CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

4.0 ENVIRONMENTAL CONSEQUENCES

Chapter 4 describes the environmental impacts of the alternatives evaluated in this *Final Surplus Plutonium Disposition Supplemental Environmental Impact Statement*. Each alternative is described in Chapter 2, Section 2.3, and visually depicted in Figures 2–2 through 2–6. Those resource areas having the greatest potential for environmental impacts are discussed in Sections 4.1.1 through 4.1.6: air quality, human health impacts, socioeconomics, waste management, transportation, and environmental justice, respectively. Impacts on remaining resource areas (land resources, geology and soils, water resources, noise, ecological resources, cultural resources, and infrastructure) are addressed in Section 4.1.7. Sections 4.2 and 4.3, respectively, address the potential incremental impacts that could result from processing additional surplus plutonium, and from processing plutonium at reduced rates or from constructing and operating smaller plutonium facilities. Section 4.4 addresses the avoided environmental impacts associated with use of mixed oxide fuel in commercial reactors rather than only low-enriched uranium fuel. Cumulative impacts are addressed in Section 4.5; deactivation, decontamination, and decommissioning in Section 4.6; irreversible and irretrievable commitments of resources in Section 4.7; the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity in Section 4.8; and mitigation in Section 4.9. Environmental consequences under the alternatives are compared in Chapter 2, Section 2.6.

In accordance with the National Environmental Policy Act (NEPA), the U.S. Department of Energy (DOE) has prepared this chapter of this *Final Surplus Plutonium Disposition Supplemental Environmental Impact Statement (SPD Supplemental EIS)* to describe the environmental consequences from the execution of alternatives addressed in this *SPD Supplemental EIS*.

Alternatives and Options. The alternatives addressed in this *SPD Supplemental EIS* are described in Chapter 2, Section 2.3, and represent combinations of options for pit disassembly and conversion (described in Section 2.1) and plutonium disposition (described in Section 2.2). **Figure 4–1** illustrates the relationship of the surplus plutonium disposition alternatives and options, and the presentation of impacts, in this *SPD Supplemental EIS*, while the alternatives and options are summarized in the following text box. As shown in the text box, each alternative comprises one or two plutonium disposition options; and for each alternative, one to four options are analyzed for pit disassembly and conversion.

Each resource area addressed in Section 4.1 contains an assessment of the environmental consequences from implementing a particular mix of pit disassembly and conversion and plutonium disposition options,[1] from operation of principal plutonium support facilities at the Savannah River Site (SRS) and Los Alamos National Laboratory (LANL), and from shipment of mixed oxide (MOX) fuel assemblies to, and their use at, domestic commercial nuclear power reactors. At SRS, the principal plutonium support facilities are the plutonium storage and surveillance capabilities at the K-Area Complex (principally the Material Storage Area [MSA] and the K-Area Interim Surveillance capability [KIS]), the Waste Solidification Building (WSB), and the waste management capability at E-Area. At LANL, the principal plutonium support facility is the waste management capability at Technical Area 54 (TA-54), which is expected to transition to other locations in TA-54 and TA-63. The commercial nuclear power reactors addressed in this *SPD Supplemental EIS* are the Browns Ferry and Sequoyah Nuclear Plants operated by the Tennessee Valley Authority (TVA) near Athens, Alabama, and Soddy-Daisy, Tennessee, respectively; and one or more generic commercial nuclear power reactors that could be located anywhere in the United States. Information about the facilities addressed in this *SPD Supplemental EIS* is provided in Appendix B.

[1] *Additional options are considered in this chapter under the WIPP Alternative for pit plutonium and the MOX Fuel and WIPP Alternatives for non-pit plutonium for disposal of surplus plutonium as contact-handled transuranic (CH-TRU) waste at the Waste Isolation Pilot Plant (WIPP). Under these alternatives, impacts are evaluated assuming that the surplus plutonium would be processed and repackaged into pipe overpack containers (POCs) before shipment to WIPP. Under these additional options, criticality control overpacks, which hold more plutonium than POCs, would be used and unirradiated Fast Flux Test Facility (FFTF) fuel would be shipped to WIPP without first disassembling and repackaging the fuel.*

