in reactor accident analysis because other accidents would have greater consequences. TVA has considered applicable natural phenomena, such as earthquakes, tornados, flooding, and dam failure, in Safety Analysis Reports prepared for each reactor (TVA 2009, 2010). This *SPD Supplemental EIS* does not evaluate a dam failure "river tsunami accident," as this was not determined to be a credible accident in TVA's Safety Analysis Reports. Section J.3.3.3 describes the NRC recommendations developed in response to the accident at the Fukushima Daiichi Nuclear Power Station in Japan and subsequent actions that TVA has taken to further reduce the likelihood and severity of accidents at its nuclear plants.

Comment Summary: Commentors expressed concern that surplus plutonium disposition activities may interfere with cleanup and remediation activities and other projects at the DOE sites.

Response: The alternatives analyzed in this *SPD Supplemental EIS* take into account the availability of facilities and their closure schedules. Information relevant to these issues is presented in the description of the alternatives in Chapter 2, Section 2.3. DOE expects there would be minimal disruption of cleanup and remediation activities at DOE sites.

Comment Summary: A number of comments were received on the transportation of surplus plutonium, including risk of accidents, risk of transporting plutonium oxide powder, energy requirements, climate change impacts, and cumulative impacts.

Response: Chapter 4 of this *SPD Supplemental EIS* addresses the issues raised. All shipments on public roads that contain plutonium pits or metal, or plutonium oxide powder would utilize NNSA's Secure Transportation Asset. All shipments would be in compliance with applicable U.S. Department of Transportation, NRC, and DOE requirements. Transportation impacts are described in Section S.11.1 of this Summary, and in Chapter 4, Section 4.1.5, and Appendix E of this *SPD Supplemental EIS*. Cumulative transportation impacts and climate change impacts, including consideration of fuel used for transportation, are described in Section S.11.2 of this Summary and in Chapter 4, Section 4.5. Notification of pending shipments would be given to state and Federal agencies in accordance with existing regulations and agreements. For security reasons, notice would not be given to the public.

Comment Summary: A commentor suggested an alternative transportation route to WIPP.

Response: DOE is evaluating representative transportation routes for TRU waste to WIPP in this *SPD Supplemental EIS*, and will not be selecting specific shipping routes.

Comment Summary: Commentors expressed concern that the proposed use of MOX fuel is inconsistent with U.S. nonproliferation policy.

Response: The proposed use of MOX fuel is consistent with U.S. nonproliferation policy and international nonproliferation agreements. Use of MOX fuel would ensure that surplus plutonium is rendered into a used fuel form not readily usable for nuclear weapons.

Comment Summary: Commentors requested that DOE explain why disposal at WIPP is a reasonable alternative. Some commentors expressed concerns about sending plutonium to WIPP.

Response: The direct disposal of 50 metric tons (55 tons) of surplus plutonium was eliminated from further analysis in the *Storage and Disposition PEIS* because it would exceed the capacity of WIPP when added to DOE's inventory of TRU waste (DOE 1996a;2-13). The disposal at WIPP of up to 6 metric tons (6.6 tons) of non-pit plutonium, which is approximately 12 percent of the amount considered in the *Storage and Disposition PEIS*, would not exceed WIPP's capacity and therefore was considered to be a reasonable alternative in this *SPD Supplemental EIS*. A description of WIPP's capacity and the process that would be used to dispose of surplus plutonium as TRU waste at WIPP is contained in Appendix B, Sections B.1.3 and B.3; the environmental impacts of shipping waste to WIPP are described in Appendix E.

Comment Summary: Commentors were concerned that plutonium disposal at WIPP is an affirmation that disposal of plutonium utilizing the Spent Fuel Standard, by which plutonium is placed in a material with a radiation barrier, is essentially dead.

Response: DOE believes that the alternatives analyzed in this *SPD Supplemental EIS*, including the WIPP Alternative, provide protection from theft, diversion, or future reuse in nuclear weapons akin to that afforded by the Spent Fuel Standard.

Comment Summary: Commentors were concerned about the composition of the surplus plutonium and where it is currently stored.

Response: DOE has information on the composition of all pit and non-pit plutonium. This information is sensitive and therefore has not been included in this *SPD Supplemental EIS*. As described in Chapter 2, Section 2.3.1, plutonium pits are safely stored at Pantex near Amarillo, Texas, and most surplus non-pit plutonium is in safe storage at the K-Area Complex at SRS; the remaining surplus non-pit plutonium is in the process of being moved to SRS, and in the interim, is safely stored at other DOE sites.

Comment Summary: Hardened storage should be analyzed for immobilized wastes to protect them from risks posed by natural or manmade disasters and terrorist attack.

Response: As described in Appendix B, Section B.1.4.1, of this *SPD Supplemental EIS*, canisters containing cans of immobilized surplus plutonium would be filled with high-level radioactive waste (HLW) and stored in the Glass Waste Storage Buildings (GWSBs) at SRS. These buildings have controls and engineered safeguards required by safety assessments that examine the potential for, and consequences of, accidents caused by natural phenomena and manmade events. The presence of immobilized plutonium in the canisters is not expected to appreciably change their performance in severe accidents and these wastes would not be considered an attractive target for terrorist attack. DOE considers risks associated with security and safety to determine whether or not a hardened structure is required. DOE does not believe that additional hardening of the GWSBs is needed to safely store immobilized waste containing surplus plutonium.

Comment Summary: Commentors had numerous questions about the characteristics of existing facilities that would be used for plutonium disposition, including MFFF, H-Canyon/HB-Line, and DWPF at SRS; WIPP; and PF-4 at LANL.

Response: Appendix B of this *SPD Supplemental EIS* describes the facilities that could be used for surplus plutonium disposition at SRS, LANL, and WIPP, including building and process line modifications and plutonium throughput. The environmental impacts and human health risks of construction and operation of these facilities are described in Appendices F ("Impacts of Pit Disassembly and Conversion Options"), G ("Impacts of Plutonium Disposition Options"), and H ("Impacts of Principal Plutonium Support Facilities"). The environmental impacts and human health risks of construction and operation of the alternatives are described in Chapter 4, including the potential impacts of accidents at DOE facilities in Section 4.1.2.2. Transportation impacts are described in Appendix E. Impacts from TRU waste disposal at WIPP are analyzed in the *Waste Isolation Pilot Plant Disposal Phase Final*

Supplemental Environmental Impact Statement (DOE 1997) and briefly described in Appendix A, Section A.2, of this *SPD Supplemental EIS*.

Comment Summary: Commentors requested that this *SPD Supplemental EIS* describe the impacts of used MOX fuel on used fuel management at a reactor. In addition, commentors asked that this *SPD Supplemental EIS* describe where the used MOX fuel and the can-in-canister assemblies containing immobilized plutonium would be disposed of and the thermal impacts of used MOX fuel on an interim storage facility or geologic repository.

Response: As described in Appendix I, Section I.1, of this *SPD Supplemental EIS*, each low-enriched uranium (LEU) fuel assembly and each MOX fuel assembly would be discharged from the reactor with its own unique burn-up level and decay heat. The used fuel assemblies would be placed in the used fuel pool to reduce decay heat. When the decay heat reaches manageable levels, the used fuel assemblies would be moved to dry storage casks. By the time used fuel assemblies are ready for dry storage, the decay heat for the LEU and MOX fuel assemblies would be similar. DOE anticipates that MOX fuel and LEU fuel assemblies would be managed similarly.

Comment Summary: Commentors requested information on plutonium in MOX fuel, including how much plutonium would be in the fresh MOX fuel and how much plutonium would remain when the fuel is withdrawn from the reactors following irradiation.

Response: The footnote in Section S.8 of this Summary provides a description of the amount of plutonium-239 in fresh MOX fuel and the reduction in plutonium-239 after irradiation in a nuclear power reactor. In addition, Appendix J, Section J.2.2, of this *SPD Supplemental EIS* compares the radionuclide inventory in a full LEU core to that in a partial MOX fuel core.

Comment Summary: Commentors requested information on the environmental impacts and risks of expanded pit disassembly and conversion at PF-4 at LANL, including seismic and wildfire risks.

Response: Appendix F of this *SPD Supplemental EIS* includes analyses of the environmental impacts and human health risks of expanded pit disassembly and conversion in PF-4, including the effects of handling larger quantities of plutonium in metal and oxide form. Appendix D, Section D.1.5.2.11, provides more-detailed information on accidents at PF-4, including consideration of natural phenomena hazards such as earthquakes, volcanoes, and wildfires. Section D.2.9.2 describes the completed and planned seismic upgrades to PF-4. The accident analyses in this *SPD Supplemental EIS* consider the current state of PF-4 without future seismic upgrades.

Comment Summary: Commentors had concerns about environmental justice issues related to American Indian tribes near LANL. Commentors requested that community meetings be held in each pueblo and connecting river community within a 100-mile (161-kilometer) radius from LANL to honor the government-to-government consultation process.

Response: Chapter 3, Section 3.2.11, describes minority and low-income populations near LANL. Chapter 4, Section 4.1.6, analyzes environmental justice impacts of the alternatives for surplus plutonium disposition at LANL, including consideration of a tribal exposure or special pathways scenario, and has concluded that American Indians living near LANL are not exposed to elevated risks compared to nonminority populations living in the same area, and that the risks associated with the activities proposed to be done at LANL are small. In support of its public outreach effort, DOE conducted public scoping meetings in Carlsbad, Pojoaque (on the Pojoaque reservation), and Santa Fe, New Mexico. DOE has a significant tribal outreach program with the tribes surrounding LANL and routinely meets with interested tribal governments to discuss issues of mutual concern. In support of this *SPD Supplemental EIS*, DOE will continue to hold discussions with American Indian groups and tribal governments.

A number of other issues raised by commentors are outside the scope of this *SPD Supplemental EIS*, including plutonium recycling, plutonium production, a nuclear-free world, war and nuclear weapons, mining sites that are contaminated and unsafe, the number of contractors with foreign roots involved in surplus plutonium disposition activities, concern that the Surplus Plutonium Disposition Program could be manipulated by special interests, the impacts of AREVA's operations in Europe, financial arrangements with utilities to use MOX fuel, TVA's interest in building new plants and its involvement in energy conservation and renewable energy, existing conditions at nuclear power reactors that are not a part of the proposed action, establishing a disposition path for the research reactor fuel in storage at SRS by processing through H-Canyon, compensation for local communities for extending plutonium storage at SRS, funding the complete cleanup of SRS, the presence of radioactive chemicals in the Rio Grande and Albuquerque drinking water, conduct of public meetings on the *CMRR-NF SEIS* (DOE 2011c), how the fate of waste vitrified at the Hanford Site affects the proposed immobilization activities, support for other energy sources, emissions from coal-fired power plants, fluoride in toothpaste, and an invention to produce electricity.

S.6 Scope of the *Surplus Plutonium Disposition Supplemental Environmental Impact Statement*

In this *SPD Supplemental EIS*, DOE considers four action alternatives for the disposition of 13.1 metric tons (14.4 tons) of surplus plutonium and four options for pit disassembly and conversion of 34.6 metric tons (38.1 tons) (rounded to 35 metric tons [38.5 tons] in this *SPD Supplemental EIS*).[8] These alternatives involve DOE facilities at LANL, SRS, and WIPP. DOE also analyzes the potential environmental impacts of using MOX fuel in TVA's Browns Ferry and Sequoyah Nuclear Plants, as well as in one or more generic reactors. **Figure S–8** shows the locations of major facilities that could be affected by activities analyzed in this *SPD Supplemental EIS*.[9]

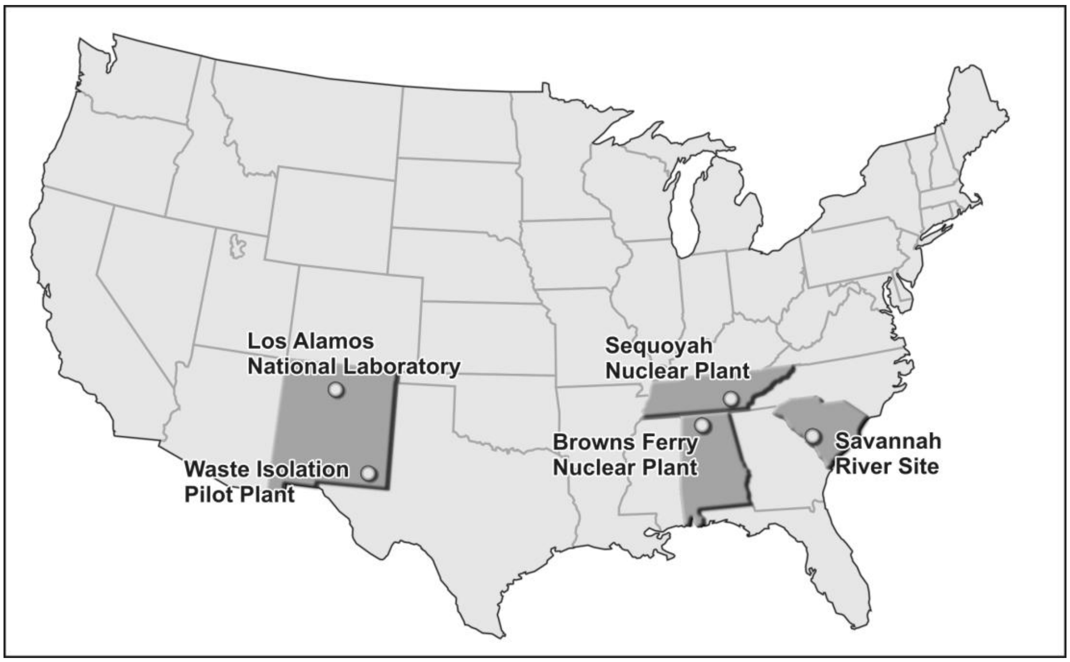

Figure S–8 Locations of Major Facilities Evaluated in the *Surplus Plutonium Disposition Supplemental Environmental Impact Statement*

[8] *As described earlier, in two RODs for the* SPD EIS *(65 FR 1608 and 68 FR 20134), DOE decided to fabricate 34 metric tons (37.5 tons) of surplus plutonium into MOX fuel at an MFFF being constructed at SRS. DOE is not revisiting those decisions. However, because DOE is revisiting its decision to construct and operate a PDCF at SRS, the pit disassembly and conversion options* analyzed in the SPD Supplemental EIS *will apply to the 27.5 metric tons (30.3 tons) of plutonium metal that DOE has decided to fabricate into MOX fuel, as well as the 7.1 metric tons (7.7 tons) of pit plutonium for which disposition is under consideration in the* SPD Supplemental EIS.

[9] *Because reactors that may use MOX fuel could be located anywhere in the United States, they are not shown on Figure S–8.*

Potential impacts from transporting surplus plutonium to WIPP are addressed in this *SPD Supplemental EIS*. The impacts from TRU waste disposal at WIPP are analyzed in the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* (DOE 1997) and briefly described in Appendix A, Section A.2, of this *SPD Supplemental EIS*.

The 7.1 metric tons (7.8 tons) of surplus plutonium pits addressed in this *SPD Supplemental EIS* are currently stored at Pantex near Amarillo, Texas. The continued storage of these pits is already analyzed in the *Final Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components* (DOE 1996b), which is incorporated by reference in this *SPD Supplemental EIS*. Potential impacts from transporting pits from Pantex to SRS and LANL are addressed in this *SPD Supplemental EIS.* The impacts from continued storage of pits at Pantex are briefly described in Appendix A, Section A.2, of this *SPD Supplemental EIS*.

This supplement to the *SPD EIS* incorporates Appendix F, "Impact Assessment Methodology," from the *SPD EIS* (DOE 1999) by reference. Rather than repeat the details of this appendix, Chapter 4 of this *SPD Supplemental EIS* refers to Appendix F and describes only variations for the impact assessment methodology outlined in the *SPD EIS*.

S.7 Decisions to be Supported by the *Surplus Plutonium Disposition Supplemental Environmental Impact Statement*

DOE may issue a ROD announcing its decision no sooner than 30 days after publication in the *Federal Register* of the U.S. Environmental Protection Agency (EPA) Notice of Availability for the *Final SPD Supplemental EIS*. DOE could decide, based on programmatic, engineering, facility safety, cost, and schedule information, and on the environmental impact analysis in this *SPD Supplemental EIS*, which pit disassembly and conversion option to implement and which options to implement for disposition of the additional 13.1 metric tons (14.4 tons) of surplus plutonium.

As stated in the 2010 amended NOI (75 FR 41850) and reaffirmed in the 2012 amended NOI (77 FR 1920), DOE and TVA are evaluating the use of MOX fuel in up to five TVA reactors at the Sequoyah and Browns Ferry Nuclear Plants. TVA would determine whether to pursue irradiation of MOX fuel in TVA reactors and which reactors to use for this purpose.

S.8 Alternatives Analyzed in the *Surplus Plutonium Disposition Supplemental Environmental Impact Statement*

This section describes the alternatives DOE has identified to disposition an additional 13.1 metric tons (14.4 tons) of surplus plutonium—7.1 metric tons (7.8 tons) of pit plutonium and 6 metric tons (6.6 tons) of non-pit plutonium. The alternatives addressed in this *SPD Supplemental EIS* are made up of a combination of pit disassembly and conversion options and plutonium disposition options[10] as summarized below and explained in more detail in Sections S.8.1, S.8.2, and S.8.3.

Pit Disassembly and Conversion Options. Currently, surplus pit plutonium is not in a form suitable for disposition. Plutonium pits that must be disassembled or plutonium metal derived from pits must be converted to plutonium oxide before it can be dispositioned. In its ROD for the *SPD EIS* (65 FR 1608), DOE made a decision to construct, operate, and eventually decommission a stand-alone PDCF at SRS. DOE is reconsidering that decision and analyzing other pit disassembly and conversion options that would use existing facilities and a workforce experienced in these operations. As part of that reconsideration, DOE commissioned a study that examined, among other things, use of existing plutonium processing infrastructure at LANL and H-Canyon/HB-Line at SRS, and delivery of plutonium metal in addition to plutonium oxide to MFFF accompanied by installation of oxidation furnaces at MFFF (MPR 2011).

[10] *In the 2012 amended NOI (77 FR 1920), DOE described the four pit disassembly and conversion variants and the four plutonium disposition variants as "alternatives." The* SPD Supplemental EIS *considers these variants to be options under comprehensive surplus plutonium disposition alternatives.*

Based on the results of the study, DOE developed a range of pit disassembly and conversion options for analysis in this *SPD Supplemental EIS*: (1) a stand-alone PDCF at F-Area at SRS, (2) a Pit Disassembly and Conversion Project (PDC) at K-Area at SRS, (3) a pit disassembly and conversion capability in PF-4 at LANL and metal oxidation in MFFF at SRS, and (4) a pit disassembly and conversion capability in PF-4 at LANL with the potential for pit disassembly in K-Area, conversion at H-Canyon/HB-Line and metal oxidation in MFFF at SRS. Pit disassembly and conversion options are described in Section S.8.1, and the impacts of each option are described in Appendix F of this *SPD Supplemental EIS*.

In the 2000 ROD (65 FR 1608) and 2003 amended ROD (68 FR 20134) for the *SPD EIS*, DOE decided to convert 34 metric tons (37.5 tons) of surplus plutonium into MOX fuel at the MFFF currently being constructed at SRS. DOE is not revisiting that decision. However, DOE is revisiting its PDCF decision, and a total of 35 metric tons (38.6 tons) is analyzed for all pit disassembly and conversion options. Regardless of the disposition alternative selected, pit disassembly and conversion would be necessary for 35 metric tons (38.6 tons) of surplus plutonium.

Plutonium Disposition Options. DOE evaluates the impacts of four options for disposition of 13.1 metric tons (14.4 tons) of surplus plutonium: (1) immobilization and vitrification at DWPF at SRS; (2) MOX fuel fabrication and use in domestic commercial nuclear power reactors;[11] (3) processing at H-Canyon/HB-Line and vitrification at DWPF; and (4) preparation at H-Canyon/HB-Line for disposal as TRU waste at WIPP, a deep geologic repository in southeastern New Mexico. Plutonium disposition options are described in Section S.8.2, and the impacts of each option are described in Appendix G of this *SPD Supplemental EIS*.

Alternatives. DOE evaluates the impacts of four action alternatives, which are combinations of the pit disassembly and conversion options and disposition options, and a No Action Alternative. **Table S–1** summarizes the pit disassembly and conversion and disposition pathways for the 13.1 metric tons (14.4 tons) of surplus pit and non-pit plutonium. Each disposition option could be combined with different pit disassembly and conversion options (see **Table S–2**). Each alternative also reflects the MOX disposition path previously designated for 34 metric tons (37.5 tons) of surplus plutonium (65 FR 1608 and 68 FR 20134), because that surplus plutonium is impacted by any decisions made on a pit disassembly and conversion option (also reflected in Table S–2). The action alternatives are: (1) Immobilization to DWPF Alternative – glass can-in-canister immobilization for both surplus non-pit and disassembled and converted pit plutonium and subsequent filling of the canister with HLW at DWPF; (2) MOX Fuel Alternative – fabrication of the disassembled and converted pit plutonium and much of the non-pit plutonium into MOX fuel at MFFF for use in domestic commercial nuclear power reactors to generate electricity, and disposition of the surplus non-pit plutonium that is not suitable for MFFF as TRU waste at WIPP; (3) H-Canyon/HB-Line to DWPF Alternative – processing the surplus non-pit plutonium in H-Canyon/HB-Line and subsequent vitrification with HLW (in DWPF) and fabrication of the pit plutonium into MOX fuel at MFFF; and (4) WIPP Alternative – processing the surplus non-pit plutonium in H-Canyon/HB-Line for disposal as TRU waste at WIPP and fabrication of the pit plutonium into MOX fuel at MFFF. The alternatives are described in Section S.8.3 and the impacts of each of the alternatives are described in Chapter 4 of this *SPD Supplemental EIS* and are summarized in Section S.11 of this Summary.

[11] *The disposition of surplus plutonium (plutonium-239) can be accomplished by creating MOX assemblies that use plutonium-239 instead of uranium-235 as the fissile isotope. For example, if a fuel assembly is loaded with 4 percent plutonium-239 before it goes into the core, it would reasonably come out after two cycles of irradiation with about 1.6 percent plutonium-239 (a 60 percent reduction) and a buildup of fission products that make the material unattractive for nuclear weapons use. A non-MOX fuel assembly that starts with LEU eventually accumulates about 1 percent plutonium and a significant fission product inventory, making the irradiated fuel unattractive for nuclear weapons use.*

Table S–1 Pit Disassembly and Conversion and Plutonium Disposition Pathways

Plutonium Type		Description	Pit Disassembly and Conversion					Plutonium Disposition			
			PDCF at F-Area	PDC at K-Area	H-Canyon/ HB-Line	Oxidation in MFFF	PF-4 at LANL	Immobilization	MFFF [a]	H-Canyon/ HB-Line	WIPP [b]
Pits (7.1 metric tons)		Plutonium metal	X	X	X [c]	X	X	X	X		
Non-Pit (6 metric tons)	Metal and oxide (~4 metric tons)	Low levels of impurities						X	X	X	X
	Metal and oxide (~2 metric tons) [d]	Higher levels of impurities						X		X	X

LANL = Los Alamos National Laboratory; MFFF = Mixed Oxide Fuel Fabrication Facility; PDC = Pit Disassembly and Conversion Project; PDCF = Pit Disassembly and Conversion Facility; PF-4 = Plutonium Facility; WIPP = Waste Isolation Pilot Plant.

[a] Only surplus plutonium that would meet the MFFF feed specification would be dispositioned as MOX fuel.

[b] Only surplus plutonium meeting the WIPP waste acceptance criteria would be disposed of at WIPP.

[c] Pits would be disassembled at PF-4 at LANL or at K-Area and plutonium would be converted to plutonium oxide at H-Canyon/HB-Line.

[d] Includes approximately 0.7 metric tons of unirradiated Fast Flux Test Facility fuel.

Note: To convert metric tons to tons, multiply by 1.1023.

Table S–2 Relationship Between Plutonium Disposition Alternatives and Options [a]

Alternatives	*Options*		
	Pit Disassembly and Conversion [b]	*Plutonium Disposition* [c]	*MOX Fuel Use in Domestic Commercial Nuclear Power Reactors*
No Action [d]	PDCF at F-Area at SRS	MOX Fuel (34 metric tons)	Generic Reactors
Immobilization to DWPF [e]	PDCF at F-Area at SRS PF-4 at LANL and MFFF at SRS PF-4 at LANL, and HC/HBL[f] and MFFF at SRS	MOX Fuel (34 metric tons), Immobilization and DWPF (13.1 metric tons)	TVA Reactors Generic Reactors
MOX Fuel	PDCF at F-Area at SRS PDC at K-Area at SRS PF-4 at LANL and MFFF at SRS PF-4 at LANL, and HC/HBL[g] and MFFF at SRS	MOX Fuel (45.1 metric tons), WIPP Disposal (2 metric tons)	TVA Reactors Generic Reactors
H-Canyon/HB-Line to DWPF	PDCF at F-Area at SRS PDC at K-Area at SRS PF-4 at LANL and MFFF at SRS PF-4 at LANL, and HC/HBL[g] and MFFF at SRS	MOX Fuel (41.1 metric tons), H-Canyon/HB-Line and DWPF (6 metric tons)	TVA Reactors Generic Reactors
WIPP	PDCF at F-Area at SRS PDC at K-Area at SRS PF-4 at LANL and MFFF at SRS PF-4 at LANL, and HC/HBL[g] and MFFF at SRS	MOX Fuel (41.1 metric tons), WIPP Disposal (6 metric tons)	TVA Reactors Generic Reactors

DWPF = Defense Waste Processing Facility; HC/HBL = H-Canyon/HB-Line; LANL = Los Alamos National Laboratory; MFFF = Mixed Oxide Fuel Fabrication Facility; MOX = mixed oxide; PDC = Pit Disassembly and Conversion Project; PDCF = Pit Disassembly and Conversion Facility; PF-4 = Plutonium Facility; SRS = Savannah River Site; TVA = Tennessee Valley Authority; WIPP = Waste Isolation Pilot Plant.

[a] Principal support facilities (see Appendix H) are evaluated under all alternatives.

[b] All pit disassembly and conversion options include the production of 2 metric tons of plutonium oxide at PF-4 at LANL as documented in previous NEPA documentation and Records of Decision.

[c] All alternatives include the disposition of 34 metric tons of surplus plutonium via MOX fuel fabrication.

[d] 7.1 metric tons of pit plutonium and 6 metric tons of non-pit plutonium (13.1 metric tons total) remain in storage.

[e] PDC and immobilization are mutually exclusive because there is insufficient space at K-Area to construct and operate both capabilities.

[f] Pit disassembly could occur at PF-4 at LANL and pits disassembled at PF-4 could be sent to SRS for conversion at HC/HBL.

[g] Pit disassembly could occur at PF-4 at LANL or K-Area at SRS and conversion at HC/HBL.

Note: To convert metric tons to tons, multiply by 1.1023.

Each pathway has minimum technical acceptance criteria for plutonium, which could preclude some volume of plutonium from being considered for disposition via that pathway. For instance, only plutonium that meets the MFFF feed specification could be dispositioned through the MOX fuel fabrication process. DOE estimates that, after processing, up to approximately 4 metric tons (4.4 tons) of the 6 metric tons (6.6 tons) of non-pit plutonium would meet the feed specification for MOX fuel fabrication, while approximately 2 metric tons (2.2 tons) would not meet the feed specification. Thus, the analysis for the MOX Fuel Alternative includes preparation of 2 metric tons (2.2 tons) for disposal at WIPP.

In this *SPD Supplemental EIS* DOE also analyzes the potential environmental impacts of using MOX fuel in up to five reactors owned by TVA and one or more domestic commercial nuclear power reactors.

S.8.1 Pit Disassembly and Conversion Options

This section describes four options for converting plutonium pits and plutonium metal to a form suitable for use in the disposition options. Pit disassembly and conversion capabilities could be located at SRS and at LANL. Pits would be transported by the DOE/NNSA Secure Transportation Asset operated by NNSA's Office of Secure Transportation from Pantex to K-Area storage at SRS or PF-4 at LANL, depending on where the capability was ultimately located, and where they would be stored until ready for processing.

Under all of the pit disassembly and conversion options, in accordance with previous decisions (65 FR 1608; 73 FR 55833), 2 metric tons (2.2 tons) of plutonium would be disassembled and converted to plutonium oxide at PF-4 at LANL and shipped to SRS for fabrication into MOX fuel at MFFF. The Advanced Recovery and Integrated Extraction System (ARIES) line at PF-4 at LANL has been operational since 1998 and production operations are now underway to provide 2 metric tons (2.2 tons) of plutonium oxide feed for MFFF by 2018 (DOE 1998, 2008b; LANL 2012a).

S.8.1.1 PDCF at F-Area at SRS (PDCF)

Under this option, DOE would construct and operate a stand-alone PDCF at F-Area at SRS, as described in the *SPD EIS*, to convert plutonium pits and metal to an oxide form suitable for feed to MFFF or for immobilization.[12] PDCF would be a new facility constructed at F-Area near MFFF. Pits would be mechanically disassembled. As part of the metal preparation process, plutonium would be mechanically or chemically separated from other materials. The plutonium metal that was bonded with highly enriched uranium or other material would be size-reduced and separated from these materials via a hydride/dehydride process. The hydride/dehydride process converts plutonium metal to plutonium hydride, which can be easily removed from other materials. The plutonium hydride can then be converted to either plutonium metal or plutonium oxide (DOE 1999). All mechanically or chemically separated plutonium metal would then be converted to plutonium oxide via an oxidation process. The plutonium oxide would be sealed in DOE-STD-3013 cans[13] for transfer to MFFF and subsequent disposition.

S.8.1.2 PDC at K-Area at SRS (PDC)

Under this option, PDCF would not be constructed, and an equivalent capacity PDC would be constructed at K-Area. PDC would be constructed largely within an existing building, with some support facilities outside the building, but within K-Area. Pit disassembly and conversion would take place as described in Section S.8.1.1.

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[12] *Only the 7.1 metric tons (7.8 tons) of pit plutonium under consideration in this* SPD Supplemental EIS *are included in the 13.1 metric tons (14.4 tons) of plutonium being considered for immobilization, given DOE's prior decision to fabricate 34 metric tons (37.5 tons) of plutonium into MOX fuel.*

[13] *Containers that meet the specifications in DOE-STD-3013,* Stabilization, Packaging, and Storage of Plutonium-Bearing Materials, *DOE-STD-3013-2012 (DOE 2012b).*

S.8.1.3 PF-4 at LANL and MFFF at SRS (PF-4 and MFFF)

Under this option, a new stand-alone pit disassembly and conversion capability (i.e., PDCF or PDC) would not be constructed at SRS, and DOE would use PF-4 at LANL for pit disassembly and conversion. The existing ARIES capability in PF-4 would be supplemented with equipment to process additional material. Pits would be disassembled and some plutonium would be converted to plutonium oxide and shipped to SRS. In addition, some of the plutonium could be shipped as metal to MFFF at SRS, where it would be converted to plutonium oxide for use as feed for MOX fuel. Plutonium oxidation furnaces and associated systems and equipment would be installed in MFFF to convert the metal received from LANL to oxide suitable for subsequent fabrication into MOX fuel.[14]

S.8.1.4 PF-4 at LANL, and H-Canyon/HB-Line and MFFF at SRS (PF-4, H-Canyon/HB-Line, and MFFF)

Under this option, pit disassembly and conversion capabilities would be located at both LANL and SRS. Pit disassembly and conversion would take place in PF-4 at LANL as described in Section S.8.1.3, and plutonium metal and plutonium oxide would be shipped to SRS as feed for either H-Canyon/HB-Line or MFFF. Oxidation furnaces and associated systems and equipment would be installed in MFFF to convert the metal received from LANL to oxide suitable for subsequent processing into MOX fuel. Pit disassembly at SRS could also take place within a glovebox in K-Area, where pits would be disassembled, resized, packaged, and transported to H-Canyon/HB-Line for preparation for ultimate disposition or to MFFF for metal oxidation and use as feed for MOX fuel. At H-Canyon, pit metal would be dissolved in existing dissolvers and sent to HB-Line for conversion to plutonium oxide feed for ultimate disposition.

S.8.2 Plutonium Disposition Options

This section describes the four plutonium disposition options for the 13.1 metric tons (14.4 tons) of surplus plutonium analyzed in this *SPD Supplemental EIS*.

S.8.2.1 Immobilization and DWPF

Under this option, plutonium would be immobilized using a can-in-canister immobilization capability to be constructed at K-Area. Non-pit plutonium would be brought to the immobilization capability from K-Area storage, while pit plutonium in oxide form would be brought to the immobilization capability from PDCF or H-Canyon/HB-Line at SRS, or PF-4 at LANL. Clean oxides not requiring conversion would be stored pending immobilization. Metals and alloys would be converted to oxide in one of two oxidation furnaces housed within gloveboxes. The cladding from the Fast Flux Test Facility (FFTF) fuel from the Hanford Site would be removed, and the fuel pellets sorted according to fissile material content. Pellets containing plutonium or enriched uranium would be ground to an acceptable particle size for proper mixing. Plutonium oxide feed would be prepared to produce individual batches with the desired composition, and then milled to reduce the size of the oxide powder to achieve faster and more-uniform distribution during the subsequent melting process. The milled oxide would be blended with borosilicate glass frit (i.e., small glass particles) containing neutron absorbers (e.g., gadolinium, boron, hafnium). The mixture would be melted in a platinum/rhodium melter vessel and drained into stainless steel cans. The cans would be loaded into canisters and transferred to DWPF to be filled with an HLW[15]/glass mixture (DOE 1999, 2007b; SRS 2007a, 2007b, 2007c). Filled canisters would be transported to one of the GWSBs, pending offsite storage or disposal. Because the cans of immobilized plutonium would displace an equivalent volume of vitrified HLW, approximately 95 additional HLW canisters would be processed

[14] *MFFF must be operated pursuant to a license from NRC to possess and use special nuclear material, and DOE's contractor has applied for the applicable license. If a plutonium oxidation capability at MFFF were selected by DOE in its ROD for the* SPD Supplemental EIS, *amendment to the NRC license may be required.*

[15] *HLW is used to surround the plutonium to meet the Spent Fuel Standard and thereby provide a proliferation barrier. Under the Spent Fuel Standard, the surplus weapons-usable plutonium would be made as inaccessible and unattractive for weapons use as the much larger and growing quantity of plutonium that exists in used nuclear fuel from commercial nuclear power reactors.*

at DWPF, if 13.1 metric tons (14.4 tons) of plutonium were immobilized using this approach, and stored in the GWSBs. The immobilization capability and PDC (Section S.8.1.2) are mutually exclusive because there is insufficient space at K-Area to construct and operate both capabilities.

S.8.2.2 MOX Fuel

Under this option, plutonium would be fabricated into MOX fuel at MFFF, which is currently under construction at F-Area (DOE 2003a). Plutonium oxide from pit disassembly and conversion or from processing some of the non-pit plutonium could serve as feed for MFFF. DOE estimates that after processing, up to approximately 4 metric tons (4.4 tons) of the 6 metric tons (6.6 tons) of non-pit plutonium would meet the feed specification for MOX fuel fabrication. This non-pit plutonium would be processed at H-Canyon/HB-Line. As described under the pit disassembly and conversion options in Section S.7.1, plutonium would be shipped from PDCF, PDC, or H-Canyon/HB-Line at SRS or from PF-4 at LANL. Some of the plutonium from PF-4 could be shipped as metal and converted to plutonium oxide in oxidation furnaces at MFFF or H-Canyon/HB-Line.

The MOX fuel would be used in domestic commercial nuclear power reactors as previously decided by DOE in the *SPD EIS* ROD (65 FR 1608).[16] Appendix I, Section I.1, of this *SPD Supplemental EIS* includes an impact analysis of using MOX fuel in up to five reactors at TVA's Browns Ferry and Sequoyah Nuclear Plants. To support future DOE decisions involving domestic utilities that may be interested in using MOX fuel in one or more of their reactors, a generic reactor impact analysis has been included in Appendix I, Section I.2. Before MOX fuel could be used in any reactor in the United States, the utility operating the reactor would be required to obtain a license amendment from NRC in accordance with 10 CFR Parts 50 or 52.

When the MOX fuel completes its time within the reactor core, it would be withdrawn from the reactor in accordance with the plant's refueling procedures and placed in the plant's used fuel pool for cooling among other used fuel. MOX used fuel has a slightly greater heat content than LEU used fuel, but this would have no meaningful impacts on fuel pool operation. No major changes are expected in the plant's used fuel storage plans to accommodate the MOX used fuel.

S.8.2.3 H-Canyon/HB-Line and DWPF

Under this option, non-pit plutonium would be brought to H-Canyon/HB-Line from K-Area storage. Plutonium processing in H-Canyon/HB-Line would start with dissolution of the majority of the material that is in oxide form in HB-Line, and dissolution of most of the metals in H-Canyon. Unirradiated FFTF fuel would be repackaged into carbon steel containers suitable for dissolution in H-Canyon. The dissolved solutions would then be transferred to the separations process, during which any uranium present in the material would be recovered and ultimately sent to the Y-12 National Security Complex in Oak Ridge, Tennessee, for disposition. The plutonium solutions would be transferred to the Liquid Radioactive Waste Tank Farm where it would be combined with HLW, pending vitrification at DWPF. Canister-filling operations in DWPF for these solutions would be similar to the operations described in Section S.8.2.1.

S.8.2.4 WIPP Disposal

Under this option, non-pit plutonium would be processed through H-Canyon/HB-Line for WIPP disposal. DOE-STD-3013 containers would be shipped to HB-Line, where they would be cut open in an existing glovebox. Metals would be converted to oxide using an existing or new furnace. Oxide would be repackaged into suitable cans, mixed/blended with inert material, and loaded into Pipe Overpack

[16] *The* SPD EIS *ROD (65 FR 1608) identified Duke Energy's McGuire and Catawba Nuclear Plants, along with Virginia Power's North Anna Nuclear Plant, as reactors that would use MOX fuel. In April, 2000, Virginia Power made a business decision to withdraw from the MOX fuel program. The subcontract with Duke Energy expired and DOE's contractor (Shaw AREVA MOX Services, LLC) currently does not have a subcontract in place with a utility to use this fuel. DOE intends to have a fuel sales subcontract in place with one or more utilities prior to producing MOX fuel assemblies.*

Containers (POCs). The inert material is added to reduce the plutonium content to less than 10 percent by weight and inhibit plutonium material recovery and could include dry mixtures of commercially available materials. The loaded POCs would be transferred to E-Area, where WIPP waste characterization activities would be performed: nondestructive assay, digital radiography, and headspace gas sampling. Once POCs have successfully passed the characterization process and meet WIPP waste acceptance criteria, they would be shipped to WIPP in TRUPACT-II [Transuranic Package Transporter Model 2] or HalfPACT shipping containers.

If the unirradiated FFTF fuel cannot be disposed of by direct disposal at WIPP, the FFTF fuel would be disassembled and packaged for disposal at WIPP. H-Canyon would be used to disassemble the fuel bundles, remove the pellets from the fuel pins, and package the pellets into suitable containers. HB-Line could prepare and mix/blend the fuel pellet material with inert material, then package it for shipment to WIPP. Some modifications to H-Canyon and HB-Line may be required.

S.8.3 Alternatives

This section describes the No Action and four action alternatives, which are combinations of the pit disassembly and conversion options and plutonium disposition options described above. Each alternative also reflects the MOX disposition path previously designated for 34 metric tons (37.5) tons of surplus plutonium (65 FR 1608 and 68 FR 20134), because that surplus plutonium is affected by any decisions made on a pit disassembly and conversion option. In accordance with previous decisions (65 FR 1608; 73 FR 55833), 2 metric tons (2.2 tons) of plutonium would be converted to plutonium oxide at the ARIES line at PF-4 at LANL and shipped to SRS for fabrication into MOX fuel at MFFF.