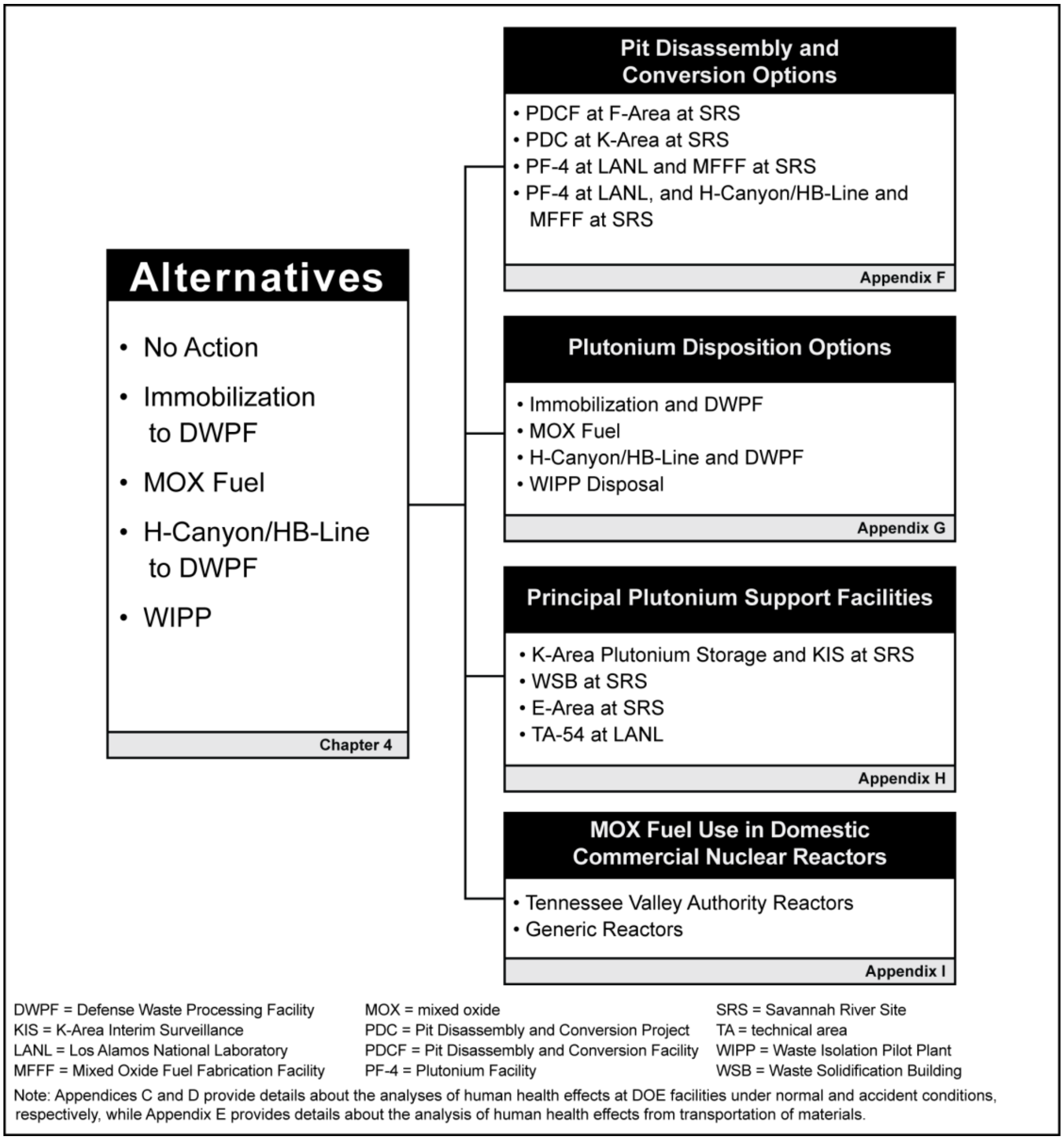

Figure 4–1 Relationship of Surplus Plutonium Disposition Alternatives and Options, and the Presentation of Impacts, in this *Surplus Plutonium Disposition Supplemental Environmental Impact Statement*

This chapter does not address impacts from continued storage of plutonium at the Pantex Plant (Pantex) under the No Action Alternative. Annual impacts from continued pit storage would be small, and these impacts are summarized in Appendix A, Section A.2.1. This chapter also does not address impacts from construction of the Mixed Oxide Fuel Fabrication Facility (MFFF) (other than the proposed installation of metal oxidation furnaces), construction of the principal plutonium support facilities at SRS, or minor upgrades to the Plutonium Facility (PF-4) in TA-55 at LANL to facilitate disassembly and conversion of 2 metric tons (2.2 tons) of pit plutonium. MFFF is already under construction and impacts have been assessed in previous NEPA analyses (DOE 1999b; NRC 2005a). Principal plutonium support facilities at SRS are already operational or are under construction; impacts from facilities under construction have been assessed in previous NEPA analyses (DOE 2008i). The minor upgrades to PF-4 needed to support a 2-metric-ton (2.2-ton) pit disassembly and conversion effort, which is underway, are summarized in Appendix B, Section B.2.1, and have been assessed (DOE 2008f).

Surplus Plutonium Disposition Alternatives		
Alternative	***Pit Disassembly and Conversion Option***	***Plutonium Disposition Option***
No Action	PDCF	MOX Fuel (34 metric tons) [a]
Immobilization to DWPF	PDCF; PF-4 and MFFF; **or** PF-4, HC/HBL, and MFFF	MOX Fuel (34 metric tons) **and** Immobilization and DWPF (13.1 metric tons)
MOX Fuel	PDCF; PDC; PF-4 and MFFF; **or** PF-4, HC/HBL, and MFFF	MOX Fuel (45.1 metric tons) **and** WIPP Disposal (2 metric tons)
HC/HBL to DWPF	PDCF; PDC; PF-4 and MFFF; **or** PF-4, HC/HBL, and MFFF	MOX Fuel (41.1 metric tons) **and** HC/HBL and DWPF (6 metric tons)
WIPP	PDCF; PDC; PF-4 and MFFF; **or** PF-4, HC/HBL, and MFFF	MOX Fuel (34 metric tons) **and** WIPP Disposal (13.1 metric tons)

Pit Disassembly and Conversion and Plutonium Disposition Options	
Pit Disassembly and Conversion	***Plutonium Disposition***
PDCF. Pit disassembly and conversion to plutonium oxide would principally occur at PDCF at F-Area at SRS. Pit disassembly and conversion of 2 metric tons of plutonium would occur at PF-4 at TA-55 at LANL; the plutonium oxide would be shipped to SRS.	***Immobilization and DWPF.*** Plutonium would be immobilized at SRS at a K-Area immobilization capability, and canisters of immobilized plutonium would be filled with vitrified HLW at DWPF at S-Area, and transferred to GWSBs.
PDC. Pit disassembly and conversion to plutonium oxide would principally occur at PDC at K-Area at SRS. As under the PDCF Option, pit disassembly and conversion of 2 metric tons of plutonium would occur at PF-4 at LANL.	***MOX Fuel.*** Plutonium would be fabricated at SRS into MOX fuel at MFFF. MOX fuel would be shipped to and used at commercial nuclear power plants.[b]
PF-4 and MFFF. Pit disassembly would occur at PF-4 at TA-55 at LANL. Disassembled pits would be converted to plutonium oxide and shipped to SRS, or plutonium metal would be shipped to SRS and converted to plutonium oxide at metal oxidation furnaces in MFFF at F-Area.	***HC/HBL and DWPF.*** Non-pit plutonium would be dissolved at SRS HC/HBL and combined with vitrified HLW at DWPF.[c] Canisters containing vitrified HLW and surplus plutonium would be transferred to GWSBs.
PF-4, HC/HBL, and MFFF. Pit disassembly would occur at PF-4 at LANL and at the K-Area Complex at SRS. Pits disassembled at PF-4 would be converted to plutonium oxide and the oxide shipped to SRS, or plutonium metal would be shipped to SRS and converted to plutonium oxide at HC/HBL or in metal oxidation furnaces at MFFF. Pits disassembled at the K-Area Complex would be converted to plutonium oxide at HC/HBL.	***WIPP Disposal.*** Plutonium would be combined with inert material at SRS or LANL, placed within POCs,[d] and staged at SRS or LANL, pending shipment to WIPP near Carlsbad, New Mexico, for disposal as contact-handled TRU waste. All non-pit plutonium would be prepared at SRS for potential WIPP disposal, while under the WIPP Alternative, 7.1 metric tons of pit plutonium would be prepared at SRS or LANL for potential WIPP disposal. Preparation for potential WIPP disposal could occur at HC/HBL or the K-Area Complex at SRS,[e] or at TA-55 at LANL. Staging before shipment to WIPP may occur at E-Area at SRS or at TA-54 or TA-63 at LANL.

DWPF = Defense Waste Processing Facility; GWSB = Glass Waste Storage Building; HC/HBL = H-Canyon/HB-Line; HLW = high-level radioactive waste; 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; POC = pipe overpack container; SRS = Savannah River Site; TA = Technical Area; TRU = transuranic; WIPP = Waste Isolation Pilot Plant.

[a] Under the No Action Alternative, storage of 13.1 metric tons of plutonium would continue at the Pantex Plant and SRS.

[b] Under the MOX Fuel Alternative, 4 metric tons of non-pit plutonium would be converted to plutonium oxide at HC/HBL before fabrication into MOX fuel at MFFF. Plutonium treatment at HC/HBL may include vacuum salt distillation and sodium peroxide fusion.

[c] Plutonium treatment at HC/HBL may include vacuum salt distillation and sodium peroxide fusion.