S.8.3.1 No Action Alternative

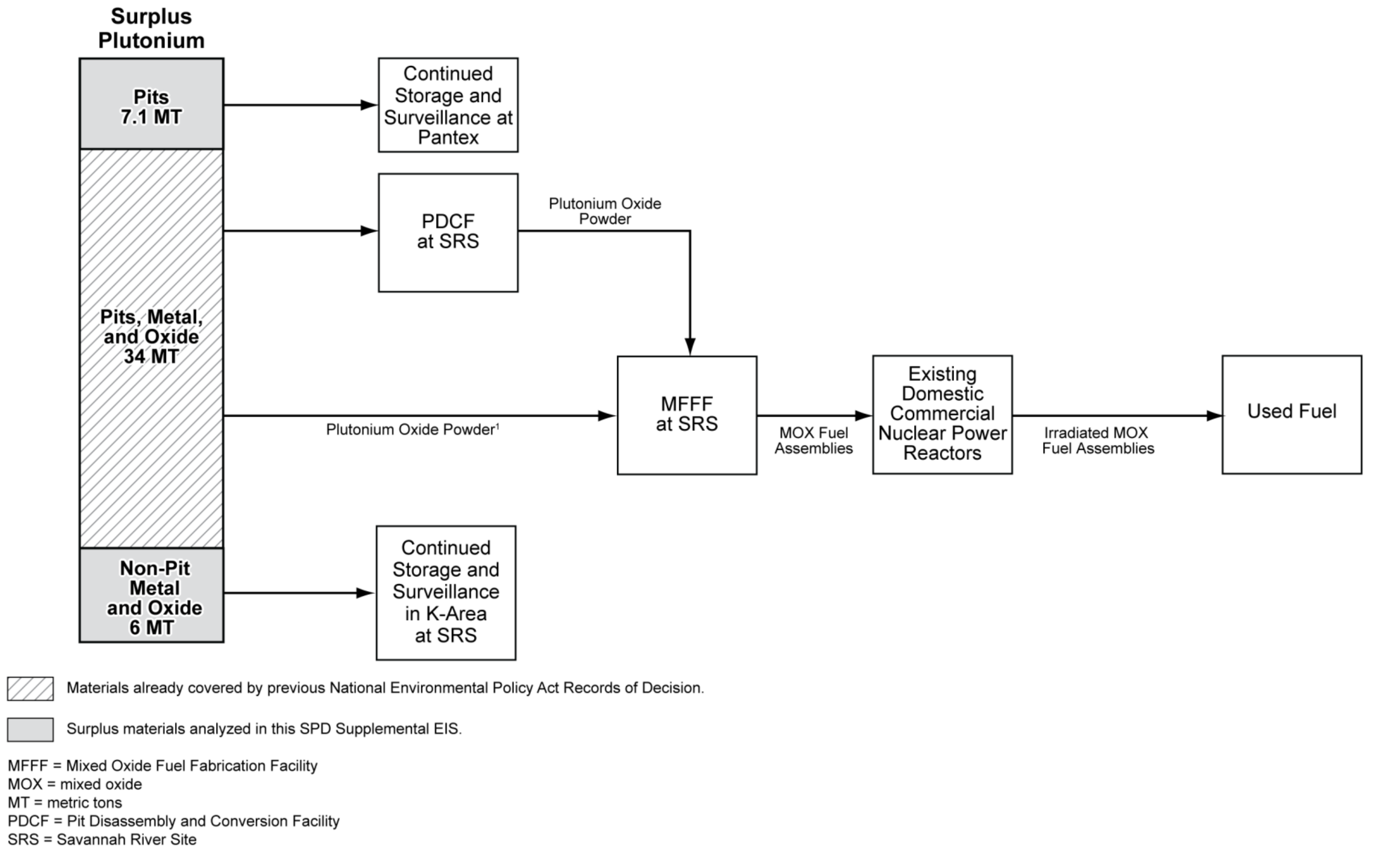
In its ROD for the *SPD EIS* (65 FR 1608) and amended ROD (68 FR 20134), DOE decided to fabricate 34 metric tons (37.5 tons) of surplus plutonium into MOX fuel for use in commercial nuclear power reactors and has begun to implement the decision. DOE is not revisiting that decision.

Since the issuance of the *SPD EIS*, there have been changes in the MOX fuel program. The 1999 *SPD EIS* addressed the potential environmental impacts of using MOX fuel in Duke Energy and Virginia Power nuclear reactors (Section 1.6, lines 233–243). Neither company is part of the MOX fuel program at this time, and the No Action Alternative for this *SPD Supplemental EIS* addresses the use of MOX fuel at generic reactor sites.

Under the No Action Alternative for this *SPD Supplemental EIS*, surplus plutonium would remain in storage at various DOE sites. 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 SRS, consistent with the 2002 amended ROD (67 FR 19432); the *Supplement Analysis, Storage of Surplus Plutonium Materials at the Savannah River Site* (DOE/EIS-0229-SA-4) (DOE 2007a); and an amended ROD issued in 2007 (72 FR 51807).

Under the No Action Alternative, the 13.1 metric tons (14.4 tons) of surplus plutonium analyzed in this *SPD Supplemental EIS* would be managed through the approaches illustrated in **Figure S–9**. Six metric tons (6.6 tons) of surplus non-pit plutonium would continue to be stored at K-Area at SRS, consistent with previous NEPA analyses and decisions (DOE 2002; 67 FR 19432). The 7.1 metric tons (7.8 tons) of the 9 metric tons (9.9 tons) of pit plutonium declared excess in 2007 (see Figure S–5) would remain in storage at Pantex.[17] DOE would also disposition as MOX fuel only 34 metric tons (37.5 tons) of surplus plutonium in accordance with previous decisions. Pits would be disassembled and the disassembled pits and other plutonium metal would be converted to plutonium oxide at PDCF as described in Section S.8.1.1. The 34 metric tons (37.5 tons) of plutonium would be fabricated into MOX fuel at MFFF, as described in Section S.8.2.2, for use at commercial nuclear power reactors; under the No Action Alternative, TVA would not receive MOX fuel from DOE.

[17] *The remaining 1.9 metric tons (2.1 tons) of pit plutonium declared excess in 2007 is included in the 34 metric tons (37.5 tons) already designated for fabrication into MOX fuel at MFFF (see Section S.4).*



[1] Includes plutonium oxide prepared at Los Alamos National Laboratory and H-Canyon/HB-Line at SRS.

Figure S–9 No Action Alternative

The No Action Alternative would not satisfy the purpose and need for agency action because no disposition pathway would be selected for 13.1 metric tons (14.4 tons) of surplus plutonium. Although this surplus plutonium would continue to be stored safely, disposition of this portion of the U.S. surplus plutonium inventory would not occur. In addition, the No Action Alternative would not be consistent with DOE's *Plan for Alternative Disposition of Defense Plutonium and Defense Plutonium Materials That Were Destined for the Cancelled Plutonium Immobilization Plant* (DOE 2007b) under Section 3155 of the National Defense Authorization Act of 2002 (Public Law 107-107). This plan documented DOE's approach for disposition and removal from South Carolina of surplus weapons-usable plutonium located at, or transferred to, SRS that had been previously destined for a cancelled immobilization facility.

S.8.3.2 Immobilization to DWPF Alternative

This alternative evaluates disposition of 13.1 metric tons (14.4 tons) of surplus pit and non-pit plutonium by immobilization and vitrification with HLW, while, as under the No Action Alternative, 34 metric tons (37.5 tons) of surplus plutonium would be dispositioned as MOX fuel. Under the Immobilization to DWPF Alternative, the surplus plutonium addressed in this *SPD Supplemental EIS* would be dispositioned through the approaches illustrated in **Figure S–10**. The 7.1 metric tons (7.8 tons) of pit plutonium and 6 metric tons (6.6 tons) of non-pit plutonium would be immobilized as described in Section S.8.2.1. The 34 metric tons (37.5 tons) addressed in previous decisions would be fabricated into MOX fuel and dispositioned as discussed in Section S.8.2.2.

Plutonium immobilization would need to be completed by 2026 to avoid affecting the current DWPF schedule for HLW vitrification; the schedule is determined by compliance with applicable permits and consent orders (SRR 2010). Based on the proposed rates and schedule for treatment of HLW at DWPF, there would be insufficient HLW having the characteristics needed to enable vitrification of more than approximately 6 metric tons (6.6 tons) of surplus plutonium. Under these conditions it is possible that the remaining approximately 7.1 metric tons (7.8 tons) of plutonium could not be immobilized and vitrified under this alternative, but would need to be dispositioned by another method.

As noted in Section S.8.2.1, the immobilization capability and PDC (Section S.8.1.2) are mutually exclusive because there is insufficient space at K-Area to construct and operate both capabilities. Therefore, only three options for pit disassembly and conversion are possible under the Immobilization to DWPF Alternative: PDCF, PF-4 and MFFF, or PF-4, H-Canyon/HB-Line and MFFF. These options are discussed in Section S.8.1.

S.8.3.3 MOX Fuel Alternative

The MOX Fuel Alternative would maximize the disposition of surplus plutonium as MOX fuel. Under this alternative, surplus plutonium would be dispositioned using the approaches illustrated in **Figure S–11**.

The 7.1 metric tons (7.8 tons) of surplus pit plutonium and 4 metric tons (4.4 tons) of surplus non-pit plutonium, along with the 34 metric tons (37.5 tons) of surplus plutonium addressed in previous decisions (for a total of 45.1 metric tons [49.7 tons]), would be fabricated into MOX fuel at MFFF, as described in Section S.8.2.2. Preparation of the 2 metric tons (2.2 tons) of non-pit plutonium that could not meet the criteria for MOX feed would be processed and packaged at H-Canyon/HB-Line for disposal as TRU waste at WIPP in accordance with the WIPP waste acceptance criteria, as described in Section S.8.2.4. The four options for pit disassembly and conversion under the MOX Fuel Alternative are discussed in Section S.8.1.

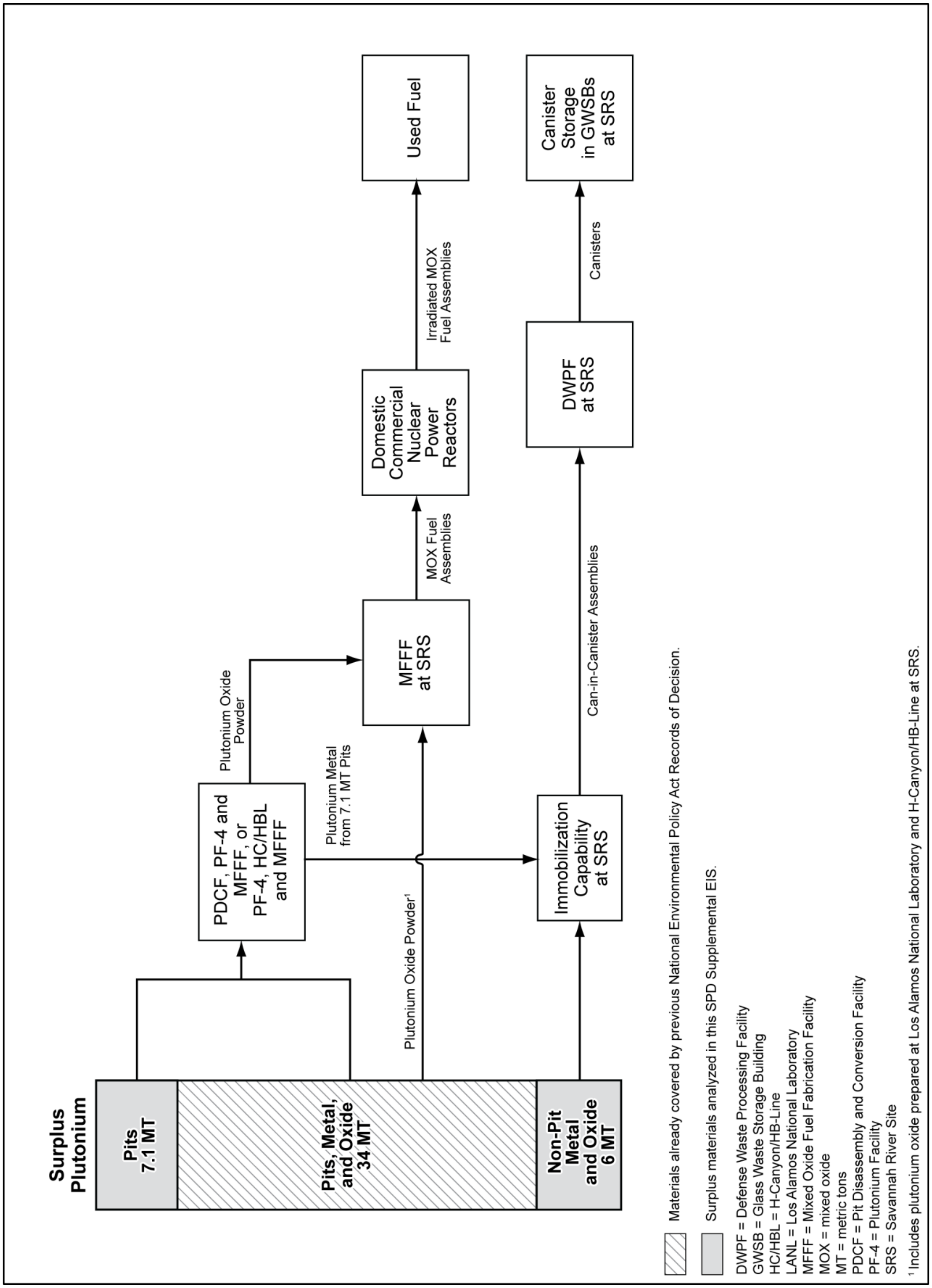
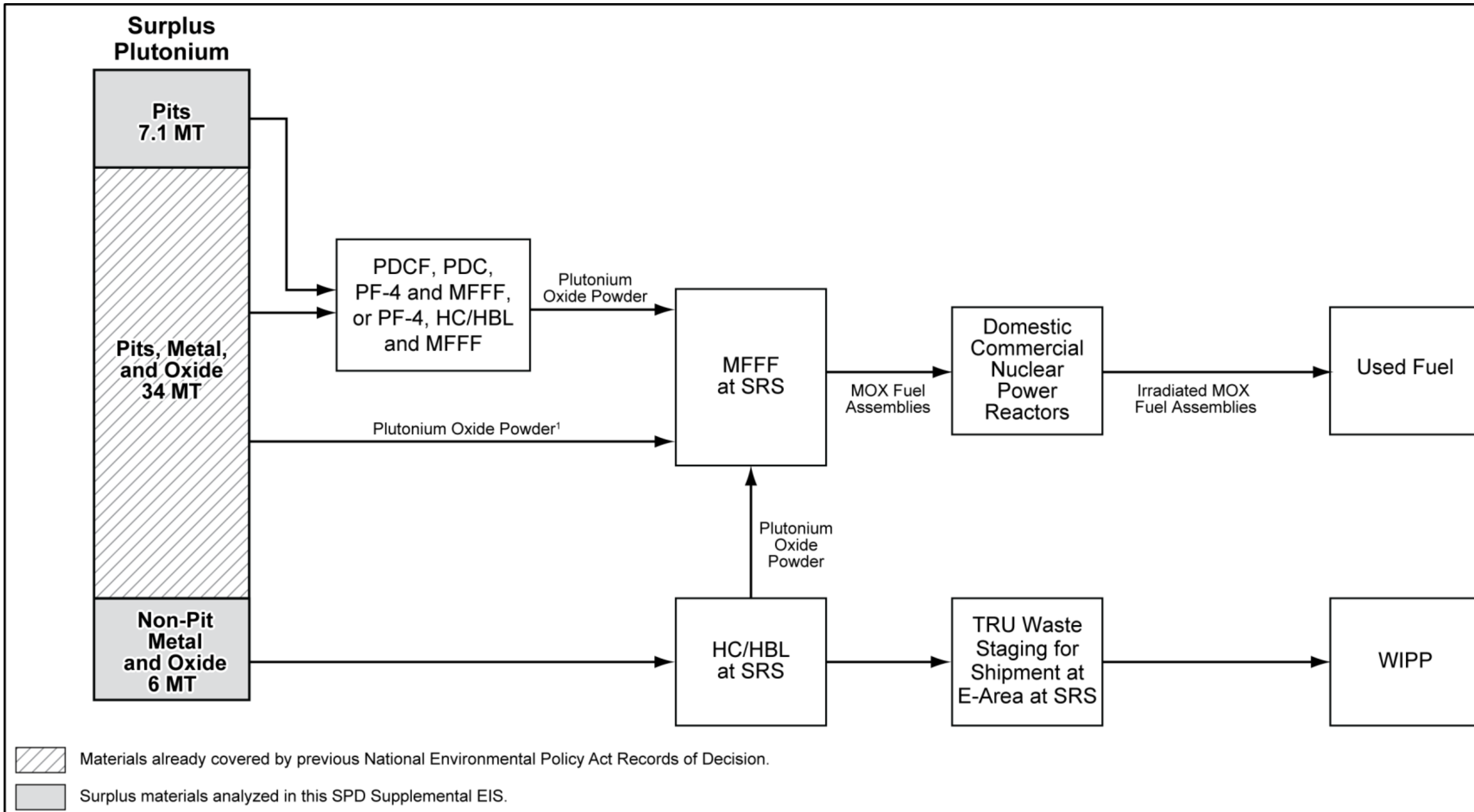


Figure S–10 Immobilization to DWPF Alternative



HC/HBL = H-Canyon/HB-Line
LANL = Los Alamos National Laboratory
MFFF = Mixed Oxide Fuel Fabrication Facility
MOX = mixed oxide
MT = metric tons
PDC = Pit Disassembly and Conversion Project
PDCF = Pit Disassembly and Conversion Facility
PF-4 = Plutonium Facility
SRS = Savannah River Site
TRU = transuranic
WIPP = Waste Isolation Pilot Plant

[1] Includes plutonium oxide prepared at Los Alamos National Laboratory and H-Canyon/HB-Line at SRS.

Figure S–11 MOX Fuel Alternative

S.8.3.4 H-Canyon/HB-Line to DWPF Alternative

The H-Canyon/HB-Line to DWPF Alternative evaluates disposition of 6 metric tons (6.6 tons) of surplus non-pit plutonium through H-Canyon/HB-Line and disposition of 7.1 metric tons (7.8 tons) of surplus pit plutonium as MOX fuel using the approaches illustrated in **Figure S–12**. The 6 metric tons (6.6 tons) of surplus non-pit plutonium would be processed in H-Canyon/HB-Line with subsequent vitrification with HLW at DWPF as described in Section S.8.2.3. Pit plutonium is not considered for dissolution and vitrification with HLW because there would be insufficient HLW having the characteristics needed to vitrify more than approximately 6 metric tons (6.6 tons) of surplus plutonium. The 7.1 metric tons (7.8 tons) of surplus pit plutonium, along with the 34 metric tons (37.5 tons) of surplus plutonium addressed in previous decisions (for a total of 41.1 metric tons [45.3 tons]), would be fabricated into MOX fuel at MFFF with subsequent irradiation in domestic commercial nuclear power reactors as described in Section S.8.2.2. The four options for pit disassembly and conversion under this alternative would be the same as those under the MOX Fuel Alternative.

S.8.3.5 WIPP Alternative

The WIPP Alternative evaluates disposition of 6 metric tons (6.6 tons) of surplus non-pit plutonium at WIPP and disposition of 7.1 metric tons (7.8 tons) of surplus pit plutonium as MOX fuel using the approaches illustrated in **Figure S–13**. The 6 metric tons (6.6 tons) of surplus non-pit plutonium would be processed at H-Canyon/HB-Line such that it would meet the WIPP waste acceptance criteria and could be disposed of at WIPP as TRU waste, as described in Section S.8.2.4. The 7.1 metric tons (7.8 tons) of surplus pit plutonium, along with the 34 metric tons (37.5 tons) of surplus plutonium addressed in previous decisions (for a total of 41.1 metric tons [45.3 tons]), would be fabricated into MOX fuel at MFFF with subsequent irradiation in domestic commercial nuclear power reactors, as described in Section S.8.2.2. The four options for pit disassembly and conversion under this alternative would be the same as those under the MOX Fuel Alternative.

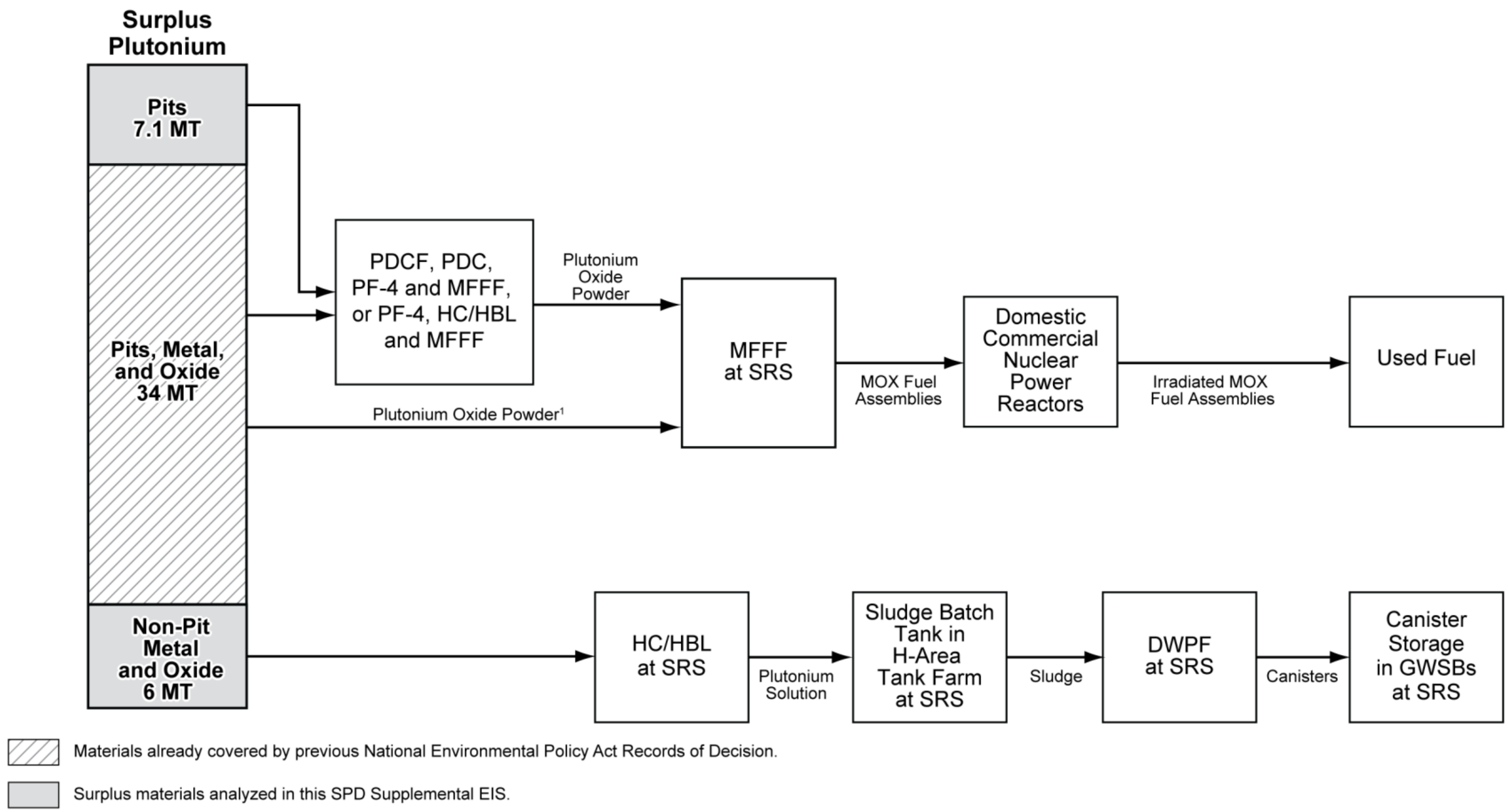
S.9 Alternatives Considered but Dismissed from Detailed Study

The *Storage and Disposition PEIS* (DOE 1996a) and the *SPD EIS* (DOE 1999) considered numerous alternatives for surplus plutonium disposition including disposal of the entire surplus plutonium inventory (which at that time was 50 metric tons [55 tons]) at WIPP, immobilization of the entire surplus plutonium inventory, and pit disassembly and conversion at Pantex.

The direct disposal of 50 metric tons (55 tons) of surplus plutonium was eliminated from further analysis in the *Storage and Disposition PEIS* because it would exceed the capacity of WIPP when added to DOE's inventory of TRU waste (DOE 1996a:2-13). The disposal at WIPP of up to 6 metric tons (6.6 tons) of non-pit plutonium, which is approximately 12 percent of the amount considered in the *Storage and Disposition PEIS,* would not exceed WIPP's capacity and therefore is considered to be a reasonable alternative in this *SPD Supplemental EIS*.

Immobilization of the entire surplus plutonium inventory was evaluated in the *SPD EIS* (DOE 1999), and DOE selected the MOX approach for most of the material declared surplus for reasons set forth in the *SPD EIS* ROD (65 FR 1608). DOE is not revisiting the decisions made in that ROD, or in the 2002 and 2003 amended RODs (67 FR 19432 and 68 FR 20134), other than the decision to construct and operate a stand-alone PDCF.

Pit disassembly and conversion at Pantex was evaluated in the *SPD EIS* (DOE 1999), and DOE selected PDCF at SRS for reasons set forth in the *SPD EIS* ROD (65 FR 1608). Although DOE is reconsidering the decision to build a PDCF at SRS and is looking at other options including using PF-4 at LANL, DOE is not reconsidering pit disassembly and conversion at Pantex for the reasons set forth in the *SPD EIS* ROD.



DWPF = Defense Waste Processing Facility
GWSB = Glass Waste Storage Building
HC/HBL = H-Canyon/HB-Line
LANL = Los Alamos National Laboratory
MFFF = Mixed Oxide Fuel Fabrication Facility
MOX = mixed oxide
MT = metric tons
PDC = Pit Disassembly and Conversion Project
PDCF = Pit Disassembly and Conversion Facility
PF-4 = Plutonium Facility
SRS = Savannah River Site

[1] Includes plutonium oxide prepared at Los Alamos National Laboratory and H-Canyon/HB-Line at SRS.

Figure S–12 H-Canyon/HB-Line to DWPF Alternative

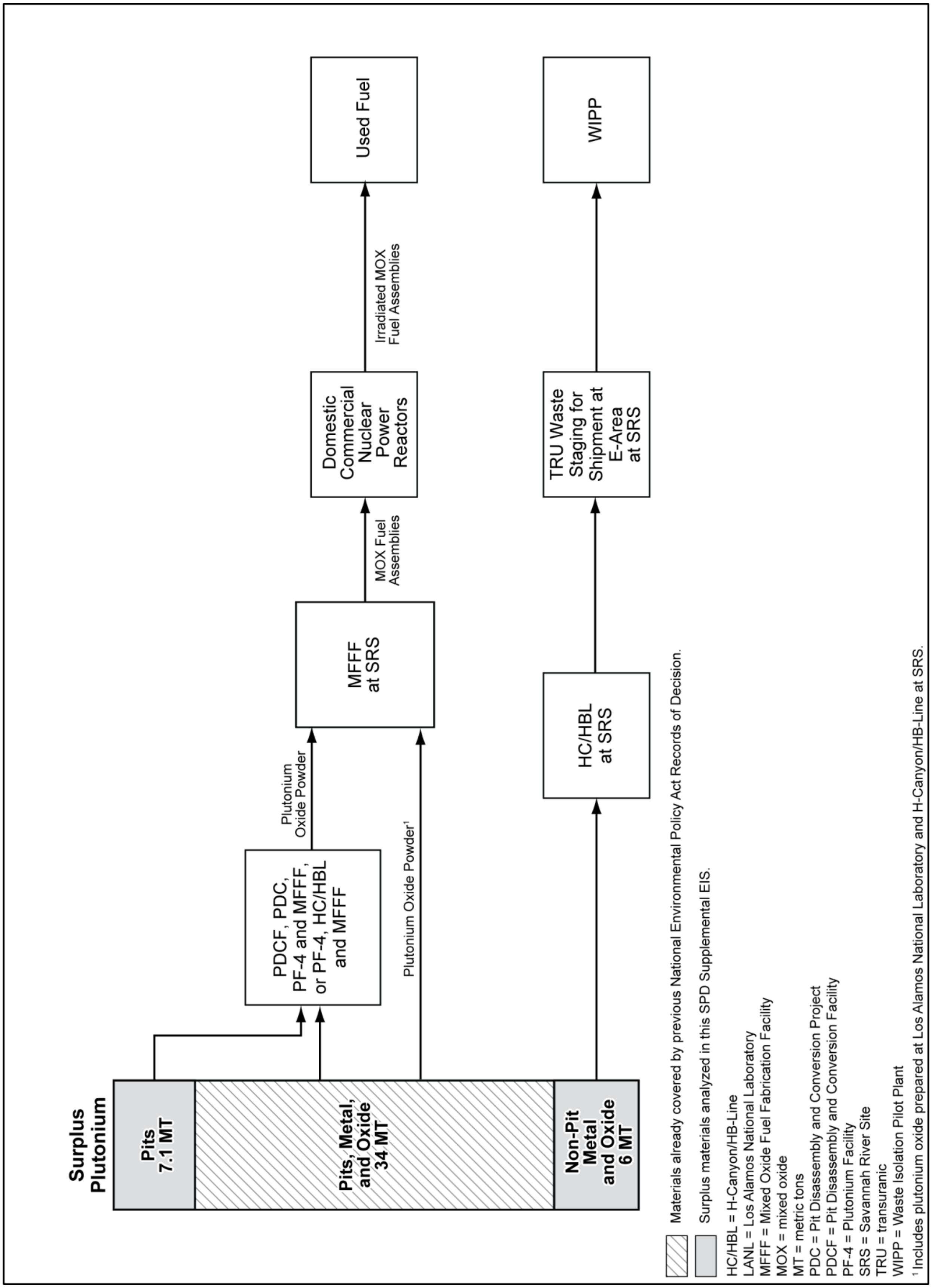


Figure S–13 WIPP Alternative

The following alternatives were considered for evaluation, but dismissed from detailed study in this *SPD Supplemental EIS*: (1) The ceramic can-in canister approach to immobilization; (2) disposal of the entire 13.1 metric tons (14.4 tons) of surplus plutonium using the MOX fuel approach; (3) disposal of the entire 13.1 metric tons (14.4 tons) of surplus plutonium using H-Canyon/HB-Line and DWPF; (4) disposal of the entire 13.1 metric tons (14.4 tons) of surplus plutonium at WIPP. These alternatives are described in the following sections.

S.9.1 Ceramic Can-in-Canister Approach

DOE considered the ceramic can-in-canister approach to immobilization for evaluation, but dismissed it from detailed study in this *SPD Supplemental EIS.* In the *SPD EIS*, DOE evaluated both ceramic and the glass waste form approaches to can-in-canister immobilization, and discussed the potential environmental impacts associated with each (DOE 1999). In Chapter 4, Section 4.29, of the *SPD EIS*, no substantial differences were identified between these two technology variants in terms of the expected environmental impacts on air quality, waste management, human health risk, facility accidents, facility resource requirements, intersite transportation, and environmental justice. Subsequently, in the *SPD EIS* ROD (65 FR 1608), DOE selected ceramic as the preferred can-in-canister immobilization waste form, and the surplus plutonium immobilization program proceeded based on a ceramic process.

This decision was based in part on DOE's expectation that the ceramic can-in-canister approach could provide: (1) better performance in a geologic repository due to the ceramic form's projected higher durability under repository conditions and lower potential for long-term criticality, and (2) greater proliferation resistance than the glass can-in-canister approach because recovery of plutonium from the ceramic form would require a more chemically complex process than what had been developed up to that time (DOE 1999:1-11).

In 2002, however, DOE made the decision to cancel the surplus plutonium immobilization program due to budgetary constraints (67 FR 19432). As a result of this action, work supporting further refinement of the ceramic technology for plutonium disposition was stopped. The United States has not focused policy direction on development of the ceramic process or waste form qualification since that time, and concomitantly, DOE infrastructure and expertise associated with this technology has not evolved or matured.

In contrast, DOE has maintained research, development, and production infrastructure capabilities for glass waste forms. In 2003, work began on qualifying the waste form for inclusion in the Yucca Mountain Geologic Repository license application pursuant to 10 CFR Part 63. Understanding of the glass approach has also benefited from parallel work to develop or qualify similar processes for other applications, including the immobilization of HLW.

Studies have shown that neither waste form has significant advantages over the other in terms of resistance to theft or diversion; resistance to retrieval, extraction, and reuse; technical viability; environment, safety, and health; cost effectiveness; or timeliness. The choice between ceramic and glass immobilized waste forms would also not significantly affect surplus plutonium disposition, or other nonproliferation missions (DOE 2008c:447-453). Therefore, for analysis purposes in this *SPD Supplemental EIS*, the glass can-in-canister approach is evaluated as the representative case for both technologies, and the ceramic can-in-canister technology variant is not evaluated.

S.9.2 Disposition of 13.1 Metric Tons (14.4 Tons) of Surplus Plutonium using the MOX Fuel Approach

Under the MOX Fuel Alternative, DOE is considering disposition of the entire 7.1 metric tons (7.8 tons) of surplus plutonium pits and up to 4 metric tons (4.4 tons) of surplus non-pit plutonium using the MOX fuel approach. Approximately 2 metric tons (2.2 tons) of the surplus non-pit plutonium contains impure metals and oxides that do not meet the acceptance criteria for feed to MFFF even after consideration of modifications that would allow for processing of additional alternate feedstock. The additional 2 metric tons (2.2 tons) of the surplus non-pit plutonium is not considered to be viable for processing at MFFF and, therefore, an alternative that considers the disposal of entire surplus plutonium inventory using the MOX fuel approach was not evaluated.

S.9.3 Disposition of 13.1 Metric Tons (14.4 Tons) of Surplus Plutonium using H-Canyon/HB-Line and DWPF

Under the H-Canyon/HB-Line to DWPF Alternative, DOE is considering disposition of the 6 metric tons (6.6 tons) of surplus non-pit plutonium using H-Canyon/HB-Line and vitrification at DWPF. Disposition of the 7.1 metric tons (7.8 tons) of surplus plutonium pits using H-Canyon/HB-Line is not being considered. Based on planned rates, loading and schedule for treatment of waste at DWPF, there would be insufficient HLW having the characteristics needed to vitrify more than approximately 6 metric tons (6.6 tons) of surplus plutonium. In addition, concerns about criticality would limit the loading in the waste storage tanks and would not support vitrification of 13.1 metric tons (14.4 tons) of plutonium. Therefore, an alternative that evaluates the disposition of the entire 13.1 metric tons (14.4 tons) of surplus plutonium inventory using H-Canyon/HB-Line and DWPF was not evaluated.

S.9.4 Disposal of 13.1 Metric Tons (14.4 Tons) of Surplus Plutonium at the Waste Isolation Pilot Plant

Under the WIPP Alternative, DOE is considering disposal of the 6 metric tons (6.6 tons) of surplus non-pit plutonium at WIPP. Disposal of the 7.1 metric tons (7.8 tons) of surplus plutonium pits at WIPP is not being considered. Based on the proposed rates and schedules for disposal of waste at WIPP, disposal of an additional 7.1 metric tons (7.8 tons) of plutonium pits would significantly increase the volume of TRU waste generated and exceed the remaining WIPP capacity. Therefore, an alternative that evaluates the disposal of the entire 13.1 metric tons (14.4 tons) of surplus plutonium inventory at WIPP was not evaluated.

S.10 Preferred Alternative

The MOX Fuel Alternative is DOE’s Preferred Alternative for surplus plutonium disposition. DOE’s preferred option for pit disassembly and the conversion of surplus plutonium metal, regardless of its origins, to feed for MFFF is to use some combination of facilities at TA-55 at LANL and K-Area, H-Canyon/HB-Line, and MFFF at SRS, rather than to construct a new stand-alone facility. This would likely require the installation of additional equipment and other modifications to some of these facilities. DOE’s preferred alternative for disposition of surplus non-pit plutonium that is not suitable for MOX fuel fabrication is disposal at WIPP.

TVA does not have a preferred alternative at this time regarding whether to pursue irradiation of MOX fuel in TVA reactors and which reactors might be used for this purpose.

S.11 Summary of Environmental Consequences

This section summarizes the impact analyses for the alternatives evaluated in this *SPD Supplemental EIS*. Section S.11.1 summarizes the potential consequences of each alternative by resource area at SRS and LANL, as well as potential domestic commercial nuclear power reactor sites. Section S.11.2 is a summary of the cumulative impacts analysis that considers the consequences of the proposed alternatives in the context of other past, present, and reasonably foreseeable future actions. See Chapter 2, Section 2.6, of this *SPD Supplemental EIS*, for more information.

S.11.1 Comparison of Potential Consequences of Alternatives

Table S–3 summarizes the potential impacts of the alternatives evaluated in this *SPD Supplemental EIS* on activities at SRS and LANL. Impacts on key resource areas at these DOE sites (i.e., air quality, human health, socioeconomics, waste management, transportation, and environmental justice) are discussed in the following paragraphs. The remaining resource areas (i.e., land resources, geology and soils, water resources, noise, ecological resources, cultural resources, and infrastructure) are likely to experience minimal or no impacts regardless of the alternative being considered and, therefore, are analyzed in less detail.

Normal operation of reactors using a partial MOX fuel core is not expected to change substantively from operations using a full LEU fuel core. Construction related to a reactor's ability to use MOX fuel is expected to be minimal and would not substantively add to the environmental impacts currently associated with these plants. The environmental analysis performed in support of this *SPD Supplemental EIS* included both boiling water and pressurized water reactors. The impacts of operating these reactors using a partial MOX fuel core are not expected to change from the impacts currently being realized during normal operations of the reactors using full LEU fuel cores. The areas where some minor differences are noted are worker dose, reactor accidents, used fuel generation, and transportation. Given the small changes, if any, in the impacts associated with the use of a partial MOX fuel core, the results are discussed in the following paragraphs and are not included in Table S–3.

Air Quality. Particulate matter from soil disturbance and criteria and toxic pollutants from construction equipment could be emitted during construction and modification activities under all alternatives. Alternatives with modifications to existing facilities at SRS and LANL would result in lower levels of criteria and toxic pollutants than alternatives that include construction of new facilities. Under all alternatives, air pollutant concentrations at site boundaries from construction activities would not exceed air quality standards. The site boundary concentrations from operation of the plutonium disposition facilities under each alternative also would not exceed ambient air quality standards at either site. Actual emissions from currently operating facilities are less than the permitted emission levels, and the proposed activities would result in site boundary concentrations at SRS and LANL that are lower than the ambient air quality standards. Generally, the incremental impacts from implementing these *SPD Supplemental EIS* alternatives would be minimal.

Greenhouse gases emitted by operations of the proposed surplus plutonium disposition facilities at SRS and LANL would add a relatively small increment to emissions of these gases in the United States and the world. Overall greenhouse gas emissions in the United States during 2009 totaled about 6.8 billion metric tons (7.5 billion tons) of carbon dioxide equivalent[18] (EPA 2012). By way of comparison, increases in annual operational emissions of greenhouse gases from the proposed surplus plutonium disposition facilities at SRS and LANL (up to 170,000 metric tons [190,000 tons]) would equal about 0.003 percent of the United States' total emissions in 2009. However, emissions from the proposed surplus plutonium disposition facilities at SRS and LANL would contribute incrementally to climate change impacts. At present, there is no methodology that would allow DOE to estimate the specific impacts this increment of climate change would produce in the vicinity of the facility or elsewhere.

Operations at the reactor sites would result in the release of a small amount of nonradioactive air pollutants to the atmosphere, mainly due to the requirement to periodically test diesel generators and the operation of auxiliary steam boilers. The estimated air pollutants resulting from operation of the reactors are not expected to increase due to the use of MOX fuel in these reactors.

Human Health – Workers. Total construction worker doses (SRS and LANL combined) would range from 0 to 6.6 person-rem for any of the alternatives implementing the PDCF or PDC Option for pit disassembly and conversion and from 140 to 150 person-rem for any of the action alternatives that implement the PF-4 and MFFF or PF-4, H-Canyon/HB-Line, and MFFF Option for pit disassembly and conversion. No latent cancer fatalities (LCFs)[19] would be expected as a result of these doses.

The annual collective worker dose during operations of all required capabilities at LANL and SRS under each alternative is estimated to range from approximately 310 person-rem under the H-Canyon/HB-Line to DWPF Alternative with the PF-4 and MFFF Option for pit disassembly and conversion to approximately 650 person-rem under the Immobilization to DWPF Alternative with the PF-4, H-Canyon/HB-Line and MFFF Option for pit disassembly and conversion. Based on exposures over the

[18] Carbon dioxide equivalents include emissions of carbon dioxide and other greenhouse gases multiplied by their global warming potential, a metric for comparing the potential climate impact of the emissions of different greenhouse gases.

[19] For each individual or population group considered, an estimate of the potential LCFs is made using the risk estimator of 0.0006 latent fatal cancers per rem or person-rem (or 600 latent fatal cancers per 1 million rem or person-rem) (DOE 2003b).

operating life of the plutonium disposition facilities required under each alternative, 2 LCFs (under the MOX Fuel and H-Canyon/HB-Line to DWPF Alternatives with the PDCF or PDC Option for pit disassembly and conversion) to 7 LCFs (under the Immobilization to DWPF Alternative with the PF-4, H-Canyon/HB-Line, and MFFF Option for pit disassembly and conversion) could occur among the facilities' radiation workers. Worker doses would be monitored and controlled to ensure that individual doses are less than 2,000 millirem per year and as low as reasonably achievable (ALARA) to limit the potential health effects of these worker doses.

Occupational doses to plant workers during periods of MOX fuel loading and irradiation are expected to be similar to those for LEU fuel. The only time any increase in dose is likely to occur would be during acceptance inspections at the reactor when the fuel assemblies are first delivered to the plant. Workers are required to inspect the fuel assemblies to ensure there are no apparent problems; however, TVA has indicated that any potential increases in worker dose would be prevented through the continued implementation of aggressive ALARA programs (TVA 2012). If needed, additional shielding and remote handling equipment would be used to prevent an increase in worker dose. After inspection, worker doses would be limited because the assemblies would be handled remotely as they are loaded into the reactor and subsequently removed from the reactor and transferred into the used fuel pool. Worker doses at the reactors would continue to meet 10 CFR Part 20 Federal regulatory dose limits as required by NRC, and steps would be taken at the reactor sites to limit any increase in doses to workers that could result from use of MOX fuel.

Human Health – Public. Construction of the required plutonium disposition capabilities under all alternatives at SRS or LANL is not expected to result in radiological exposures to the public.

The annual dose to the population[20] surrounding SRS from operation of the proposed plutonium disposition activities would range from 0.45 to 0.97 person-rem across the alternatives, resulting in no LCFs. The annual dose to the offsite maximally exposed individual (MEI)[21] from SRS operations of the proposed plutonium disposition activities would range from 0.0052 to 0.010 millirem across the alternatives, resulting in an annual risk of a latent fatal cancer ranging from 1 chance in 170 million to 1 chance in 320 million.

Based on exposures from normal operations over the life of the surplus plutonium disposition activities required under each alternative, no LCFs are expected from these surplus plutonium disposition activities among the general population surrounding SRS. Similarly, the MEI at SRS is not expected to develop a fatal cancer from exposures from normal operations over the life of the plutonium disposition activities required under each alternative. The risk to the MEI at SRS of developing a fatal cancer from these exposures over the operating life of the alternatives would be 1 chance in 10 million or less.