[d] Additional options for pit plutonium include packaging into criticality control overpacks (CCOs) rather than POCs; additional options for non-pit plutonium include packaging into CCOs rather than POCs, and shipment and disposal of unirradiated Fast Flux Test Facility fuel without first disassembling and repackaging the fuel.

[e] The analysis reflects the assumption that HC/HBL would be the facility used at SRS for preparation of surplus plutonium for potential WIPP disposal; however, surplus plutonium could also be prepared at the K-Area Complex at SRS for potential WIPP disposal with impacts enveloped by those for the Pit Disassembly and Conversion Project (see Appendix F).

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

This chapter does not address impacts from disposal of transuranic (TRU) waste at the Waste Isolation Pilot Plant (WIPP) or disposal of high-level radioactive waste (HLW) or used nuclear fuel (also known as spent fuel or spent nuclear fuel).[2] Impacts from TRU waste disposal are addressed in the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement (WIPP SEIS II)* (DOE 1997b), and incorporated by reference in this *SPD Supplemental EIS* (see Appendix A, Section A.2.2).

This chapter qualitatively evaluates the option under the WIPP Alternative of using LANL facilities to prepare 7.1 metric tons (7.8 tons) of surplus pit plutonium for potential disposal as contact-handled transuranic (CH-TRU) waste at WIPP. The pit plutonium would first be disassembled and converted to oxide as part of LANL's enhanced pit disassembly and conversion capability. But instead of packaging the plutonium oxide for shipment to SRS for preparation for potential WIPP disposal, some or all of this pit plutonium could be prepared at LANL for potential WIPP disposal. DOE has included a qualitative evaluation of the impacts of preparing plutonium at LANL for potential disposal at WIPP. It is expected that existing or planned LANL facilities could be used, such as PF-4 in TA-55 and the TRU Waste facility in TA-63 (when operational). Use of LANL facilities to prepare pit plutonium for potential disposal at WIPP may require additional NEPA analysis.

Approach to Analysis. Following the impact assessment methods described in Appendix F of the *Surplus Plutonium Disposition Final Environmental Impact Statement (SPD EIS)* (DOE 1999b), impacts for each alternative are estimated based on facility characteristics and requirements from Chapter 2 and Appendix B of this *SPD Supplemental EIS* and affected environment information from Chapter 3. Impact assessment methods presented in the *SPD EIS* are not repeated herein, although differences between those analyses and analyses for this *SPD Supplemental EIS* are described in the resource area sections in this chapter.

The primary focus of this chapter is to compare impacts among the five alternatives addressed in this *SPD Supplemental EIS*. The analysis for each alternative addresses impacts as a function of the pit disassembly and conversion option when the impacts differ by option. Detailed facility-specific impacts are provided in Appendices C, D, and F through J.

Facility-specific periods of construction and operation were assumed as summarized for each alternative in Appendix B, Table B–2. The construction and operations periods were assumed based on current plans and schedules and could vary somewhat upon implementation. Any dates cited in this *SPD Supplemental EIS* are for purposes of analyses. The assessed impacts and operational periods only reflect those that could be attributed to the surplus plutonium disposition alternatives addressed in this *SPD Supplemental EIS*.[3]

[2] *DOE has terminated the program for a geologic repository for used nuclear fuel and HLW at Yucca Mountain, in Nevada. Notwithstanding the decision to terminate the Yucca Mountain program, DOE remains committed to meeting its obligations to manage and ultimately dispose of used nuclear fuel and HLW. DOE established the Blue Ribbon Commission on America's Nuclear Future to conduct a comprehensive review and evaluate alternative approaches for meeting these obligations. The Commission report to the Secretary of Energy of January 26, 2012 (BRCANF 2012) provided a strong foundation for the Administration's January 2013* Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste *(DOE 2013a). This Strategy provides a framework for moving toward a sustainable program to deploy an integrated system capable of transporting, storing, and disposing of used nuclear fuel and HLW from civilian nuclear power generation, defense, national security, and other activities. The link to the strategy is http://energy.gov/downloads/strategy-management-and-disposal-used-nuclear-fuel-and-high-level-radioactive-waste. Full implementation of this Strategy will require legislation.*

[3] *For example, the assumed operational periods for the Defense Waste Processing Facility under the* SPD Supplemental EIS *alternatives only reflect the time estimated to process surplus plutonium and not the time required for processing all high-level radioactive waste. Similarly, the annual impacts assessed for the Defense Waste Processing Facility only reflect those impacts that would be attributable to processing plutonium at the facility and not the annual impacts for operating the facility for all waste. This is because surplus plutonium would constitute only a fraction of the material that would be annually vitrified at the Defense Waste Processing Facility.*

4.1 Impacts from Alternatives

4.1.1 Air Quality

Nonradioactive air pollutant impacts at SRS and LANL under each alternative are evaluated in this section. Radioactive air pollutant impacts at SRS and LANL are evaluated in Section 4.1.2.

Activities under the alternatives could result in emissions of criteria, hazardous, and toxic air pollutants from facility construction and operation. Air pollutant emissions were evaluated for construction activities. In addition, projected air pollutant concentrations at site boundaries were evaluated for operational activities and compared to applicable standards and significance levels. Significance levels are concentrations below which no further analysis is necessary for that pollutant for the purpose of permitting. Concentrations above the significance levels would need to undergo further analysis to consider the cumulative impacts from other sources within the impact area (EPA 1990:C28; Page 2010a, 2010b; 40 CFR 51.165(b) (2)). Where new modeling was performed for this *SPD Supplemental EIS*, current U.S. Environmental Protection Agency (EPA) models were used. For example, the EPA AERMOD dispersion model (EPA 2004) was used unless stated otherwise. As required, updated emissions and resultant concentrations were determined based on information provided in cited references.

The maximum concentration values presented in this section are the highest 1st-high concentrations calculated at a specific receptor. Use of the highest 1st-high concentrations is appropriate for comparison with significance levels. However, use of the highest 1st-high concentrations is not always appropriate for comparison with ambient air quality standards. As discussed in footnote "a" of Chapter 3, Table 3–7, the ambient air quality standards allow the use of a variety of methods for evaluating the number of exceedances allowed before the standard is considered to not be met. For example, the basis for compliance with the 1-hour nitrogen dioxide standard in this *SPD Supplemental EIS* is a 3-year average of the 98th percentile of the daily maximum 1-hour average. However, EPA guidance (EPA 2011b) on demonstrating compliance with the 1-hour nitrogen dioxide National Ambient Air Quality Standards (NAAQS) is to use the eighth-highest daily maximum 1-hour value (not the highest 1-hour value) as an unbiased surrogate for the 98th percentile.

EPA's final rule for "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" (40 CFR 93.150 – 93.165) requires a conformity determination for certain-sized projects in nonattainment areas. A conformity determination is not necessary to meet the requirements of the conformity rule for the alternatives considered in this *SPD Supplemental EIS* because SRS and LANL are located in areas that are in attainment for all criteria pollutants (DOE 2000a).