The annual dose to the population surrounding LANL from pit disassembly and conversion activities would range from 0.025 to 0.21 person-rem across the alternatives, resulting in no LCFs. The total annual dose to the MEI from LANL operations of the pit disassembly and conversion activities would range from 0.0097 to 0.081 millirem across the alternatives, with an annual risk of a latent fatal cancer ranging from 1 chance in 20 million to 1 chance in 170 million.

Based on exposures from normal operations over the life of the pit disassembly and conversion activities under all of the alternatives, no LCFs are expected from these surplus plutonium disposition activities among the general population surrounding LANL. Similarly, the MEI at LANL is not expected to develop a latent fatal cancer from exposures due to normal operations over the life of the plutonium

[20] *Populations for the area within an 80-kilometer (50-mile) radius around the DOE or reactor sites were projected to 2020 using 2010 and past decennial census data.*
[21] *The MEI is a hypothetical member of the public at a location of public access that would result in the highest exposure; for purposes of evaluation in the* SPD Supplemental EIS*, the offsite MEI is considered to be at the site boundary, or in the case of reactor accidents, at the exclusion area boundary.*

disposition activities under any of the alternatives. The risk to the MEI at LANL of developing a latent fatal cancer from these exposures would be 1 chance in a million or less.

Based on information presented in this *SPD Supplemental EIS* and the *SPD EIS* (DOE 1999), normal operation of reactors using partial MOX cores as opposed to LEU cores is not expected to result in any greater doses to the general population surrounding the reactor,[22] or the MEI. Doses from normal operation of the TVA reactors are very low and are not expected to result in any additional LCFs among the public.

Human Health – Accidents. The risks to the MEI and the general population from accidents at SRS and LANL are very small.

Under the No Action Alternative, the limiting design-basis accident[23] for the general population and MEI at SRS would be an overpressurization of a plutonium oxide storage can at PDCF under the PDCF Option for pit disassembly and conversion. This accident would result in no LCFs in the general population, should it occur. The dose to the MEI would increase that individual's probability of developing a latent fatal cancer by about 1 chance in 3,300, should this accident occur. The dose to a noninvolved worker from the limiting design-basis operational accident (a K-Area interim storage vault fire) would increase that individual's probability of developing a latent fatal cancer by about 1 chance in 330, should this accident occur.

Under the Immobilization to DWPF Alternative, the limiting design-basis operational accident at SRS would be an explosion in a metal oxidation furnace during immobilization activities. This accident would result in no LCFs in the general population, should it occur. The dose to the MEI would increase that individual's probability of developing a latent fatal cancer by about 1 chance in 1,000, should this accident occur. The dose to a noninvolved worker would increase that individual's probability of developing a latent fatal cancer by about 1 chance in 33, should this accident occur.

Under the MOX Fuel, H-Canyon/HB-Line to DWPF, and WIPP Alternatives, the limiting design-basis operational accident for the population at SRS would be a level-wide fire in HB-Line. This accident would result in no LCFs in the general population, should it occur. The limiting design-basis operational accident for the MEI would be overpressurization of a plutonium oxide storage can at PDCF; the resulting dose would increase that individual's probability of developing a latent fatal cancer by about 1 chance in 3,300, should this accident occur. The dose to a noninvolved worker from the limiting design-basis operational accident (a K-Area interim storage vault fire and 3013 can rupture) would increase that individual's probability of developing a latent fatal cancer by about 1 chance in 330, should this accident occur.

Under all alternatives, the limiting design-basis operational accident at LANL could be different for the general public and the MEI or noninvolved worker. For the public, it would be from an elevated release as a result of a fire in the PF-4 vault or a hydrogen deflagration from dissolution of plutonium metal. Neither of these accidents would result in LCFs in the general population, should either of them occur. For the MEI and the noninvolved worker, the limiting design-basis accident would be from the hydrogen deflagration. The dose to the MEI would increase that individual's probability of developing a latent fatal cancer by about 1 chance in 14,000, should this accident occur. The dose to a noninvolved worker would increase that individual's probability of developing a latent fatal cancer by about 1 chance in 500, should this accident occur.

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[22] *Populations for the area within an 80-kilometer (50-mile) radius around the reactor sites were projected to 2020 using past decennial census data. By 2020, the MOX program should be firmly established and is expected to remain stable through the end of the program.*

[23] *As used here, the limiting design-basis accident means the individual facility accident analyzed in the* SPD Supplemental EIS *that would have the largest potential impact with the exception of accidents involving earthquakes. Accidents involving earthquakes are assumed to affect multiple facilities and are addressed separately.*

Under all alternatives, the maximum design-basis, natural-phenomenon-initiated accident at SRS would be a design-basis earthquake with fire. This accident is considered unlikely to beyond extremely unlikely. Such an accident could affect multiple facilities supporting the disposition of surplus plutonium. Under all alternatives, this accident would result in no LCFs in the general population, should it occur. The MOX Fuel, H-Canyon/HB-Line to DWPF, and WIPP Alternatives would have the largest impacts; should a design-basis earthquake with fire occur at SRS under any of these alternatives, the increased risk of a latent fatal cancer to the MEI would be about 1 chance in 2,500. Should this accident occur under the Immobilization to DWPF Alternative, with the PF-4 and MFFF Option for pit disassembly and conversion, it would result in the lowest risk to the MEI at SRS. The increased risk of a latent fatal cancer, should the accident occur, would be about 1 chance in 50,000. The risks of a latent cancer to the MEI at SRS under the other alternative and pit disassembly and conversion option combinations range from about 1 chance in 2,500 to 1 chance in 10,000. The dose to a noninvolved worker at SRS from this accident would increase that individual's probability of developing a fatal cancer by about 1 chance in 1,000 to 1 chance in 3,300 should this accident occur.

Under any of the action alternatives, the maximum design-basis, natural-phenomenon-initiated accident at LANL would be a design-basis earthquake with spill plus fire. This accident is considered extremely unlikely and would result in no LCFs in the general population, should it occur. Under the pit disassembly and conversion options involving processing 2 metric tons (2.2 tons) of plutonium at LANL (the PDCF and PDC Options for pit disassembly and conversion), the dose to the MEI at LANL from this accident, should it occur, would increase the probability of the MEI developing a latent fatal cancer by about 1 chance in 1,100. The dose to a noninvolved worker at LANL would increase that individual's probability of developing a latent fatal cancer by about 1 chance in 17. For the PF-4 and MFFF and the PF-4, H-Canyon/HB-Line, and MFFF Options for pit disassembly and conversion, which involve a higher level of pit disassembly and conversion in PF-4, the dose from this accident, should it occur, would increase the probability of the MEI developing a latent fatal cancer by about 1 chance in 500. The dose to a noninvolved worker would increase that individual's probability of developing a latent fatal cancer by about 1 chance in 5, should this accident occur.

The maximum evaluated beyond-design-basis accident at SRS or LANL under all alternatives would be an earthquake that could result in severe damage to the facilities. This accident is considered extremely unlikely to beyond extremely unlikely. This accident would result in 3 to 16 LCFs among the general population surrounding SRS from radiation exposure and uptake of radionuclides, should it occur. A similar accident at LANL involving pit disassembly and conversion activities would result in 1 to 2 LCFs among the general population surrounding LANL from radiation exposure and uptake of radionuclides, should it occur. At the same time, however, numerous deaths associated with falling structural materials would be expected in the area surrounding SRS or LANL, should an earthquake severe enough to significantly damage highly engineered facilities such as those proposed to support surplus plutonium disposition activities occur at either site.

Based on the reactor accident evaluation performed for this *SPD Supplemental EIS*, the risk from potential design-basis accidents with either a full LEU or partial MOX fuel core would be similar for a member of the general public at the exclusion area boundary at the time of the accident or for the general population residing within 50 miles (80 kilometers) of the reactor (see Appendix I of this *SPD Supplemental EIS*). The maximum evaluated design-basis accident at TVA's Sequoyah and Browns Ferry Nuclear Plants would be a loss-of-coolant accident. This accident, should it occur, would result in no LCFs among the general population residing within 50 miles (80 kilometers) of the reactor site from radiation exposure and uptake of radionuclides.

The maximum evaluated beyond-design-basis accident at Browns Ferry would be an early containment failure accident. Taking into account the frequency of this accident, the average individual's probability of developing a fatal cancer would increase by about 1 chance in 3.3 billion, regardless of whether the plant was operating with a partial MOX fuel core or a full LEU fuel core. The maximum evaluated beyond-design-basis accident at Sequoyah would be a steam generator tube rupture accident. Taking into account the frequency of this accident, the average individual's probability of developing a fatal cancer would increase by about 1 chance in 330 million, regardless of whether the plant was operating with a partial MOX fuel core or a full LEU fuel core.

Socioeconomics. Peak construction direct employment at SRS would range from 252 under the Immobilization to DWPF Alternative with the PF-4 and MFFF Option for pit disassembly and conversion, to a maximum of 943 under the Immobilization to DWPF Alternative with the PDCF Option for pit disassembly and conversion. These construction efforts are expected to result in indirect employment in the area surrounding SRS ranging from 159 to 595 jobs. Peak construction direct employment at LANL would range from 0 to 46 with the higher value related to modification of pit disassembly and conversion activities in PF-4 to support a higher level of pit disassembly and conversion in PF-4. These construction efforts are expected to result in indirect employment in the area surrounding LANL ranging from 0 to 26 jobs. The total change in employment related to construction would represent less than 1 percent of the region of influence (ROI) labor force under all alternatives for both SRS and LANL.

Under all alternatives, the additional workers required for operations at SRS would help offset recent reductions in other activities at the site. Peak operations direct employment would range from 1,242 under the H-Canyon/HB-Line to DWPF Alternative with the PF-4 and MFFF Option for pit disassembly and conversion, to 2,111 under the Immobilization to DWPF Alternative with the PDCF Option for pit disassembly and conversion. These operations-related jobs are expected to result in indirect employment in the area surrounding SRS ranging from 1,430 to 2,511 jobs. The total change in employment related to operations would represent about 1.6 percent of the SRS ROI labor force under all alternatives. When considered in conjunction with planned reductions in the workforce at SRS, it is expected that the local housing market would be able to absorb any in-migration of workers resulting from implementation of any of the alternatives. Likewise, the flow of traffic on main transportation corridors to and from the site would remain largely unchanged.

LANL peak operations direct employment would range from 85 under all of the alternatives that include the PDCF or PDC Option for pit disassembly and conversion to 253 under all of the action alternatives that include increased pit disassembly and conversion activities at LANL (i.e., the PF-4 and MFFF or PF-4, H-Canyon/HB-Line, and MFFF Option). These operations-related jobs are expected to result in indirect employment in the area surrounding LANL ranging from 86 to 256 jobs. The total change in employment related to operations would represent less than 1 percent of the LANL ROI labor force under all alternatives. It is expected that the local housing market would be able to absorb any in-migration of workers resulting from implementation of any of the alternatives. Likewise, the flow of traffic on main transportation corridors to and from the site would remain largely unchanged.

Nuclear power reactors would not need to employ additional workers to support MOX fuel use. This is consistent with information presented in the *SPD EIS*, which concluded that MOX fuel use would not result in increases in the worker population at the reactor sites (DOE 1999).

Waste Management. Nonradiological waste would be the major type of waste generated during construction at SRS, although some TRU waste, low-level radioactive waste (LLW), and mixed low-level radioactive waste (MLLW) would be generated due to removal of contaminated equipment and structures. TRU waste, MLLW, and hazardous waste would be disposed of off site; LLW would be disposed of on site or off site; and nonhazardous solid and liquid wastes would be treated and disposed of on site. Sufficient SRS treatment, storage, and disposal capacity exists to manage the wastes generated during construction under all alternatives.

Small amounts of TRU waste, LLW, and MLLW would be generated at LANL during modification of PF-4 to support the proposed pit disassembly and conversion activities under all of the action alternatives. TRU waste would be shipped to WIPP for disposal, MLLW would be disposed of off site, and LLW would be disposed of on site or off site. Sufficient LANL treatment, storage, and disposal capacity exists to manage the wastes generated during construction under all alternatives.

The lowest amount of waste would be generated under the No Action Alternative; however, much of the plutonium would remain in storage under this alternative and would not be dispositioned. Under the WIPP Alternative, there would be more TRU waste, but less MLLW and LLW, generated compared to the other alternatives over the life of the alternatives. The greatest amounts of radioactive waste from construction and operations at both SRS and LANL would be generated under the following alternatives:

- TRU waste – up to 17,000 cubic meters (600,000 cubic feet) under the WIPP Alternative with pit disassembly and conversion accomplished under the PF-4, H-Canyon/HB-Line, and MFFF Option
- MLLW – up to 1,000 cubic meters (35,000 cubic feet) under the Immobilization to DWPF Alternative if all 13.1 metric tons (14.4 tons) of plutonium were immobilized and pit disassembly and conversion was accomplished under the PF-4, H-Canyon/HB-Line, and MFFF Option
- LLW – up to 50,000 cubic meters (1.8 million cubic feet) under the H-Canyon/HB-Line to DWPF Alternative with pit disassembly and conversion accomplished under the PDC Option

Sufficient waste treatment, storage, and disposal capacities currently exist at SRS and LANL to manage the waste generated under all of the alternatives. Additional HLW canisters would be generated under the Immobilization to DWPF and H-Canyon/HB-Line to DWPF Alternatives. These canisters would be stored on site at SRS until a final disposition path is identified.

All alternatives would also generate TRU waste. The total WIPP capacity for TRU waste disposal is currently set at 175,600 cubic meters (6.2 million cubic feet) by the WIPP Land Withdrawal Act, or 168,485 cubic meters (5.95 million cubic feet) of contact-handled TRU waste (DOE 2008d:16). Estimates in the *Annual Transuranic Waste Inventory Report – 2011* indicate that 148,800 cubic meters (5.25 million cubic feet) of contact-handled TRU waste would be disposed of at WIPP (DOE 2011d:Table C–1), approximately 19,700 cubic meters (696,000 cubic feet) less than the current contact-handled TRU waste capacity. TRU waste generation for the activities being considered under the *SPD Supplemental EIS* alternatives would represent 30 to 88 percent of this unsubscribed disposal capacity. Less TRU waste would be generated, representing a smaller percentage of the unsubscribed WIPP disposal capacity (down to 63 percent compared to 88 percent under the WIPP Alternative), if a decision is made to ship the FFTF portion of non-pit plutonium inventory as TRU waste directly to WIPP, and if criticality control containers[24] could be used for packaging of some materials rather than the assumed POCs.

Decisions about disposal of any significant quantities of TRU waste would be made within the context of the needs of the entire DOE complex. It should be also noted that surplus plutonium disposition activities would extend to 2036 for the No Action Alternative and 2038 for the action alternatives. It was assumed for analysis in the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* (DOE 1997) that TRU waste would be received at WIPP over about a 35-year period, through approximately 2033, but because the total quantity of TRU waste that may be disposed of at WIPP is statutorily established by the WIPP Land Withdrawal Act, the actual operating period for WIPP will depend on the volumes of TRU waste that are disposed of at WIPP by all DOE waste generators. Waste minimization across the DOE complex could extend the WIPP operating period. The potential impacts and resolution of these issues would be evaluated as additional information becomes available during the course of operations.

Reactors using MOX fuel are expected to continue to produce LLW, MLLW, hazardous waste, and nonhazardous waste as part of their normal operations. However, waste volumes are not expected to increase as a result of MOX fuel use. Some additional used nuclear fuel would likely be generated from use of a partial MOX core. Based on the analyses done in this *SPD Supplemental EIS* and the *SPD EIS* (DOE 1999), the amount of additional used nuclear fuel generated during the period MOX fuel would be

[24] A criticality control container is a proposed transportation package that would allow the transport of more plutonium material in a package (estimated at 380 plutonium fissile gram equivalents per container) than in a POC. A criticality control container would have components that would address possible criticality concerns that would be inherent in transporting a larger quantity of plutonium in a container.

used in a reactor is estimated to increase by approximately 2 to 16 percent compared to the reactor continuing to use only LEU fuel. It is expected that these small increases would be managed within the reactor's normal planning for used fuel storage.

Transportation. Construction activities at SRS would generate waste streams that would primarily be disposed of on site and would, therefore, have negligible transportation impacts. However, some MLLW would be generated at SRS during construction that would need to be shipped off site for treatment and disposal. The impacts associated with these shipments would be small and are included in the total estimated impacts shown in the operations discussion.

Similarly, construction activities at LANL would generate waste streams that would primarily be disposed of on site and would, therefore, have negligible transportation impacts. Some MLLW and TRU waste, however, would be generated at LANL during modification of PF-4. This MLLW and TRU waste would be shipped off site for treatment and/or disposal. The impacts associated with these shipments would be small and are included in the total estimated impacts shown in the operations discussion.

For operations under all alternatives, offsite shipments of radioactive wastes and materials would be required, including the following: MLLW, LLW, and TRU waste to treatment and disposal facilities; pit transport from Pantex to SRS or LANL; plutonium metal or oxide from LANL to SRS; highly enriched uranium from SRS or LANL to the Y-12 National Security Complex in Oak Ridge, Tennessee; pieces and parts from pit disassembly from SRS to LANL if pit disassembly is performed at SRS; depleted uranium hexafluoride from Piketon, Ohio, to a uranium conversion plant in Richland, Washington; and depleted uranium dioxide and depleted uranyl nitrate hexahydrate from Richland, Washington, to SRS. Under all alternatives, no LCFs are expected in the general public along the transportation routes due to incident-free transport of radioactive wastes and materials to and from SRS and LANL (i.e., no more than about 1 chance in 3 for the duration of any alternative), including shipment of unirradiated MOX fuel for use in TVA or generic commercial nuclear power reactors (assumed for analysis purposes to be located in the northwestern United States to maximize potential transportation impacts). The risk to the transportation crew from these shipments would also be low. No LCFs are expected in the transportation crews due to incident-free transport of radioactive wastes and materials to and from SRS and LANL (i.e., no more than about 1 chance in 3 for the duration of any alternative).

There is the risk of up to 1 fatality due to a traffic accident. The risk of an LCF due to the release of the radioactive cargo in an accident under all alternatives would be much less than 1 (i.e., no more than about 1 chance in 10,000 for the duration of an alternative).

In addition to the offsite shipments of radioactive wastes and materials, all alternatives would include the shipment of hazardous wastes and construction materials. Under all of the alternatives, these shipments could result in three to four accidents over the life of the alternative. The risk of a fatality due to a traffic accident from these shipments would be less than 1 under all of the alternatives.

All alternatives would also include onsite transportation to and from the facilities involved in surplus plutonium disposition activities. Onsite transportation would not affect members of the public because roads between SRS and LANL processing areas are closed to the public. Onsite transportation is not expected to significantly increase the risk to onsite workers. Transportation activities currently conducted as part of site operations do not have a discernible impact on onsite workers.

Environmental Justice. As discussed in Chapter 4, Section 4.1.6, of this *SPD Supplemental EIS*, the potential environmental impacts and risks associated with the proposed surplus plutonium disposition activities are essentially the same or lower for minority and low-income populations residing near SRS or LANL as they are for nonminority and non-low-income populations. Included in the analysis described in Section 4.1.6 is a discussion of the potential impacts on an American Indian who may live a more traditional lifestyle on lands near LANL. This analysis concluded that this person would not be subject to significantly increased risks due to the actions proposed in this *SPD Supplemental EIS*. Therefore, no disproportionately high and adverse impacts on minority or low-income populations residing near SRS or LANL would result from implementing any alternative.

Table S–3 Summary of Environmental Consequences of Alternatives for Surplus Plutonium Disposition Activities at Department of Energy Sites

Resource Area	*Alternative*				
	No Action	***Immobilization to DWPF***	***MOX Fuel***	***H-Canyon/HB-Line to DWPF***	***WIPP***
Air Quality	***Construction***				
	- Particulate matter would be emitted from land-disturbing activities associated with construction of PDCF in F-Area at SRS. Pollutants would be emitted from diesel construction equipment, operation of a concrete batch plant, and vehicle emissions. - Concentrations at the site boundary would not exceed air quality standards.	- Impacts would be approximately the same as under the No Action Alternative. - Activities at LANL, if undertaken, would not exceed air quality standards.	- Impacts would be approximately the same as under the No Action Alternative from construction of PDCF or reduced impacts from construction of PDC or modification of existing facilities at SRS. - Activities at LANL would be the same as under the Immobilization to DWPF Alternative.	Same as under the MOX Fuel Alternative.	Same as under the MOX Fuel Alternative.
	Operations				
	Concentrations at the SRS and LANL site boundaries would not exceed air quality standards.	Same as under the No Action Alternative for SRS. Expanded activities at LANL, if undertaken, would not exceed air quality standards.	Approximately the same as under the Immobilization to DWPF Alternative.	Approximately the same as under the Immobilization to DWPF Alternative.	Approximately the same as under the Immobilization to DWPF Alternative.
Human Health – Normal Operations, Workers	***Construction***				
	No additional worker doses or risks are expected at SRS or LANL.	- Total worker dose at SRS – up to 11 person-rem - SRS total LCFs – 0 (up to 0.007) - Total worker dose at LANL – up to 140 person-rem - LANL total LCFs – 0 (up to 0.08)	- Total worker dose at SRS – up to 4.5 person-rem - SRS total LCFs – 0 (up to 0.003) - Total worker dose and LCFs at LANL would be the same as under the Immobilization to DWPF Alternative.	Same as under the MOX Fuel Alternative.	- Total worker dose at SRS – up to 5.7 person-rem - SRS total LCFs – 0 (up to 0.003) - Total worker dose and LCFs at LANL would be the same as under the Immobilization to DWPF Alternative.
	Operations				
	- Annual total worker dose at SRS – 300 person-rem - SRS annual LCFs – 0 (0.2) - SRS total LCFs – 3 - Annual total worker dose at LANL – 29 person-rem - LANL annual LCFs – 0 (0.02) - LANL total LCFs – 0 (0.1)	- Annual total worker dose at SRS – 430 to 620 person-rem - SRS annual LCFs – 0 (0.3 to 0.4) - SRS total LCFs – 3 to 4 - Annual total worker dose at LANL – 29 to 190 person-rem - LANL annual LCFs – 0 (0.02 to 0.1) - LANL total LCFs – 0 (0.1) to 3	- Annual total worker dose at SRS – 130 to 320 person-rem - SRS annual LCFs – 0 (0.08 to 0.2) - SRS total LCFs – 1 to 2 - Annual total worker dose at LANL would be the same as under the Immobilization to DWPF Alternative	- Annual total worker dose at SRS – 120 to 310 person-rem - SRS annual LCFs – 0 (0.07 to 0.2) - SRS total LCFs – 2 - Annual total worker dose at LANL would be the same as under the Immobilization to DWPF Alternative	- Annual total worker dose at SRS – 170 to 360 person-rem - SRS annual LCFs – 0 (0.1 to 0.2) - SRS total LCFs – 2 to 3 - Annual total worker dose at LANL would be the same as under the Immobilization to DWPF Alternative

Resource Area	*Alternative*				
	No Action	***Immobilization to DWPF***	***MOX Fuel***	***H-Canyon/HB-Line to DWPF***	***WIPP***
Human Health – Normal Operations, General Population	***Construction***				
	Construction of PDCF in F-Area at SRS would be in uncontaminated areas. No radiological exposure to the public would result.	- Same as under the No Action Alternative, except activities would include removal of contaminated equipment and structures during construction of the immobilization capability at K-Area and could include modification of H-Canyon/ HB-Line to support plutonium conversion. - Modification at PF-4 at LANL would be within the existing building. No radiological exposure to the public would result at SRS or LANL.	- Same as under the No Action Alternative, except activities could include removal of contaminated equipment and structures during construction of PDC at K-Area at SRS or modification of H-Canyon/ HB-Line to support plutonium conversion. - Modification of PF-4 at LANL would be the same as that under the Immobilization to DWPF Alternative. No radiological exposure to the public would result at SRS or LANL.	Same as under the MOX Fuel Alternative.	- Same as under the MOX Fuel Alternative, except would include modification of H-Canyon/HB-Line to support preparation of plutonium for WIPP disposal. - Modification of PF-4 at LANL would be the same as that under the Immobilization to DWPF Alternative. No radiological exposure to the public would result at SRS or LANL.
	Operations				
	Annual population dose (person-rem) - SRS – 0.54 - LANL – 0.025 Annual population LCFs - SRS – 0 (3×10^{-4}) - LANL – 0 (2×10^{-5}) Project total population LCFs - SRS – 0 (4×10^{-3}) - LANL – 0 (1×10^{-4}) Annual MEI dose (millirem) - SRS – 0.0066 - LANL – 0.0097 Annual MEI LCF risk - SRS – 4×10^{-9} - LANL – 6×10^{-9} Project total MEI LCF risk - SRS – 4×10^{-8} - LANL – 4×10^{-8} Risk to the public would be small.	Annual population dose (person-rem) - SRS – 0.45 to 0.71 - LANL – 0.025 to 0.21 Annual population LCFs - SRS – 0 (3×10^{-4} to 4×10^{-4}) - LANL – 0 (2×10^{-5} to 1×10^{-4}) Project total population LCFs - SRS – 0 (4×10^{-3} to 7×10^{-3}) - LANL – 0 (1×10^{-4} to 3×10^{-3}) Annual MEI dose (millirem) - SRS – 0.0052 to 0.0076 - LANL – 0.0097 to 0.081 Annual MEI LCF risk - SRS – 3×10^{-9} to 5×10^{-9} - LANL – 6×10^{-9} to 5×10^{-8} Project total MEI LCF risk - SRS – 5×10^{-8} to 8×10^{-8} - LANL – 4×10^{-8} to 1×10^{-6} Risk to the public would be small.	Annual population dose (person-rem) - SRS – 0.71 to 0.97 - LANL – 0.025 to 0.21 Annual population LCFs - SRS – 0 (4×10^{-4} to 6×10^{-4}) - LANL – 0 (2×10^{-5} to 1×10^{-4}) Project total population LCFs - SRS – 0 (6×10^{-3} to 9×10^{-3}) - LANL – 0 (1×10^{-4} to 3×10^{-3}) Annual MEI dose (millirem) – - SRS – 0.0077 to 0.010 - LANL – 0.0097 to 0.081 Annual MEI LCF risk - SRS – 5×10^{-9} to 6×10^{-9} - LANL – 6×10^{-9} to 5×10^{-8} Project total MEI LCF risk - SRS – 7×10^{-8} to 1×10^{-7} - LANL – 4×10^{-8} to 1×10^{-6} Risk to the public would be small.	Annual population dose (person-rem) - SRS – 0.46 to 0.72 - LANL – 0.025 to 0.21 Annual population LCFs - SRS – 0 (3×10^{-4} to 4 × 10-^{4}) - LANL – 0 (2×10^{-5} to 1×10^{-4}) Project total population LCFs - SRS – 0 (4×10^{-3} to 7×10^{-3}) - LANL – 0 (1×10^{-4} to 3×10^{-3}) Annual MEI dose (millirem) – - SRS – 0.0053 to 0.0077 - LANL – 0.0097 to 0.081 Annual MEI LCF risk - SRS – 3×10^{-9} to 5×10^{-9} - LANL – 6×10^{-9} to 5×10^{-8} Project total MEI LCF risk - SRS – 6×10^{-8} to 9×10^{-8} - LANL – 4×10^{-8} to 1×10^{-6} Risk to the public would be small.	Annual population dose (person-rem) - SRS – 0.71 to 0.97 - LANL – 0.025 to 0.21 Annual population LCFs - SRS – 0 (4×10^{-4} to 6×10^{-4}) - LANL – 0 (2×10^{-5} to 1×10^{-4}) Project total population LCFs - SRS – 0 (6×10^{-3} to 9×10^{-3}) - LANL – 0 (1×10^{-4} to 3×10^{-3}) Annual MEI dose (millirem) – - SRS – 0.0077 to 0.010 - LANL – 0.0097 to 0.081 Annual MEI LCF risk - SRS – 5×10^{-9} to 6×10^{-9} - LANL – 6×10^{-9} to 5×10^{-8} Project total MEI LCF risk - SRS – 8×10^{-8} to 1×10^{-7} - LANL – 4×10^{-8} to 1×10^{-6} Risk to the public would be small.

Resource Area	*Alternative*				
	No Action	***Immobilization to DWPF***	***MOX Fuel***	***H-Canyon/HB-Line to DWPF***	***WIPP***
Human Health – Facility Accidents	Limiting design-basis accident at SRS (overpressurization of oxide storage can at PDCF): - Frequency – extremely unlikely - Population LCFs – 0 (1×10^{-1}) - MEI LCF risk – 3×10^{-4} Design-basis earthquake with fire at SRS: - Frequency – unlikely to beyond extremely unlikely - Population LCFs – 0 (6×10^{-2}) - MEI LCF risk – 1×10^{-4} Beyond-design-basis earthquake with fire at SRS: - Up to 7 LCFs from high radiation exposure and uptake of radionuclides; numerous worker and public injuries and deaths are expected from collapsed buildings in a severe earthquake postulated to significantly damage highly engineered facilities working with plutonium. Limiting design-basis accident at LANL (fire in TA-55 vault or hydrogen deflagration from plutonium dissolution): - Frequency – extremely unlikely to beyond extremely unlikely - Population LCFs – 0 (2×10^{-2}) - MEI LCF risk – 7×10^{-5} Design-basis earthquake with spill plus fire at LANL: - Frequency – extremely unlikely to beyond extremely unlikely - Population LCFs – 0 (2×10^{-1}) - MEI LCF risk – 9×10^{-4} Beyond-design-basis earthquake with spill plus fire at LANL: - Up to 1 LCF from high radiation exposure and uptake of radionuclides; numerous worker and public injuries and deaths are expected from collapsed buildings in a severe earthquake postulated to significantly damage highly engineered facilities working with plutonium. Risk to the public from accidents would be small.	Limiting design-basis accident at SRS (explosion in metal oxidation furnace during immobilization): - Frequency – extremely unlikely to beyond extremely unlikely - Population LCFs – 0 (4×10^{-1}) - MEI LCF risk – 1×10^{-3} Design-basis earthquake with fire at SRS: - Frequency – unlikely to beyond extremely unlikely - Population LCFs – 0 (up to 2×10^{-1}) - MEI LCF risk – up to 3×10^{-4} Beyond-design-basis earthquake with fire at SRS: - Up to 12 LCFs from high radiation exposure and uptake of radionuclides; numerous worker and public injuries and deaths are expected from collapsed buildings in a severe earthquake postulated to significantly damage highly engineered facilities working with plutonium. Limiting design-basis accident at LANL: same as under the No Action Alternative Design-basis earthquake with spill plus fire at LANL: - Frequency – extremely unlikely to beyond extremely unlikely - Population LCFs – up to 1 (5×10^{-1}) - MEI LCF risk – up to 2×10^{-3} Beyond-design-basis earthquake with spill plus fire at LANL: - Up to 2 LCFs from high radiation exposure and uptake of radionuclides; numerous worker and public injuries and deaths are expected from collapsed buildings in a severe earthquake postulated to significantly damage highly engineered facilities working with plutonium. Risk to the public from accidents would be small.	Limiting design-basis accident at SRS (overpressurization of oxide storage can at PDCF or level-wide fire at HB-Line): - Frequency –extremely unlikely - Population LCFs – 0 (2×10^{-1}) - MEI LCF risk – up to 3×10^{-4} Design-basis earthquake with fire at SRS: - Frequency – unlikely to beyond extremely unlikely - Population LCFs – 0 (2×10^{-1}) - MEI LCF risk – up to 4×10^{-4} Beyond-design-basis earthquake with fire at SRS: - Up to 16 LCFs from high radiation exposure and uptake of radionuclides; numerous worker and public injuries and deaths are expected from collapsed buildings in a severe earthquake postulated to significantly damage highly engineered facilities working with plutonium. Accident risks to the public at LANL would be the same as under the Immobilization to DWPF Alternative. Risk to the public from accidents would be small.	Same as under the MOX Fuel Alternative.	Same as under the MOX Fuel Alternative.

Resource Area	Alternative				
	No Action	***Immobilization to DWPF***	***MOX Fuel***	***H-Canyon/HB-Line to DWPF***	***WIPP***
Socioeconomics (impacts in peak year)	***Construction***				
	- SRS direct employment, peak – 722 - SRS indirect employment, peak – 455 - Value added to local economy near SRS, peak – $67 million Impacts on housing and traffic would be small.	- SRS direct employment, peak – 252 to 943 - SRS indirect employment, peak – 159 to 595 - Value added to local economy near SRS, peak – $23 million to $87 million - LANL direct employment, peak – 0 to 46 - LANL indirect employment, peak – 0 to 26 - Value added to local economy near LANL, peak – $0 to $3.8 million Impacts on housing and traffic would be small.	- SRS direct employment, peak – 275 to 741 - SRS indirect employment, peak – 173 to 467 - Value added to local economy near SRS, peak – $25 million to $68 million - LANL impacts would be the same as under the Immobilization to DWPF Alternative Impacts on housing and traffic would be small.	- SRS direct employment, peak – 275 to 741 - SRS indirect employment, peak – 173 to 467 - Value added to local economy near SRS, peak – $25 million to $68 million - LANL impacts would be the same as under the Immobilization to DWPF Alternative Impacts on housing and traffic would be small.	- SRS direct employment, peak – 285 to 741 - SRS indirect employment, peak – 180 to 467 - Value added to local economy near SRS, peak – $26 million to $68 million - LANL impacts would be the same as under the Immobilization to DWPF Alternative Impacts on housing and traffic would be small.
	Operations				
	- Direct employment at SRS, peak – 1,677 - Indirect employment at SRS, peak – 1,995 - Value added to local economy near SRS, peak – $250 million - Total worker-years (includes construction) – 36,400 - Direct employment at LANL, peak – 85 - Indirect employment at LANL, peak – 86 - Value added to local economy at LANL, peak – $11 million - Total worker-years – 600 Impacts on housing and traffic would be small.	- Direct employment at SRS, peak – 1,596 to 2,111 - Indirect employment at SRS, peak – 1,898 to 2,511 - Value added to local economy at SRS, peak – $240 million to $320 million - Total worker-years (includes construction) – up to 43,300 - Direct employment at LANL, peak – 85 to 253 - Indirect employment at LANL, peak – 86 to 256 - Value added to local economy at LANL, peak – $11 million to $32 million - Total worker-years (includes construction) – 600 to 5,900 Impacts on housing and traffic would be small.	- Direct employment at SRS, peak – 1,357 to 1,716 - Indirect employment at SRS, peak – 1,614 to 2,041 - Value added to local economy at SRS, peak – $200 million to $260 million - Total worker-years (includes construction) – Up to 41,100 LANL impacts would be the same as under the Immobilization to DWPF Alternative Impacts on housing and traffic would be small.	- Direct employment at SRS, peak – 1,242 to 1,676 - Indirect employment at SRS, peak – 1,430 to 1,993 - Value added to local economy at SRS, peak – $180 million to $250 million - Total worker-years (includes construction) – Up to 38,800 LANL impacts would be the same as under the Immobilization to DWPF Alternative Impacts on housing and traffic would be small.	- Direct employment at SRS, peak – 1,257 to 1,716 - Indirect employment at SRS, peak – 1,495 to 2,041 - Value added to local economy at SRS, peak – $190 million to $260 million - Total worker-years (includes construction) – Up to 39,700 LANL impacts would be the same as under the Immobilization to DWPF Alternative Impacts on housing and traffic would be small.

Resource Area	Alternative				
	No Action	***Immobilization to DWPF***	***MOX Fuel***	***H-Canyon/HB-Line to DWPF***	***WIPP***
Waste Management (cubic meters over life of the project)	***SRS Construction***				
	TRU waste – 0 MLLW – 0 LLW – 0 Hazardous – 56 Nonhazardous (solid) – 1,300 Waste treatment, storage, and disposal capacities are sufficient to manage these waste streams.	TRU waste – 0 to 23 MLLW – 100 LLW – 2,500 Hazardous – 100 to 160 Nonhazardous (solid) – 2,500 to 3,800 Waste treatment, storage, and disposal capacities are sufficient to manage these waste streams.	TRU waste – 10 to 33 MLLW – 0 to 210 LLW – 0 to 12,000 Hazardous – 0 to 7,000 Nonhazardous (solid) – 0 to 6,800 Waste treatment, storage, and disposal capacities are sufficient to manage these waste streams.	TRU waste – 0 to 23 Remainder same as under the MOX Fuel Alternative. Waste treatment, storage, and disposal capacities are sufficient to manage these waste streams.	Same as under the MOX Fuel Alternative. Waste treatment, storage, and disposal capacities are sufficient to manage these waste streams.
	SRS Operations				
	TRU waste – 5,900 MLLW – 0 LLW – 16,000 Hazardous – 10 Nonhazardous (solid) – 29,000 Waste treatment, storage, and disposal capacities are sufficient to manage these waste streams.	TRU waste – 10,000 to 12,000 MLLW – 800 to 830 LLW – 12,000 to 33,000 Hazardous – 810 Nonhazardous (solid) – 16,000 to 2,800,000 Waste treatment, storage, and disposal capacities are sufficient to manage these waste streams.	TRU waste – 9,900 to 12,000 MLLW – 14 to 34 LLW – 20,000 to 32,000 Hazardous – 7 to 8 Nonhazardous (solid) – 1,200,000 to 2,800,000 Waste treatment, storage, and disposal capacities are sufficient to manage these waste streams.	TRU waste – 6,700 to 8,500 MLLW – 31 to 34 LLW – 27,000 to 37,000 Hazardous – 7 to 8 Nonhazardous (solid) – 2,600,000 to 2,800,000 Waste treatment, storage, and disposal capacities are sufficient to manage these waste streams.	TRU waste – 14,000 to 16,000 MLLW – 0 to 34 LLW – 11,000 to 32,000 Hazardous – 6 to 7 Nonhazardous (solid) – 15,000 to 2,800,000 Waste treatment, storage, and disposal capacities are sufficient to manage these waste streams.
	LANL Construction				
	Not applicable.	TRU waste – 0 to 19 MLLW – 0 to 56 LLW – 0 to 37 Hazardous – 0 Nonhazardous (solid) – 0 Waste treatment, storage, and disposal capacities are sufficient to manage these waste streams.	Same as under the Immobilization to DWPF Alternative.	Same as under the Immobilization to DWPF Alternative.	Same as under the Immobilization to DWPF Alternative.
	LANL Operations				
	TRU waste – 70 MLLW – 2 LLW – 200 Hazardous – 0 Nonhazardous (solid) – 0 Waste treatment, storage, and disposal capacities are sufficient to manage these waste streams.	TRU waste – 70 to 1,200 MLLW – 2 to 31 LLW – 200 to 4,000 Hazardous – 0 to 4 Nonhazardous (solid) – 0 Waste treatment, storage, and disposal capacities are sufficient to manage these waste streams.	Same as under the Immobilization to DWPF Alternative.	Same as under the Immobilization to DWPF Alternative.	Same as under the Immobilization to DWPF Alternative.