Emissions from shipping unirradiated MOX fuel to domestic commercial nuclear power reactors are addressed in Appendix I, as are impacts on air quality from use of a 40 percent MOX fuel core in these reactors. As described in Appendix I, emissions from shipping unirradiated MOX fuel to domestic commercial nuclear power reactor sites are not expected to be substantially different than those from shipping low-enriched uranium (LEU) fuel to these reactor sites. In addition, the use of a 40 percent MOX fuel core in domestic commercial nuclear power reactors is not expected to meaningfully change the impacts on air quality that currently occur from use of a 100 percent LEU fuel core. Therefore, the impacts from shipping unirradiated MOX fuel to domestic commercial nuclear power reactors, and from irradiation of MOX fuel at these reactors, are not discussed further in this section.

In addition, although pit disassembly and conversion at PF-4 at LANL occurs under all alternatives, this section only addresses in detail those impacts on air quality that could result from construction activities at PF-4 under the action alternatives for the PF-4 at LANL and MFFF at SRS Option (PF-4 and MFFF Option) and the PF-4 at LANL, and H-Canyon/HB-Line and MFFF at SRS Option (PF-4, H-Canyon/HB-Line, and MFFF Option). These activities are needed under these alternatives and options to process 35 metric tons (38.6 tons) of plutonium. No additional construction is needed at PF-4 under the No Action Alternative, and for the PDCF at F-Area at SRS Option (PDCF Option) and the PDC at K-Area at SRS Option (PDC Option) under the action alternatives, to process 2 metric tons (2.2 tons) of plutonium, and thus there would be no construction impacts on air quality. Furthermore, there would be no increase in criteria or nonradioactive toxic air pollutant emissions at PF-4 from pit disassembly and conversion operations under any alternative. This is because emissions of pollutants to the air from PF-4 operations result from tests of emergency diesel generators, and the frequency and extent of these tests at PF-4 would not change whether 2 or 35 metric tons (2.2 tons or 38.6 tons) of plutonium were processed at PF-4 (LANL 2013a). Under the WIPP Alternative, however, some surplus plutonium could be prepared at LANL for potential WIPP disposal, which would involve activities in addition to those evaluated under the other alternatives. Therefore, impacts on air quality from operations at PF-4 are only addressed in Section 4.1.1.5, WIPP Alternative.

Finally, under all alternatives, it is not expected that surplus plutonium disposition activities at the principal plutonium support facilities at LANL would result in significant increases in emissions of criteria or nonradioactive toxic air pollutants. Therefore, the impacts under the alternatives from operations at the principal LANL plutonium support facilities are not discussed further in this section.

4.1.1.1 No Action Alternative

Construction—Construction-related impacts would include nonradioactive air pollutant emissions from construction of the Pit Disassembly and Conversion Facility (PDCF). This construction activity would emit particulate matter and other pollutants from operation of diesel-powered construction equipment and a concrete batch plant, as well as from vehicles and other mobile sources. Construction of PDCF, as currently designed, would impact additional land compared to that analyzed in the *SPD EIS* (DOE 1999b). Earthmoving and other construction activities are expected to result in emissions higher than those estimated in the *SPD EIS*. Estimated nonradioactive air pollutant concentrations at the SRS site boundary from PDCF construction are provided in Appendix F, Table F–1. These concentrations would not exceed the NAAQS or applicable state standards. Peak year air pollutant emissions (metric tons per year) from construction of PDCF are provided in Appendix F, Table F–2.

Operations—Estimated contributions to air pollutant concentrations at the SRS site boundary from facility operations under the No Action Alternative are presented in **Table 4–1**. Principal sources of emissions include PDCF, MFFF, and WSB (see Appendices F, G, and H, respectively). Additional sources of operational air pollutants include boilers that provide heating for plutonium management activities at the K-Area Complex, including plutonium storage and KIS. No change is expected in the annual emissions from operation of the K-Area Complex under this alternative.

Concentrations of toxic pollutants from WSB were estimated to be less than 0.0001 percent of the acceptable source impact levels for all the toxic pollutants except nitric acid, which was estimated at 0.12 percent. Emissions from KIS, PDCF, and MFFF would include small quantities of nickel, nickel oxide, beryllium, beryllium oxide, and fluoride (WSRC 2008a). Emissions would be in compliance with all air pollutant control regulations (SCDHEC 2010b, 2010c, 2012). Mitigation of air pollutants and protection of workers are discussed in Sections 4.9.4 and 4.9.6, respectively.

Table 4–1 indicates that the applicable standards for criteria pollutants would not be exceeded. In addition, when the concentrations (maximum permitted contribution) from existing sources at SRS (see Chapter 3, Table 3–7) and ambient concentrations (see Chapter 3, Table 3–8) are added to the contributions shown in Table 4–1, the applicable standards would still not be exceeded. Because the maximum concentrations would not necessarily occur at the same location or time, the addition of these values provides a conservative estimate of the potential maximum site boundary concentrations. Actual values are expected to be lower. Emissions of PM_{10} (particulate matter less than or equal to 10 microns in aerodynamic diameter) were used to represent $PM_{2.5}$ (particulate matter less than or equal to 2.5 microns in aerodynamic diameter) emissions when $PM_{2.5}$ emission factors were not available, which may overstate the emissions of $PM_{2.5}$. If a background concentration for $PM_{2.5}$ and the contribution from existing facilities were added to the $PM_{2.5}$ concentrations for the alternative, the $PM_{2.5}$ 24-hour or annual standard could be exceeded. This could occur as a result of the conservative nature of the site boundary concentration estimates. The contributions to concentrations of criteria pollutants are below significance levels except for the nitrogen dioxide 1-hour average contribution.

Table 4–1 Summary of Air Pollutant Concentrations at the Site Boundary from Savannah River Site Operations by Alternative