Resource Area	***Alternative***				
	No Action	***Immobilization to DWPF***	***MOX Fuel***	***H-Canyon/HB-Line to DWPF***	***WIPP***
Transportation (total health effects)	***Construction Material and Hazardous Waste Shipments at SRS and LANL***				
	Shipments – 42,000 Accident fatalities – 0 (0.2)	Shipments – 1,300 to 43,000 Accident fatalities – 0 (0.01 to 0.2)	Shipments – <10 to 43,000 Accident fatalities – 0 (0.0004 to 0.2)	Same as under the MOX Fuel Alternative.	Same as under the MOX Fuel Alternative.
	Radioactive Material and Waste Shipments from Operations at SRS and LANL				
	Shipments – 3,300 *Incident-free* - Crew LCFs – 0 (0.1) - Population LCFs – 0 (0.09) *Accidents* - Population LCF risk – 0 (0.00007) - Traffic fatalities – 0 (0.4)	Shipments – 4,300 to 4,800 *Incident-free* - Crew LCFs – 0 (0.2) - Population LCFs – 0 (0.1) *Accidents* - Population LCF risk – 0 (0.00007 to 0.00009) - Traffic fatalities –1 (0.5)	Shipments – 4,100 to 4,800 *Incident-free* - Crew LCFs – 0 (0.1 to 0.2) - Population LCFs – 0 (0.09 to 0.1) *Accidents* - Population LCF risk – 0 (0.00009 to 0.0001) - Traffic fatalities –1 (0.5 to 0.6)	Shipments – 3,900 to 4,400 *Incident-free* - Crew LCFs – 0 (0.1 to 0.2) - Population LCFs – 0 (0.09 to 0.1) *Accidents* - Population LCF risk – 0 (0.00008 to 0.0001) - Traffic fatalities – 0 to 1 (0.4 to 0.5)	Shipments – 4,400 to 5,700 *Incident-free* - Crew LCFs – 0 (0.2) - Population LCFs – 0 (0.1) *Accidents* - Population LCF risk – 0 (0.00008 to 0.0001) - Traffic fatalities – 1 (0.5 to 0.7)
	SRS and LANL Operations Including Fresh MOX Fuel Shipments to BFN and SQN				
	Not applicable; no shipments to the Browns Ferry or Sequoyah Nuclear Plants are planned under the No Action Alternative.	Shipments – 6,400 to 6,900 *Incident-free* - Crew LCFs – 0 (0.2) - Population LCFs – 0 (0.1) *Accidents* - Population LCF risk – 0 (0.00007 to 0.00009) - Traffic fatalities – 1 (0.5 to 0.6)	Shipments –7,000 to 7,700 *Incident-free* - Crew LCFs – 0 (0.2) - Population LCFs – 0 (0.1) *Accidents* - Population LCF risk – 0 (0.00009 to 0.0001) - Traffic fatalities – 1 (0.5 to 0.6)	Shipments – 6,500 to 7,000 *Incident-Free* - Crew LCFs – 0 (0.1 to 0.2) - Population LCFs – 0 (0.1) *Accidents* - Population LCF risk – 0 (0.00008 to 0.0001) - Traffic fatalities – 1 (0.5)	Shipments – 7,000 to 8,300 *Incident-Free* - Crew LCFs – 0 (0.2) - Population LCFs – 0 (0.1 to 0.2) *Accidents* - Population LCF risk – 0 (0.00008 to 0.0001) - Traffic fatalities – 1 (0.6 to 0.7)
	SRS and LANL Operations Including Fresh MOX Fuel Shipments to a Generic Reactor				
	Shipments – 6,700 *Incident-Free* - Crew LCFs – 0 (0.2) - Population LCFs – 0 (0.3) *Accidents* - Population LCF risk – 0 (0.00007) - Traffic fatalities – 1 (0.7)	Shipments – 7,700 to 8,200 *Incident-Free* - Crew LCFs – 0 (0.2 to 0.3) - Population LCFs – 0 (0.3) *Accidents* - Population LCF risk – 0 (0.00007 to 0.00009) - Traffic fatalities – 1 (0.8)	Shipments – 8,600 to 9,300 *Incident-Free* - Crew LCFs – 0 (0.3) - Population LCFs – 0 (0.3) *Accidents* - Population LCF risk – 0 (0.00009 to 0.0001) - Traffic fatalities – 1 (0.9 to 1)	Shipments – 8,000 to 8,500 *Incident-Free* - Crew LCFs – 0 (0.2 to 0.3) - Population LCFs – 0 (0.3) *Accidents* - Population LCF risk – 0 (0.00008 to 0.0001) - Traffic fatalities – 1 (0.8 to 0.9)	Shipments – 8,500 to 9,800 *Incident-Free* - Crew LCFs – 0 (0.3) - Population LCFs – 0 (0.3) *Accidents* - Population LCF risk – 0 (0.00008 to 0.0001) - Traffic fatalities – 1 (0.9 to 1)

Resource Area	Alternative				
	No Action	***Immobilization to DWPF***	***MOX Fuel***	***H-Canyon/HB-Line to DWPF***	***WIPP***
Environmental Justice	***Construction***				
	No disproportionately high and adverse impacts on minority or low-income populations are expected.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
	Operations				
	No disproportionately high and adverse impacts on minority or low-income populations are expected.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Land and Visual Resources	***Construction***				
	- No exterior construction or land disturbance at E-, H-, or S-Areas at SRS is expected. - PDCF would require 50 acres adjacent to built-up portions of F-Area at SRS. - Minimal impacts on land use and no change in the Visual Resource Management Class IV designation are expected.	- Impacts within E-, F-, H-, and S-Areas at SRS would be similar to those described under the No Action Alternative. - Immobilization capability would require 2 acres of previously disturbed land within the built-up portion of K-Area at SRS. - Modifications at LANL would require up to 2 acres of land in TA-55. - Minimal impacts on land use and no change in the Visual Resource Management Class IV designation are expected.	- Impacts within E-, F-, H-, and S-Areas at SRS would be similar to those described under the No Action Alternative. - PDC would require up to 30 acres of land within K-Area at SRS. - Impacts at LANL would be the same as under the Immobilization to DWPF Alternative. - Minimal impacts on land use and no change in the Visual Resource Management Class IV designation are expected.	Same as under the MOX Fuel Alternative.	Same as under the MOX Fuel Alternative.
	Operations				
	- No additional impact on land use at E-, H-, K-, and S-Areas at SRS is expected. - PDCF would occupy less than 23 acres of previously unoccupied land within F-Area at SRS. - No additional impact on land use at LANL is expected. - Minimal impacts on land use and no change in the Visual Resource Management Class IV designation are expected.	Same as under the No Action Alternative.	- Same as under the No Action Alternative, except that optional operation of PDC would require up to 18 acres of land within K-Area at SRS. - Impacts at LANL would be the same as under the No Action Alternative. - Minimal impacts on land use and no change in the Visual Resource Management Class IV designation are expected.	Same as under the MOX Fuel Alternative.	Same as under the MOX Fuel Alternative.

Resource Area	***Alternative***				
	No Action	***Immobilization to DWPF***	***MOX Fuel***	***H-Canyon/HB-Line to DWPF***	***WIPP***
Geology and Soils	***Construction***				
	- SRS crushed stone, sand, and gravel – 190,000 tons - SRS soil – 130,000 cubic yards - Total quantities of geologic materials would be small percentages of regionally plentiful resources. - BMPs would be used to limit soil erosion at construction sites. Therefore, adverse impacts on geology and soils are not likely.	- SRS crushed stone, sand, and gravel – 1,200 to 190,000 tons - SRS soil – 9,500 to 140,000 cubic yards - LANL requirements for crushed stone and soil would be minimal. - Total quantities of geologic materials would be small percentages of regionally plentiful resources. - BMPs would be used to limit soil erosion at construction sites. Therefore, adverse impacts on geology and soils are not likely.	- SRS crushed stone, sand, and gravel – minimal to 530,000 tons - SRS soil – minimal to 130,000 cubic yards. - LANL requirements for crushed stone and soil would be minimal. - Total quantities of geologic materials would be small percentages of regionally plentiful resources. - BMPs would be used to limit soil erosion at construction sites. Therefore, adverse impacts on geology and soils are not likely.	Same as under the MOX Fuel Alternative.	Same as under the MOX Fuel Alternative.
	Operations				
	Because there would be no ground disturbance and little or no use of geologic and soils materials at SRS or LANL, no impacts on geology and soils are expected.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Water Resources	***Construction***				
	Surface Water: Impacts on SRS surface water are expected to be minimal. Construction wastewater would be collected, temporarily stored, treated, and/or disposed of as required by SCDHEC regulations. Potential impacts from stormwater discharges during construction would be mitigated by compliance with the Storm Water Pollution Prevention Plan. *Groundwater*: Impacts on SRS groundwater are expected to be minimal. Groundwater use for facility construction would be well within available SRS capacity.	SRS impacts would be the same as under the No Action Alternative. *Surface Water*: Impacts on LANL surface water are expected to be minimal. Construction wastewater would be collected, temporarily stored, treated, and/or disposed of as required by NMED regulations. Potential impacts from stormwater discharges during construction would be mitigated by compliance with the Storm Water Pollution Prevention Plan. *Groundwater*: Impacts on LANL groundwater are expected to be minimal. Groundwater use for facility construction would be well within available LANL capacity.	Same as under the Immobilization to DWPF Alternative.	Same as under the Immobilization to DWPF Alternative.	Same as under the Immobilization to DWPF Alternative.

Resource Area	Alternative				
	No Action	***Immobilization to DWPF***	***MOX Fuel***	***H-Canyon/HB-Line to DWPF***	***WIPP***
Water Resources (cont'd)	***Operations***				
	Surface Water: Impacts on SRS and LANL surface water are expected to be minimal. Nonhazardous facility wastewater, stormwater runoff, and other industrial waste streams would be managed and disposed of in compliance with the National Pollutant Discharge Elimination System permit limits and requirements. *Groundwater*: Impacts on groundwater are expected to be minimal. Groundwater use for facility operations would be well within available SRS or LANL capacity.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Noise	***Construction***				
	Impacts from SRS onsite noise sources would be small and construction traffic noise impacts would be unlikely to result in increased annoyance to the public.	Impacts at SRS would be similar to those under the No Action Alternative. Impacts from LANL onsite noise sources would be small and construction traffic noise impacts would be unlikely to result in increased annoyance to the public.	Same as under the Immobilization to DWPF Alternative.	Same as under the Immobilization to DWPF Alternative.	Same as under the Immobilization to DWPF Alternative.
	Operations				
	- Noise from operational activities is not expected to result in increased annoyance to the public. - Noise from traffic associated with the operation of facilities is expected to increase by less than 1 decibel at SRS as a result of the increase in staffing and would remain unchanged at LANL. - Noise would be unlikely to affect federally listed threatened or endangered species or their critical habitats.	Same as under the No Action Alternative, except for slight additional traffic noise at LANL due to an increase in staffing.	Same as under the Immobilization to DWPF Alternative.	Same as under the Immobilization to DWPF Alternative.	Same as under the Immobilization to DWPF Alternative.

Resource Area	Alternative				
	No Action	Immobilization to DWPF	MOX Fuel	H-Canyon/HB-Line to DWPF	WIPP
Ecological Resources	***Construction***				
	Land disturbed at SRS for PDCF construction was already disturbed during clearing for MFFF. No threatened or endangered species would be affected. Therefore, no major additional impacts are expected.	SRS impacts would be the same as under the No Action Alternative, except that previously disturbed land at K-Area would be used for construction of supporting structures for the immobilization capability. No major impacts are expected. Modification of PF-4 at LANL could result in temporarily disturbance of up to 2 acres of land; the preference would be to avoid previously undisturbed land in TA-55. No threatened or endangered species would be affected. Therefore, no major additional impacts are expected.	Impacts at SRS would be the same as under the No Action Alternative, except that previously disturbed land at K-Area would be used for construction of supporting structures for optional construction of PDC including 5 acres of previously undisturbed land. No major impacts are expected. LANL impacts would be the same as under the Immobilization to DWPF Alternative.	Same as under the MOX Fuel Alternative.	Same as under the MOX Fuel Alternative.
	Operations				
	No additional impacts are expected to result from operational activities at SRS or LANL.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Cultural Resources	***Construction***				
	- SRS Prehistoric Resources – No construction would be done in undisturbed areas; therefore, no impacts would occur within E-, K-, and S-Areas. Two NRHP-eligible sites at F-Area would be avoided. - SRS Historic Resources – No impacts would occur on NRHP-eligible sites within E-, F-, and S-Areas. - SRS American Indian Resources – No disturbance of American Indian resources would occur. - SRS Paleontological Resources – No disturbance of paleontological resources would occur.	- SRS Historic Resources – Impacts would be the same as under the No Action Alternative, except for several NRHP-eligible structures in K-Area. Work to install an immobilization capability in K-Area, or to modify NRHP-eligible H-Canyon would require consultation with the State Historic Preservation Office. - Other SRS resource impacts would be the same as under the No Action Alternative. - LANL Cultural Resources – Ground disturbance associated with installing temporary trailers will require the use of LANL's formal Permit Requirements Identification process to make sure all permits are in place and no cultural or natural resources are impacted.	- SRS Historic Resources – Impacts would be the same as under the No Action Alternative, except that construction of PDC within K-Area modification of the NRHP-eligible H-Canyon would require consultation with the State Historic Preservation Office. - LANL cultural resource impacts would be the same as under the Immobilization to DWPF Alternative.	Same as under the MOX Fuel Alternative.	Same as under the MOX Fuel Alternative.
	Operations				
	No impacts on cultural resources at SRS or LANL are expected.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Same as under the No Action Alternative.

Resource Area	Alternative				
	No Action	***Immobilization to DWPF***	***MOX Fuel***	***H-Canyon/HB-Line to DWPF***	***WIPP***
Infrastructure (per year)	***Construction***				
	- SRS Electricity (megawatt-hours) – 15,000 - SRS Fuel (gallons) – 390,000 - SRS Water (gallons) – 2.6 million Utility usage would remain well within SRS's available capacities.	- SRS Electricity (megawatt-hours) – 9,000 to 24,000 - SRS Fuel (gallons) – 5,000 to 400,000 - SRS Water (gallons) – 2,000 to 2.6 million Utility usage would remain well within SRS's available capacities. - LANL Electricity (megawatt-hours) – 0 to 80 - LANL Fuel (gallons) – 0 to 2,800 - LANL Water (gallons) – 0 to 340,000 Utility usage would remain within LANL's available capacities.	- SRS Electricity (megawatt-hours) – minimal to 15,000 - SRS Fuel (gallons) – minimal to 390,000 - SRS Water (gallons) – minimal to 2.6 million Utility usage would remain well within SRS's available capacities. LANL infrastructure requirements would be the same as under the Immobilization to DWPF Alternative.	Same as under the MOX Fuel Alternative.	Same as under the MOX Fuel Alternative.
	Operations				
	- SRS Electricity (megawatt-hours) – 270,000 - SRS Fuel (gallons) – 320,000 - SRS Water (gallons) – 41 million Utility usage would remain well within SRS's available capacities. - LANL Electricity (megawatt-hours – 960 - LANL Fuel (gallons) – No additional - LANL Water (gallons) – 480,000 Utility usage would remain well within LANL's available capacities.	- SRS Electricity (megawatt-hours) – 220,000 to 310,000 - SRS Fuel (gallons) – 300,000 to 340,000 - SRS Water (gallons) – 42 million to 58 million Utility usage would remain well within SRS's available capacities. - LANL Electricity (megawatt-hours) – 960 to 1,900 - LANL Fuel (gallons) – No additional - LANL Water (gallons) – 480,000 to 1,200,000 Utility usage would remain well within LANL's available capacities.	- SRS Electricity (megawatt-hours) – 170,000 to 270,000 - SRS Fuel (gallons) – 280,000 to 450,000 - SRS Water (gallons) – 25 million to 41 million Utility usage would remain well within SRS's available capacities. LANL infrastructure requirements would be the same as under the Immobilization to DWPF Alternative.	Same as under the MOX Fuel Alternative.	Same as under the MOX Fuel Alternative.

BFN = Browns Ferry Nuclear Plant; BMPs = best management practices; DWPF = Defense Waste Processing Facility; LANL = Los Alamos National Laboratory; LCF = latent cancer fatality; LLW = low-level radioactive waste; MEI = maximally exposed (offsite) individual; MFFF = Mixed Oxide Fuel Fabrication Facility; MLLW = mixed low-level radioactive waste; MOX = mixed oxide; NMED = New Mexico Environment Department; NRHP = National Register of Historic Places; PDC = Pit Disassembly and Conversion Project; PDCF = Pit Disassembly and Conversion Facility; PF-4 = Plutonium Facility; SCDHEC = South Carolina Department of Health and Environmental Control; SQN = Sequoyah Nuclear Plant; SRS = Savannah River Site; TA-55 = Technical Area 55; TRU = transuranic; WIPP = Waste Isolation Pilot Plant.

Notes: To convert miles to kilometers, multiply by 1.6093; cubic meters (solid) to cubic yards, multiply by 1.3079; cubic meters (liquid) to cubic feet, multiply by 35.314; liters to gallons, multiply by 0.26418; acres to hectares, multiply by 0.40469.

S.11.2 Summary of Cumulative Impacts

Council on Environmental Quality regulations (40 CFR Parts 1500-1508) define cumulative impacts as effects on the environment that result from implementing any of the action alternatives when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions (40 CFR 1508.7). Thus, the cumulative impacts of an action can be viewed as the total effects on a resource, ecosystem, or human community of that action and all other activities affecting that resource irrespective of the proponent.

A cumulative impact analysis was conducted to determine those resource areas that have the greatest potential for cumulative impacts including the proposed surplus plutonium disposition activities at SRS and LANL. Based on an analysis of the impacts presented in this *SPD Supplemental EIS*, these resource areas were considered to be land use, air quality, human health, socioeconomics, infrastructure, waste management, transportation, and environmental justice.

Land Use. Cumulative land use at SRS could occupy 10,567 to 10,617 acres (4,276 to 4,297 hectares) of land. Cumulative land use would be generally compatible with existing land use plans and allowable uses of the site and would involve up to 5.4 percent of the 198,344 acres (80,268 hectares) encompassing SRS. Activities proposed under the *SPD Supplemental EIS* alternatives would disturb a maximum of 52 acres (21 hectares) of land, or approximately 0.03 percent of available SRS land, and would not contribute substantially to cumulative impacts. Existing activities currently occupy approximately 9,900 acres (4,000 hectares) of SRS land.

Modification of PF-4 would not contribute to LANL cumulative impacts, as less than 2 acres (0.8 hectares) of land would be disturbed.

Air Quality. Effects on air quality from construction, excavation, and remediation activities at SRS could result in temporary increases in air pollutant concentrations at the site boundary and along roads to which the public has access. These impacts would be similar to the impacts that would occur during construction of a similarly sized housing development or a commercial project. Emissions of fugitive dust from these activities would be controlled using water sprays and other engineering and management practices, as appropriate. The maximum ground-level concentrations off site and along roads to which the public has regular access would be below ambient air quality standards. Because earthmoving activities related to the actions considered in this cumulative impacts analysis would occur at different times and locations, air quality impacts are not likely to be cumulative.

DOE expects that replacing the boilers in D-, K-, and L-Areas with new biomass-fired cogeneration and heating facilities would decrease overall annual air pollutant emissions rates for particulate matter by about 360 metric tons (400 tons), nitrogen oxides by about 2,300 metric tons (2,500 tons), and sulfur dioxide by about 4,500 metric tons (5,000 tons). Annual emissions of carbon monoxide would increase by about 180 metric tons (200 tons) and volatile organic compounds by about 25 metric tons (28 tons) (DOE 2008e).

The cumulative maximum concentrations of nonradiological air pollutants from operation of all SRS facilities at the site boundary would meet regulatory standards. It is unlikely that actual concentrations would be as high as those projected for existing activities at SRS because the values for existing activities are based on maximum permitted allowable emissions and not on actual emissions. In general, the contribution from *SPD Supplemental EIS* alternatives would be less than significant impact levels, except for nitrogen dioxide 1-hour contributions for all alternatives and $PM_{2.5}$ and sulfur dioxide short-term contributions for some alternatives.

Because of the small amount of land (2 acres [0.8 hectares]) that could be disturbed during modifications at PF-4, LANL cumulative impacts associated with construction are not expected to change. There would be no increase in emissions of criteria or nonradioactive toxic air pollutants from operation of PF-4; therefore, it would not contribute to cumulative impacts.

Human Health. Radiological health effects are estimated in terms of radiological dose and excess LCF risk for the offsite population, hypothetical MEI, and radiological workers. The maximum cumulative regional population dose is estimated to be 25 person-rem per year (including impacts from SRS and the Vogtle Electric Generating Plant). This population dose is expected to result in no LCFs. Activities proposed under the *SPD Supplemental EIS* alternatives could result in annual doses of 0.54 to 0.97 person-rem and no LCFs.

The maximum cumulative dose to the SRS MEI is estimated to be 0.44 millirem per year, well below applicable DOE regulatory limits (i.e., 10 millirem per year from the air pathway, 4 millirem per year from the liquid pathway, and 100 millirem per year for all pathways).[25] This MEI dose does not include contributions from the Vogtle Electric Generating Plant because the distance between the two sites precludes the same receptor receiving both doses.

The maximum cumulative annual SRS worker dose could total 540 to 860 person-rem, resulting in 0 to 1 LCFs. Activities proposed under the *SPD Supplemental EIS* alternatives could produce annual worker doses of 300 to 620 person-rem, resulting in no LCFs. ALARA principles would be implemented to maintain individual worker doses below the Administrative Control Level required by DOE regulations (10 CFR 835.1002), set at 2,000 millirem per year.

The maximum cumulative population dose is estimated to be 38 person-rem per year for the population living within a 50-mile (80-kilometer) radius of LANL. This population dose is not expected to result in any LCFs. Activities proposed under the *SPD Supplemental EIS* alternatives could result in an annual dose of up to 0.21 person-rem and no LCFs.

The maximum cumulative dose to the LANL MEI is estimated to be 8.6 millirem per year, which is below the applicable DOE limit for air emissions (the only viable pathway). This is a very conservative estimate of potential dose to an MEI because the activities contributing to this dose are not likely to occur at the same time and location.

The maximum cumulative annual LANL worker dose could total 570 to 740 person-rem; no LCFs are expected as a result of these doses. Activities proposed under the *SPD Supplemental EIS* alternatives could produce annual worker doses of 29 to 190 person-rem, resulting in no LCFs. ALARA principles would be implemented to maintain individual worker doses below the Administrative Control Level required by DOE regulations (10 CFR 835.1002), set at 2,000 millirem per year.

Socioeconomics. Cumulative employment at SRS could reach 9,000 to 9,900 persons under the alternatives being considered in this *SPD Supplemental EIS*. These values are conservative estimates of short-term future employment at SRS. Some of the employment would occur at different times and the numbers may not be additive. Future employment due to surplus plutonium disposition activities could reduce the adverse socioeconomic effects of a recent SRS workforce reduction of approximately 1,240 workers (Pavey 2011). Activities proposed under the *SPD Supplemental EIS* alternatives could produce direct employment of about 1,200 (under the H-Canyon/HB-Line to DWPF Alternative with the PF-4 and MFFF Option for pit disassembly and conversion) to about 2,100 (under the Immobilization to DWPF Alternative with the PDCF Option for pit disassembly and conversion). By comparison, approximately 215,000 people are employed in the ROI. In the ROI, in addition to direct jobs, an estimated 2,500 indirect jobs could be created. Anticipated fluctuations in ROI employment from activities at SRS are unlikely to greatly stress housing and community services in the ROI.