Pollutant and Averaging Period	*Pit Disassembly and Conversion Option*	*More Stringent Standard or Guideline* [a]	*Significance Level* [b]	*Alternative: No Action*	*Alternative: Immobilization to DWPF*	*Alternative: MOX Fuel*	*Alternative: HC/HBL to DWPF*	*Alternative: WIPP*
Criteria Pollutants (micrograms per cubic meter)								
Carbon monoxide – 8 hour	PDCF	10,000	500	37	55	37	37	37
	PDC	10,000	500	N/A	N/A	36	36	36
	PF-4 and MFFF	10,000	500	N/A	41	23	23	23
	PF-4, HC/HBL, and MFFF	10,000	500	N/A	41	23	23	23
Carbon monoxide – 1 hour	PDCF	40,000	2,000	150	290	150	150	150
	PDC	40,000	2,000	N/A	N/A	120	120	120
	PF-4 and MFFF	40,000	2,000	N/A	219	79	79	79
	PF-4, HC/HBL, and MFFF	40,000	2,000	N/A	219	79	79	79
Nitrogen dioxide – annual	PDCF	100	1	0.091	0.12	0.091	0.091	0.091
	PDC	100	1	N/A	N/A	0.092	0.092	0.092
	PF-4 and MFFF	100	1	N/A	0.074	0.05	0.05	0.05
	PF-4, HC/HBL, and MFFF	100	1	N/A	0.074	0.05	0.05	0.05
Nitrogen dioxide – 1 hour	PDCF	188	7.5	120 [c]	160 [c]	120	120	120
	PDC	188	7.5	N/A	N/A	73 [c]	73 [c]	73 [c]
	PF-4 and MFFF	188	7.5	N/A	39 [c]	N/R	N/R	N/R
	PF-4, HC/HBL, and MFFF	188	7.5	N/A	39 [c]	N/R	N/R	N/R
PM_{10} – annual	PDCF	50	1	<0.001 [c]	0.0012 [c]	<0.001 [c]	<0.001 [c]	<0.001 [c]
	PDC	50	1	N/A	N/A	<0.001 [c]	<0.001 [c]	<0.001 [c]
	PF-4 and MFFF	50	1	N/A	0.0012	0.00041	0.00041	0.00041
	PF-4, HC/HBL, and MFFF	50	1	N/A	0.0012	0.00041	0.00041	0.00041
PM_{10} – 24 hour	PDCF	150	5	1.3	2.3	1.3	1.3	1.3
	PDC	150	5	N/A	N/A	1.4	1.4	1.4
	PF-4 and MFFF	150	5	N/A	1.8	0.78	0.78	0.78
	PF-4, HC/HBL, and MFFF	150	5	N/A	1.8	0.78	0.78	0.78
$PM_{2.5}$ – annual	PDCF	15	0.3	0.0022	0.0022	0.0014	0.0014	0.0014
	PDC	15	0.3	N/A	N/A	0.0014	0.0014	0.0014
	PF-4 and MFFF	15	0.3	N/A	0.0012	0.0004	0.00041	0.00041
	PF-4, HC/HBL, and MFFF	15	0.3	N/A	0.0012	0.0004	0.00041	0.00041
$PM_{2.5}$ – 24 hour	PDCF	35	1.2	1.1	2.1	1.1	1.1	1.1
	PDC	35	1.2	N/A	N/A	1.3	1.3	1.3
	PF-4 and MFFF	35	1.2	N/A	1.8	0.78	0.78	0.78
	PF-4, HC/HBL, and MFFF	35	1.2	N/A	1.8	0.78	0.78	0.78
Sulfur dioxide – annual	PDCF	80	1	0.0031	0.01 [c]	0.0031	0.0031	0.0031
	PDC	80	1	N/A	N/A	0.004	0.004	0.004
	PF-4 and MFFF	80	1	N/A	0.01	0.003	0.003	0.003
	PF-4, HC/HBL, and MFFF	80	1	N/A	0.01	0.003	0.003	0.003
Sulfur dioxide – 24 hour	PDCF	365	5	4.8	13	4.8	4.8	4.8
	PDC	365	5	N/A	N/A	5	5	5
	PF-4 and MFFF	365	5	N/A	13	4.8	4.8	4.8
	PF-4, HC/HBL, and MFFF	365	5	N/A	13	4.8	4.8	4.8

Pollutant and Averaging Period	Pit Disassembly and Conversion Option	More Stringent Standard or Guideline [a]	Significance Level [b]	Alternative				
				No Action	Immobilization to DWPF	MOX Fuel	HC/HBL to DWPF	WIPP
Sulfur dioxide – 3 hour	PDCF	1,300	25	22 [c]	81 [c]	22 [c]	22 [c]	22 [c]
	PDC	1,300	25	N/A	N/A	22	22	22
	PF-4 and MFFF	1,300	25	N/A	81	22	22	22
	PF-4, HC/HBL, and MFFF	1,300	25	N/A	81	22	22	22
Sulfur dioxide – 1 hour	PDCF	197	7.8	0.12 [c]	65 [c]	0.12 [c]	0.12 [c]	0.12 [c]
	PDC	197	7.8	N/A	N/A	N/R	N/R	N/R
	PF-4 and MFFF	197	7.8	N/A	65 [c]	N/R	N/R	N/R
	PF-4, HC/HBL, and MFFF	197	7.8	N/A	65 [c]	N/R	N/R	N/R

DWPF = Defense Waste Processing Facility; HC/HBL = H-Canyon/HB-Line; MFFF = Mixed Oxide Fuel Fabrication Facility; MOX = mixed oxide; N/A = not applicable; N/R = not reported; PDC = Pit Disassembly and Conversion Project; PDCF = Pit Disassembly and Conversion Facility; PF-4 = Plutonium Facility; PM_n = particulate matter less than or equal to *n* microns in aerodynamic diameter; WIPP = Waste Isolation Pilot Plant.

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

[b] EPA 1990; Page 2010a, 2010b; 40 CFR 51.165(b)(2).

[c] Value would be somewhat higher because the contribution from at least one facility was not reported and is not included in this total.

Note: Values have been rounded where appropriate. Concentrations are maximums to which the public would be exposed and are typically at the site boundary.

Source: Appendices F, G, and H.

DOE expects that the replacement biomass-fired cogeneration plant and biomass-fired steam generating units at K- and L-Areas at SRS would decrease the annual overall 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:30-31). These changes are reflected in the concentrations listed in Chapter 3, Table 3–7.

Annual employee vehicle emissions associated with operations under the No Action Alternative in the peak employment year are expected to increase by about 19 percent at SRS over 2010 emissions based on the change in employment. However, implementation of policies to reduce the use of current fuels (e.g., gasoline, diesel fuel) and increase the use of alternative fuels (e.g., E-85) is expected to reduce the levels of vehicle emissions (Executive Order 13514; DOE Order 436.1), somewhat offsetting the projected increase in emissions under this alternative. Estimated total emissions from shipping waste, construction materials, and materials other than unirradiated MOX fuel are presented in **Table 4–2**.

Combustion of fossil fuels under this alternative would result in the emission of carbon dioxide, one of the atmospheric gases believed to influence global climate change. Annual carbon dioxide emissions under this alternative, based on estimated fuel use (see Section 4.1.7.7.1); electricity use; employee vehicles; and truck shipments of waste, construction materials, and materials other than unirradiated MOX fuel, would be about 150,000 metric tons (170,000 tons) per year, representing about 0.002 percent of the 2010 annual U.S. emissions of carbon dioxide equivalent[4] (EPA 2012). Direct (Scope 1) emissions[5] from onsite fuel use were estimated to be 3,900 metric tons (4,300 tons), representing a fraction of the total carbon dioxide emissions under this alternative.

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

[5] Direct and indirect emissions are categorized into three scopes: Scope 1 includes all direct greenhouse gas emissions; Scope 2 includes indirect emissions from consumption of purchased electricity, heat, or steam; and Scope 3 includes certain other indirect emissions. Direct emissions are from sources that the reporting party owns or controls (Executive Order 13514).

Table 4–2 Criteria Pollutant Emissions from Shipping Waste, Construction Materials, and Materials Other than Unirradiated Mixed Oxide Fuel [a] (metric tons)

Pit Disassembly and Conversion Option	*Alternative*				
	No Action	*Immobilization to DWPF*	*MOX Fuel*	*H-Canyon/HB-Line to DWPF*	*WIPP*
Carbon monoxide					
PDCF	50	62	63	56	85
PDC	N/A	N/A	67	61	89
PF-4 and MFFF	N/A	47	48	42	70
PF-4, HC/HBL, and MFFF	N/A	48	49	42	71
Nitrogen dioxide					
PDCF	170	210	210	190	290
PDC	N/A	N/A	230	210	300
PF-4 and MFFF	N/A	160	170	140	240
PF-4, HC/HBL, and MFFF	N/A	160	170	140	240
PM_{10}					
PDCF	5.0	6.1	6.2	5.5	8.4
PDC	N/A	N/A	6.7	6.0	8.8
PF-4 and MFFF	N/A	4.7	4.8	4.1	6.9
PF-4, HC/HBL, and MFFF	N/A	4.7	4.8	4.2	7.0
$PM_{2.5}$					
PDCF	4.2	5.1	5.2	4.6	7.0
PDC	N/A	N/A	5.6	5.0	7.4
PF-4 and MFFF	N/A	3.9	4.0	3.5	5.8
PF-4, HC/HBL, and MFFF	N/A	4.0	4.1	3.5	5.9
Sulfur dioxide					
PDCF	0.21	0.25	0.26	0.23	0.35
PDC	N/A	N/A	0.28	0.25	0.37
PF-4 and MFFF	N/A	0.19	0.20	0.17	0.29
PF-4, HC/HBL, and MFFF	N/A	0.20	0.20	0.17	0.29
Volatile organic compounds					
PDCF	8.0	9.7	9.9	8.9	13
PDC	N/A	N/A	11	9.6	14
PF-4 and MFFF	N/A	7.5	7.7	6.6	11
PF-4, HC/HBL, and MFFF	N/A	7.6	7.7	6.7	11

DWPF = Defense Waste Processing Facility; HC/HBL = H-Canyon/HB-Line; MFFF = Mixed Oxide Fuel Fabrication Facility; MOX = mixed oxide; N/A = not applicable; PDC = Pit Disassembly and Conversion Project; PDCF = Pit Disassembly and Conversion Facility; PF-4 = Plutonium Facility; PM_n = particulate matter less than or equal to *n* microns in aerodynamic diameter; WIPP = Waste Isolation Pilot Plant.

[a] These estimates do not include shipments of unirradiated MOX fuel to Tennessee Valley Authority and generic reactor sites which are addressed in Appendix I.

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

4.1.1.2 Immobilization to DWPF Alternative

Construction—At SRS and as addressed in Appendix G, Section G.1.1, with the exception of a 2-acre (0.8-hectare) construction site, construction of the K-Area immobilization capability under this alternative would occur inside existing buildings. Equipment used for construction of the K-Area immobilization capability would generate small quantities of fugitive dust and other emissions (SRNS 2012a). Minimal emissions of pollutants would result from modifications to the Defense Waste Processing Facility (DWPF) to support receipt and handling of canisters containing plutonium immobilized at K-Area. In addition, under the PDCF Option, potential emissions from construction-related activities could include those from construction of PDCF as described under the No Action Alternative (Section 4.1.1.1). Under the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option, no additional construction emissions would be expected from installation of metal oxidation furnaces at MFFF (SRNS 2012a). Under the PF-4, H-Canyon/HB-Line, and MFFF Option, no changes in emissions are projected from modifications to the K-Area Complex to enable pit disassembly, or from modifications to H-Canyon/HB-Line to support enhanced conversion of plutonium to plutonium oxide. Under all pit disassembly and conversion options, concentrations of criteria pollutants at the SRS boundary would not exceed the NAAQS or applicable state standards.

At LANL, with the exception of a 2-acre (0.8-hectare) parking and construction trailer site, construction activities under the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option would occur inside PF-4. Peak year site boundary concentrations of criteria pollutants from optional modifications to PF-4 are presented in Appendix F, and would not exceed the NAAQS or applicable state standards. Peak-year air pollutant emissions from modifications to PF-4 under these options are provided in Appendix F, Table F–2.

Operations—Estimated contributions to air pollutant concentrations at the SRS boundary under this alternative from facility operations are presented in Table 4–1. Boundary concentrations are projected to vary depending on the pit disassembly and conversion option. Minimal emissions from operation of the K-Area immobilization capability are expected, other than from operation and testing of diesel generators at the K-Area Complex, and no change is expected in emissions from operation of DWPF (see Appendix G, Section G.1.1). No significant increase in air pollutant emissions is expected from storage of vitrified HLW canisters containing immobilized plutonium in the Glass Waste Storage Buildings (GWSBs). Under the PDCF Option, additional contributions to boundary concentrations could result from operation of PDCF. Under the PF-4 and MFFF Option, no changes in site boundary concentrations are projected from operation of metal oxidation furnaces at MFFF. Under the PF-4, H-Canyon/HB-Line, and MFFF Option, no changes in site boundary concentrations are projected from operation of metal oxidation furnaces at MFFF, from pit disassembly at the K-Area Complex, or from oxidation of plutonium at H-Canyon/HB-Line for immobilization or fabrication into MOX fuel. Under all pit disassembly and conversion options, contributions from operation of WSB, K-Area storage, and KIS would be the same as those under the No Action Alternative.

Table 4–1 indicates that the applicable standards for criteria pollutants would not be exceeded at SRS. In addition, when the concentrations (maximum permitted contributions) from existing sources at SRS (see Chapter 3, Table 3–7) and ambient concentrations (see Chapter 3, Table 3–8) are added to the contributions shown in Table 4–1, the applicable standards would still not be exceeded. Using PM_{10} as a surrogate for $PM_{2.5}$ indicates that $PM_{2.5}$ is expected to meet the ambient standards. If a background concentration for $PM_{2.5}$ and the contribution from existing facilities were added to the $PM_{2.5}$ contributions for the alternative, the $PM_{2.5}$ 24-hour or annual standard could be exceeded. This could occur as a result of the conservative nature of the site boundary concentration estimates. The contributions for all pit disassembly and conversion options to concentrations of criteria pollutants are below significance levels except for the nitrogen dioxide 1-hour average, the $PM_{2.5}$ 24-hour, and the sulfur dioxide 24-, 3-, and 1-hour contributions. Existing air pollutant concentrations at SRS include contributions from currently operating facilities such as the K-Area Complex, H-Canyon/HB-Line, and DWPF, which are expected to be essentially unchanged under this alternative.