In addition to activities at SRS, construction of the Vogtle Electric Generating Plant Units 3 and 4 is estimated to result in peak construction employment of up to 4,300 workers. An in-migration of 2,500 construction workers is estimated to support construction activities. Although the Vogtle Electric Generating Plant is located outside the SRS ROI in nearby Burke County, Georgia, the socioeconomic impacts associated with activity at the Vogtle Electric Generating Plant would affect conditions in Richmond and Columbia Counties in Georgia, which are included in the SRS ROI. Both adverse and

[25] *As derived from DOE Order 458.1,* Radiation Protection of the Public and the Environment.

beneficial socioeconomic impacts are anticipated from construction at the Vogtle Electric Generating Plant. The impacts in both scenarios are estimated to be small to moderate (NRC 2011).

If higher levels of pit disassembly and conversion were performed at PF-4 under any of the action alternatives, there would be an increase of approximately 253 LANL employees. This additional employment would result in no change in the cumulative socioeconomic conditions of the LANL ROI, but would help to offset workforce reductions currently being pursued at LANL. The number of LANL employees supporting pit disassembly operations at PF-4 would represent a small fraction of the LANL workforce (approximately 13,500 in 2010) and an even smaller fraction of the regional workforce (approximately 163,000 in 2011). However, future employment due to surplus plutonium disposition activities at LANL could reduce the adverse socioeconomic effects of an expected workforce reduction of up to 800 workers (LANL 2012b). In the LANL ROI, in addition to direct jobs, an estimated 256 indirect jobs could be created if higher levels of pit disassembly and conversion were performed in PF-4. Any fluctuations in ROI employment are unlikely to greatly stress housing and community services in the ROI.

Infrastructure. Including activities proposed in this *SPD Supplemental EIS*, projected SRS site activities would annually require approximately 460,000 to 600,000 megawatt-hours of electricity and 380 million to 410 million gallons (1.4 billion to 1.6 billion liters) of water. SRS would remain well within its capacity to deliver electricity and water.

Including activities proposed in this *SPD Supplemental EIS*, projected LANL and Los Alamos County activities would annually require approximately 880,000 megawatt-hours of electricity and 1.7 billion gallons (6.3 billion liters) of water. LANL would remain within its capacity to deliver electricity and water.

Waste Management. TRU waste, LLW, MLLW, hazardous waste, and solid nonhazardous waste are expected to see increased generation rates under all alternatives. No additional HLW would be generated under any of the alternatives. Under the H-Canyon/HB-Line to DWPF Alternative, however, some surplus plutonium materials would be dissolved at H-Canyon/HB-Line, mixed with HLW, and vitrified at DWPF. Because the dissolved plutonium would displace some of the HLW feed to DWPF, implementation of the H-Canyon/HB-Line to DWPF Alternative could result in generation of up to 48 additional canisters containing vitrified HLW. Under the Immobilization to DWPF Alternative, approximately 95 additional canisters containing vitrified HLW could be produced at DWPF. DOE would store canisters of vitrified HLW at GWSBs pending their offsite disposition.

Approximately 19,700 cubic meters (696,000 cubic feet) of unsubscribed disposal capacity for contact-handled TRU waste remains at WIPP. Depending on the alternative, the cumulative volume of TRU waste that could be produced at SRS and LANL, including the proposed surplus plutonium disposition activities, would represent 30 to 88 percent of the unsubscribed capacity. Since the TRU waste projections from baseline activities at SRS and LANL are already included in subscribed estimates for these sites, implementation of surplus plutonium disposition would leave approximately 2,700 cubic meters (95,000 cubic feet) to 13,700 cubic meters (480,000 cubic feet) of unsubscribed capacity at WIPP to support other activities. Under the MOX Fuel and WIPP Alternatives, less TRU waste would be generated, representing a smaller percentage of the unsubscribed WIPP disposal capacity, if the portion of non-pit plutonium inventory that is unirradiated FFTF fuel were shipped as waste directly to WIPP, and if criticality control containers were used for packaging surplus plutonium for WIPP disposal rather than the assumed POCs.[26] Future decisions about the disposal of any significant quantities of TRU waste would be made in the context of the needs of the entire DOE complex.

[26] *If both options were implemented, the cumulative TRU waste volume under the MOX Fuel Alternative would drop from a maximum of 63 percent of the unsubscribed WIPP disposal capacity (assuming 2 metric tons [2.2 tons] of surplus plutonium are disposed of at WIPP) to approximately 53 percent. The cumulative TRU waste volume under the WIPP Alternative would drop from 88 percent of the unsubscribed WIPP disposal capacity to approximately 63 percent.*

LLW generated at SRS and LANL would be disposed of on site in a low-activity waste vault or engineered trench or transported off site to commercial disposal facilities or the Nevada National Security Site. MLLW would be temporarily stored at permitted SRS and LANL storage facilities and transported to offsite treatment, storage, and disposal facilities. Consistent with current practices, hazardous wastes would continue to be transported to offsite treatment, storage, and disposal facilities. Solid nonhazardous waste from SRS and LANL would continue to be disposed of at onsite and offsite landfills, consistent with current practices.

Transportation. The impacts from transportation in this *SPD Supplemental EIS* are quite small compared with overall cumulative transportation impacts. The collective worker dose from all types of shipments (including those under the alternatives in this *SPD Supplemental EIS*, historical shipments, reasonably foreseeable actions, and general transportation) was estimated to be about 420,000 person-rem (resulting in 252 LCFs) for the period 1943 through 2073 (131 years). The general population collective dose was estimated to be about 436,000 person-rem (resulting in 262 LCFs). Worker doses under *SPD Supplemental EIS* alternatives would be about 240 to 560 person-rem (no [0.1 and 0.3] LCFs). General population doses under the *SPD Supplemental EIS* alternatives would be about 180 to 580 person-rem (no [0.1 and 0.3] LCFs). To place these numbers in perspective, the National Center for Health Statistics indicates that the annual average number of cancer deaths in the United States from 1999 through 2008 was about 560,000, with less than a 1 percent fluctuation in the number of deaths in any given year (CDC 2012). The total number of LCFs (among the workers and general population) estimated to result from radioactive material transportation over the period between 1943 and 2073 is 514, or an average of about 4 LCFs per year. The transportation-related LCFs would represent about 0.0007 percent of the overall annual number of cancer deaths. The majority of the cumulative risks to workers and the general population would be due to the general transportation of radioactive material unrelated to activities evaluated in this *SPD Supplemental EIS*.

Environmental Justice. Cumulative environmental justice impacts occur when the net effect of regional projects or activities results in disproportionately high and adverse human health and environmental effects on minority or low-income populations. As discussed in Chapter 4, Section 4.1.6, of this *SPD Supplemental EIS*, an analysis of the potential environmental impacts associated with the proposed surplus plutonium disposition activities at SRS and LANL was performed for both minority and low-income populations as well as nonminority and non-low-income populations concluded that no disproportionately high and adverse human health and environmental effects would be incurred by minority or low-income populations as a result of implementing any of the alternatives under consideration in this *SPD Supplemental EIS.* Section 4.5.3.8, of this *SPD Supplemental EIS,* evaluated the cumulative impacts of additional activities in the areas surrounding SRS and LANL and reached the same conclusion.

S.12 Organization of the *Surplus Plutonium Disposition Supplemental Environmental Impact Statement*

This *SPD Supplemental EIS* consists of Chapters 1 through 10 and Appendices A through K. Chapter 1 describes the purpose and need for agency action; introduces the proposed action; summarizes the scoping process; describes the amounts of plutonium addressed; provides a description of related NEPA documents; and describes decisions to be made. Surplus plutonium disposition alternatives, as well as the materials, processes, and facilities that would be used to implement the alternatives, are described in Chapter 2. Chapter 2 also includes a comparison of potential impacts under each of the alternatives. In Chapter 3, the environment at SRS, LANL, and the TVA reactors is described in terms of resource areas or disciplines that establish the baseline for the impact analyses. Chapter 4 provides descriptions of the potential impacts of the alternatives on the resource areas or disciplines. Chapter 4 also includes discussions of deactivation, decontamination, and decommissioning; cumulative impacts; irreversible and irretrievable commitments of resources; the relationship between short-term uses of the environment and long-term productivity; and mitigation. Chapter 5 provides a description of the environmental and health and safety compliance requirements governing implementation of the alternatives, including permits and consultations. Chapters 6, 7, 8, 9, and 10 are the glossary of terms, the list of references, the list of preparers, the distribution list, and the index, respectively. Appendices A through K are the list of applicable *Federal Register* notices; a facilities description; a human health risk analysis for normal operations; a facility accident analysis; a transportation analysis; impacts of pit disassembly and conversion options; impacts of plutonium disposition options; impacts of principal support facilities; impacts of MOX fuel use in domestic commercial nuclear power reactors; evaluation of select reactor accidents with mixed oxide fuel use; and the Contractor Disclosure Statement, respectively.

S.13 Next Steps

DOE is soliciting comments on this *Draft SPD Supplemental EIS* during a 60-day public comment period, during which public hearings will be held to provide interested members of the public with opportunities to learn more about the content of this *Draft SPD Supplemental EIS*, hear DOE representatives present a summary of the results of the EIS analyses, and provide oral and written comments. The project website, http://nnsa.energy.gov/nepa/spdsupplementaleis, provides additional information about this *Draft SPD Supplemental EIS*, public hearings, comment submission, and other pertinent information. Further information on DOE's NEPA program is available on the DOE NEPA website at http://energy.gov/nepa.

Public hearing dates, times, and locations will be announced in the *Federal Register*, in local newspapers, and on the *SPD Supplemental EIS* website (http://nnsa.energy.gov/nepa/spdsupplementaleis). Members of the public who have expressed interest and are on the DOE mailing list for this *Draft SPD Supplemental EIS* will be notified by U.S. mail regarding hearing dates, times, and locations.

A complete copy of this *Draft SPD Supplemental EIS* may be reviewed on the websites listed above and at any of the reading rooms and libraries listed below.

Alabama

Athens-Limestone Public Library
405 East South Street
Athens, AL 35611
(256) 232-1233

Georgia

Asa H. Gordon Library
Savannah State University
2200 Tompkins Road
Savannah, GA 31404
(912) 358-4324

Reese Library
Augusta State University
2500 Walton Way
Augusta, GA 30904
(706) 737-1745

New Mexico

Carlsbad Field Office
U.S. Department of Energy
WIPP Information Center
4021 National Parks Highway
Carlsbad, NM 88220
(575) 234-7348

DOE Public Reading Room
Government Information Department
Zimmerman Library/University of New Mexico
1 University of New Mexico
Albuquerque, NM 87131
(505) 277-7180

Española Public Library
313 N. Paseo de Oñate
Española, NM 87532
(505) 747-6087

Los Alamos National Laboratory Reading Room
94 Cities of Gold Road
Pojoaque, NM 87501
(505) 667-0216

Mesa Public Library
2400 Central Avenue
Los Alamos, NM 87544
(505) 662-8240

New Mexico State Library
1209 Camino Carlos Rey
Santa Fe, NM 87507
(505) 476-9700

Santa Fe Public Library
145 Washington Avenue
Santa Fe, NM 87501
(505) 955-6780

Santa Fe Public Library / Oliver La Farge Branch
1730 Llano Street
Santa Fe, NM 87505
(505) 955-4860

South Carolina

Gregg-Graniteville Library
University of South Carolina-Aiken
471 University Parkway
Aiken, SC 29801
(803) 641-3320

South Carolina State Library
1500 Senate Street
Columbia, SC 29201
(803) 734-8026

Tennessee

Chattanooga Public Library
1001 Broad Street
Chattanooga, TN 37402
(423) 757-5310

Lawson McGhee Public Library
500 W. Church Avenue
Knoxville, TN 37902
(865) 215-8750

Washington, DC

U.S. Department of Energy / Freedom of Information Act Reading Room
1000 Independence Avenue, SW, 1G-033
Washington, DC 20585
(202) 586-5955

When the *Final SPD Supplemental EIS* is published, its availability will be announced in the *Federal Register*, on the websites listed above, in local newspapers, and via U.S. mail. This Summary, as well as the full *SPD Supplemental EIS*, will be sent to those who request it in compact disc or print formats. It also will be available on the *SPD Supplemental EIS* website and for review in public reading rooms. Oral and written comments received during the public comment period will be considered equally in preparing the *Final SPD Supplemental EIS*, and DOE responses will be presented in a comment response document that will be published as part of the final document.

Based on the *Final SPD Supplemental EIS* and other considerations, DOE will announce a decision regarding future actions in a ROD to be issued no sooner than 30 days after the EPA Notice of Availability for the *Final SPD Supplemental EIS* is published. The ROD will describe the alternative selected for implementation and explain how environmental impacts will be avoided, minimized, or mitigated.

To submit written comments or request more information, contact:

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S.14 References

CDC (Centers for Disease Control and Prevention), 2012, Deaths, Percent of Total Deaths, and Death Rates for the 15 Leading Causes of Death in 5-Year Age Groups, by Race and Sex, United States, 1999-2008, National Center for Health Statistics (accessed June 12, 2012, http://www.cdc.gov/nchs/data/dvs/LCWK1_2008.pdf).

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

DOE (U.S. Department of Energy), 1996b, *Final Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components*, DOE/EIS-0225, Albuquerque Operations Office, Albuquerque, New Mexico, September.

DOE (U.S. Department of Energy), 1997, *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement*, DOE/EIS-0026-S-2, Carlsbad Area Office, Carlsbad, New Mexico, September.

DOE (U.S. Department of Energy), 1998, *Pit Disassembly and Conversion Demonstration Environmental Assessment and Research and Development Activities*, DOE/EA-1207, Office of Fissile Materials Disposition. Washington, DC, August.

DOE (U.S. Department of Energy), 1999, *Surplus Plutonium Disposition Final Environmental Impact Statement*, DOE/EIS-0283, Office of Fissile Materials Disposition, Washington, DC, November.

DOE (U.S. Department of Energy), 2002, *Supplement Analysis for Storage of Surplus Plutonium Materials in the K-Area Material Storage Facility at the Savannah River Site*, DOE/EIS-0229-SA-2, Office of Environmental Management, Washington, DC, February.

DOE (U.S. Department of Energy), 2003a, *Supplement Analysis and Amended Record of Decision for Changes Needed to the Surplus Plutonium Disposition Program*, DOE/EIS-0283-SA1, Office of Fissile Materials Disposition, Washington, DC, April.

DOE (U.S. Department of Energy), 2003b, "Recommended Radiation Risk Factors Updated," *National Environmental Policy Act Lessons Learned Quarterly Report*, Issue No. 34, First Quarter FY 2003, p. 9, March 3.

DOE (U.S. Department of Energy), 2007a, *Supplement Analysis, Storage of Surplus Plutonium Materials at the Savannah River Site*, DOE/EIS-0229-SA-4, Office of Environmental Management, Washington, DC, September 5.

DOE (U.S. Department of Energy), 2007b, *Plan for Alternative Disposition of Defense Plutonium and Defense Plutonium Materials That Were Destined for the Cancelled Plutonium Immobilization Plant*, Washington, DC, August.

DOE (U.S. Department of Energy), 2008a, *Interim Action Determination, Processing of Plutonium Materials from the DOE Standard 3013 Surveillance Program in H-Canyon at the Savannah River Site*, Savannah River Operations Office, Aiken, South Carolina, December 8.

DOE (U.S. Department of Energy), 2008b, *Final Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico*, DOE/EIS-0380, National Nuclear Security Administration, Los Alamos Site Office, Los Alamos, New Mexico, May.

DOE (U.S. Department of Energy), 2008c, *Plutonium Disposition Alternatives Analysis, Document No. Y-AES-G-00001*, Predecisional Draft, Rev. 1, Savannah River Site, Aiken, South Carolina, March. OFFICIAL USE ONLY

DOE (U.S. Department of Energy), 2008d, *Annual Transuranic Waste Inventory Report – 2007,* DOE/TRU-2008-3379, Rev. 1, Carlsbad Field Office, Carlsbad, New Mexico.

DOE (U.S. Department of Energy), 2008e, *Environmental Assessment for Biomass Cogeneration and Heating Facilities at the Savannah River Site*, DOE/EA-1605, Savannah River Operations Office, Aiken, South Carolina, August.

DOE (U.S. Department of Energy), 2009, *Interim Action Determination, Processing of Plutonium Materials in H-Canyon at the Savannah River Site*, Savannah River Operations Office, Aiken, South Carolina, September 25.

DOE (U.S. Department of Energy), 2010, *Environmental Assessment for the U.S. Receipt and Storage of Gap Material – Plutonium and Finding of No Significant Impact, DOE/EA-1771,* National Nuclear Security Administration, Washington, DC, May. OFFICIAL USE ONLY

DOE (U.S. Department of Energy), 2011a, *Amended Interim Action Determination, Disposition of Plutonium Materials from the Department of Energy (DOE) Standard 3013 Surveillance Program at the Savannah River Site,* Savannah River Operations Office, Aiken, South Carolina, March 30.

DOE (U.S. Department of Energy), 2011b, *Interim Action Determination, Disposition of Certain Plutonium Materials Stored at the Savannah River Site*, Savannah River Operations Office, Aiken, South Carolina, October 17.

DOE (U.S. Department of Energy), 2011c, *Final Supplemental Environmental Impact Statement for the Nuclear Facility Portion of the Chemistry and Metallurgy Research Building Replacement Project at Los Alamos National Laboratory, Los Alamos, New Mexico*, DOE/EIS-0350-S1, National Nuclear Security Administration, Los Alamos Site Office, Los Alamos, New Mexico, August.

DOE (U.S. Department of Energy), 2011d, *Annual Transuranic Waste Inventory Report – 2011*, DOE/TRU-11-3425, Rev. 0, Carlsbad Field Office, Carlsbad, New Mexico, November.

DOE (U.S. Department of Energy), 2012a, *Interim Action Determination, Use of H-Canyon/HB-Line to Prepare Feed for the Mixed Oxide Fuel Fabrication Facility at the Savannah River Site*, Savannah River Operations Office, Aiken, South Carolina, June 26.

DOE (U.S. Department of Energy), 2012b, DOE Standard, *Stabilization, Packaging, and Storage of Plutonium-Bearing Materials*, DOE-STD-3013-2012, Washington, DC, March.

EPA (U.S. Environmental Protection Agency), 2012, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2010*, Washington, DC, April 15.

LANL (Los Alamos National Laboratory), 2012a, *Surplus Plutonium Disposition Supplemental Environmental Impact Statement* Data Call Response.

LANL (Los Alamos National Laboratory), 2012b, LANL announces plans for workforce reduction, Los Alamos News Center (http://wwwl.lanl.gov.news/releases/lanl_annouonces_plans_for_workforce).

MPR (MPR Associates, Inc.), 2011, *Pit Disassembly and Conversion Project-Evaluation of Alternatives*, MPR-3651, Rev 0, November.

NRC (U.S. Nuclear Regulatory Commission), 2011, *Issued Early Site Permit – Vogtle* (accessed June 1, 2011, http://www.nrc.gov/reactors/new-reactors/esp/vogtle.html).

Pavey, R., 2011, The Augusta Chronicle, Augusta Economy, *SRS layoffs total 184 as SRNS president resigns* (http://chronicle.augusta.com/news/metro/2011-09-01/srs-layoffs-total-184-srns-president-resigns), September 1.

SRR (Savannah River Remediation, LLC), 2010, *Liquid Waste System Plan*, SRR-LWP-2009-00001, Rev. 16, Savannah River Site, Aiken, South Carolina, December.

SRS (Savannah River Site), 2007a, Scope of Work M-SOW-K-00019, Revision 0, for Oxidation System (U), Plutonium Disposition Project (U) Project M09A, March.

SRS (Savannah River Site), 2007b, Scope of Work M-SOW-K-00026, Revision 0, for Green Fuel Disassembly System (U), Plutonium Disposition Project (U) Project M09A, April.

SRS (Savannah River Site), 2007c, Scope of Work M-SOW-K-00013, Revision 0, for Feed Preparation System (U), Plutonium Disposition Project (U) Project M09A, April.

TVA (Tennessee Valley Authority), 2009, *Browns Ferry Nuclear Plant – Updated Final Safety Analysis Report*, Amendment 23, December 4.

TVA (Tennessee Valley Authority), 2010, *Sequoyah Nuclear Power Plant – Updated Final Safety Analysis Report*, Amendment 22, May 24.

TVA (Tennessee Valley Authority), 2012, *Surplus Plutonium Disposition Supplemental Environmental Impact Statement* Data Call Response, Chattanooga, Tennessee.

USA and Russia (United States of America and Russian Federation), 2000, *Agreement Between the Government of the United States and the Government of the Russian Federation Concerning the Management and Disposition of Plutonium Designated as No Longer Required for Defense Purposes and Related Cooperation*, September 1.

WSRC (Washington Savannah River Company), 2008, *Surplus Plutonium Disposition Supplemental Environmental Impact Statement* Data Call Response, Aiken, South Carolina.