Employee vehicle emissions under the Immobilization to DWPF Alternative in the peak employment year are expected to increase by about 18 to 24 percent at SRS over 2010 emissions. Employee vehicle emissions at LANL would increase by less than 4 percent under any of the pit disassembly and conversion options. Estimated total emissions from shipping waste, construction materials, and materials other than unirradiated MOX fuel are presented in Table 4–2.

Combustion of fossil fuels associated with this alternative would result in the emission of carbon dioxide, one of the gases believed to influence global climate change. Annual carbon dioxide emissions under this alternative, based on fuel use estimates (see Section 4.1.7.7.2); electricity use; employee vehicles; and truck shipments of waste, construction materials, and materials other than unirradiated MOX fuel, would be about 180,000 metric tons (200,000 tons) per year, representing about 0.003 percent of the 2010 annual

U.S. emissions of carbon dioxide equivalent (EPA 2012). Direct (Scope 1) emissions from onsite fuel use were estimated to be 4,000 metric tons (4,400 tons), representing a fraction of the total carbon dioxide emissions under this alternative.

4.1.1.3 MOX Fuel Alternative

Construction—At SRS, potential emissions and air quality impacts could include those from construction of PDCF in F-Area (PDCF Option) as described under the No Action Alternative (Section 4.1.1.1), or from construction of the Pit Disassembly and Conversion Project (PDC) within K-Area (PDC Option) (see Appendix F, Section F.1.2). Peak annual emissions from PDC construction are presented in Appendix F, Table F–2. As under the Immobilization to DWPF Alternative (Section 4.1.1.2), no additional construction emissions are expected from installation of metal oxidation furnaces at MFFF under the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option. Under the PF-4, H-Canyon/HB-Line, and MFFF Option, no changes in emissions are projected from modifications to the K-Area Complex to enable pit disassembly, or from modifications to H-Canyon/HB-Line to support conversion of plutonium to plutonium oxide. Under any pit disassembly and conversion option, concentrations of criteria pollutants would not exceed the NAAQS or applicable state standards.

At LANL, emissions from modifications to PF-4 under the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option would be the same as those in Section 4.1.1.2 under the Immobilization to DWPF Alternative.

Operations—Estimated contributions to air pollutant concentrations at the SRS boundary from facility operations under the MOX Fuel Alternative are presented in Table 4–1. Boundary concentrations are projected to vary depending on the pit disassembly and conversion option. No change in site boundary concentrations is expected from operation of H-Canyon/HB-Line to oxidize 4 metric tons (4.4 tons) of non-pit plutonium for MOX fuel fabrication or to prepare 2 metric tons (2.2 tons) of non-pit plutonium for potential WIPP disposal. Contributions to boundary concentrations could result from operation of PDCF under the PDCF Option, or from operation of PDC under the PDC Option. Under the PF-4 and MFFF Option, no changes in site boundary concentrations are projected from operation of metal oxidation furnaces at MFFF. Under the PF-4, H-Canyon/HB-Line, and MFFF Option, no changes in existing site boundary concentrations (presented in Chapter 3, Table 3–7) are projected from operation of metal oxidation furnaces at MFFF, from pit disassembly at the K-Area Complex, or from processing plutonium at H-Canyon/HB-Line for fabrication into MOX fuel. (Processing plutonium at H-Canyon/HB-Line could include treatment using vacuum salt distillation and sodium peroxide fusion.) Contributions from operation of WSB, K-Area storage, and KIS would be the same under this alternative as those under the No Action Alternative (Section 4.1.1.1).

Table 4–1 indicates that the applicable standards for criteria pollutants would not be exceeded. In addition, when the concentrations (maximum permitted contributions) from existing sources at SRS (see Chapter 3, Table 3–7) and ambient concentrations (see Chapter 3, Table 3–8) are added to the contributions shown in Table 4–1, the applicable standards would still not be exceeded. Using PM_{10} as a surrogate for $PM_{2.5}$ indicates that $PM_{2.5}$ is expected to meet the ambient standards. If a background concentration for $PM_{2.5}$ and the contribution from existing facilities were added to the $PM_{2.5}$ contributions for the alternative, the $PM_{2.5}$ 24-hour or annual standard could be exceeded. This could occur as a result of the conservative nature of the site boundary concentration estimates. The contributions under the PDCF and PDC Options to concentrations of criteria pollutants are below significance levels except for the nitrogen dioxide 1-hour average contribution for both options and the $PM_{2.5}$ 24-hour and sulfur dioxide 24-hour contributions for the PDC Option. Existing air pollutant concentrations at SRS (Chapter 3, Table 3–7) include contributions from currently operating facilities such as the K-Area Complex, H-Canyon/HB-Line, and DWPF, which are expected to be essentially unchanged under this alternative.

Employee vehicle emissions under the MOX Fuel Alternative in the peak employment year are expected to increase by about 16 to 20 percent at SRS compared to 2010 emissions. Employee vehicle emissions at

LANL would increase by less than 4 percent under any of the pit disassembly and conversion options. Estimated total emissions from shipping waste, construction materials, and materials other than unirradiated MOX fuel, are presented in Table 4–2.

Combustion of fossil fuels associated with this alternative would result in the emission of carbon dioxide, one of the gases believed to influence global climate change. Annual carbon dioxide emissions under this alternative, based on estimated fuel use (see Section 4.1.7.7.3); electricity use; employee vehicles; and truck shipments of waste, construction materials, and materials other than unirradiated MOX fuel, would be 160,000 metric tons (180,000 tons) per year, representing about 0.002 percent of the 2010 annual U.S. emissions of carbon dioxide equivalent (EPA 2012). Direct (Scope 1) emissions from onsite fuel use were estimated to be 3,900 metric tons (4,300 tons).

4.1.1.4 H-Canyon/HB-Line to DWPF Alternative

Construction—Construction-related emissions under this alternative would be essentially the same as those under the MOX Fuel Alternative. There would be some minor modifications to H-Canyon/HB-Line within an existing structure, with minimal emissions.

Operations—Estimated contributions to air pollutant concentrations at the SRS boundary from facility operations under this alternative are presented in Table 4–1. Air quality impacts from operation under this alternative would be about the same for each pit disassembly and conversion option as those under the MOX Fuel Alternative (Section 4.1.1.3). Contributions to boundary concentrations could result from operation of PDCF under the PDCF Option or from operation of PDC under the PDC Option. Under the PF-4 and MFFF Option, no changes in site boundary concentrations are projected from operation of metal oxidation furnaces at MFFF. Under the PF-4, H-Canyon/HB-Line, and MFFF Option, no changes in site boundary concentrations are projected from operation of metal oxidation furnaces at MFFF, from pit disassembly at the K-Area Complex, or from oxidation of plutonium at H-Canyon/HB-Line for fabrication into MOX fuel. Under all pit disassembly and conversion options, contributions from operation of WSB, K-Area storage, and KIS would be the same as those under the No Action Alternative (Section 4.1.1.1).

Under all pit disassembly and conversion options, emissions from DWPF are not expected to increase, and the expected boundary concentrations would still be less than SRS baseline concentrations (SRNL 2013; WSRC 2008a). About 3 percent of DWPF emissions during the immobilization period would be attributable to the vitrification of 6 metric tons (6.6 tons) of plutonium processed through H-Canyon/HB-Line under this alternative. No changes are expected in emissions from GWSB storage of vitrified HLW containing surplus plutonium.

Under this alternative, contributions to air pollutant concentrations would be similar to those under the MOX Fuel Alternative. When the concentrations (maximum permitted contributions) from existing sources at SRS (Chapter 3, Table 3–7) and ambient concentrations (Chapter 3, Table 3–8) are added to the contributions shown in Table 4–1, the applicable standards would still not be exceeded. Using PM_{10} as a surrogate for $PM_{2.5}$ indicates that $PM_{2.5}$ is expected to meet the ambient standards. If a background concentration for $PM_{2.5}$ and the contribution from existing facilities were added to the $PM_{2.5}$ contributions for the alternative, the $PM_{2.5}$ 24-hour or annual standard could be exceeded. This could occur as a result of the conservative nature of the site boundary concentration estimates. The contributions under the PDCF and PDC Options to concentrations of criteria pollutants would be below significance levels, except for the nitrogen dioxide 1-hour average contribution for both options and the $PM_{2.5}$ and the sulfur dioxide 24-hour contributions for the PDC Option.

Employee vehicle emissions under the H-Canyon/HB-Line to DWPF Alternative in the peak employment year are expected to increase by about 14 to 19 percent at SRS over 2010 emissions. Employee vehicle emissions at LANL are expected to increase by less than 4 percent under any of the pit disassembly and conversion options. Estimated total emissions from shipping waste, construction materials, and materials other than unirradiated MOX fuel are presented in Table 4–2.

Combustion of fossil fuels associated with this alternative would result in the emission of carbon dioxide, one of the gases believed to influence global climate change. Annual carbon dioxide emissions under this alternative, based on estimated fuel use (see Section 4.1.7.7.4); electricity use; employee vehicles; and truck shipments of waste, construction materials, and materials other than unirradiated MOX fuel, would be 150,000 metric tons (170,000 tons) per year, representing about 0.002 percent of the 2010 annual U.S. emissions of carbon dioxide equivalent (EPA 2012). Direct (Scope 1) emissions from onsite fuel use were estimated to be 3,900 metric tons (4,300 tons), representing a fraction of the total carbon dioxide emissions under this alternative.

4.1.1.5 WIPP Alternative

Construction—At SRS, construction-related emissions under this alternative would be essentially the same as those under the MOX Fuel Alternative. There would be minor modifications to H-Canyon/HB-Line within an existing structure, with minimal emissions. At LANL, emissions from modifications to PF-4 under the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option would be substantially the same as those in Section 4.1.1.2 under the Immobilization to DWPF Alternative. Enhancement of the site capability under these options to prepare surplus plutonium for potential WIPP disposal would occur within existing or planned LANL facilities with correspondingly minor emissions of criteria and toxic air pollutants.

Operations—Estimated contributions to air pollutant concentrations at the SRS site boundary from facility operations under this alternative are presented in Table 4–1. Air quality impacts from operation under this alternative would be about the same for each pit disassembly and conversion option as those under the MOX Fuel Alternative (Section 4.1.1.3). Contributions to boundary concentrations could result from operation of PDCF under the PDCF Option or from operation of PDC under the PDC Option. Under the PF-4 and MFFF Option, no changes in site boundary concentrations are projected from operation of metal oxidation furnaces at MFFF. Under the PF-4, H-Canyon/HB-Line, and MFFF Option, no changes in site boundary concentrations are projected from operation of metal oxidation furnaces at MFFF, from pit disassembly at the K-Area Complex, or from oxidation of plutonium at H-Canyon/HB-Line for fabrication into MOX fuel. Under all pit disassembly and conversion options, contributions from operation of WSB, K-Area storage, and KIS would be the same as those under the No Action Alternative.

When the concentrations (maximum permitted contributions) from existing sources (see Chapter 3, Table 3–7) and ambient concentrations (see Chapter 3, Table 3–8) are added to the contributions shown in Table 4–1, the applicable standards would still not be exceeded. Using PM_{10} as a surrogate for $PM_{2.5}$ indicates that $PM_{2.5}$ is expected to meet the ambient standards. If a background concentration for $PM_{2.5}$ and the contribution from existing facilities were added to the $PM_{2.5}$ contributions for the alternative, the $PM_{2.5}$ 24-hour or annual standard could be exceeded. This could occur as a result of the conservative nature of the site boundary concentration estimates. The contributions under the PDCF and PDC Options to concentrations of criteria pollutants are below significance levels except for the nitrogen dioxide 1-hour average contribution for both options and the $PM_{2.5}$ and sulfur dioxide 24-hour contributions for the PDC Option.

Employee vehicle emissions under the WIPP Alternative in the peak employment year are expected to increase by about 14 to 24 percent at SRS over 2010 emissions. Employee vehicle emissions at LANL would increase by less than 4 percent under any of the pit disassembly and conversion options (also see below). Estimated total emissions from shipping waste, construction materials, and materials other than unirradiated MOX fuel are presented in Table 4–2.

To the extent under the PF-4 and MFFF and PF-4, H-Canyon/HB-Line, and MFFF Options that pit plutonium was prepared at LANL for potential WIPP disposal, negligible additional emissions of toxic and criteria pollutants would be expected at LANL. Emissions from PF-4 or other TA-55 facilities used for WIPP preparation are expected to be principally from testing of diesel generators which would occur independently of the particular activities conducted at these facilities, and negligible incremental emissions, if any, of toxic and criteria pollutants to the air are expected. There could be some additional emissions from employee vehicles associated with possible additional employment under this option.

Combustion of fossil fuels associated with this alternative would result in the emission of carbon dioxide, one of the gases believed to influence global climate change. Annual carbon dioxide emissions under this alternative, based on estimated fuel use (see Section 4.1.7.7.5); electricity use; employee vehicles; and truck shipments of waste, construction materials, and materials other than unirradiated MOX fuel, would be 160,000 metric tons (180,000 tons) per year, representing about 0.002 percent of the 2010 annual U.S. emissions of carbon dioxide equivalent (EPA 2012). Direct (Scope 1) emissions from onsite fuel use were estimated to be 3,900 metric tons (4,300 tons), representing a fraction of the total carbon dioxide emissions under this alternative.

4.1.2 Human Health

Following the basic approaches used in the *SPD EIS* (DOE 1999b), this section includes analyses of radiological impacts at SRS, LANL, and commercial nuclear power plants from normal operations and postulated accidents on workers and the general population. Human health risks from construction, normal operations, and facility accidents are considered for several individual receptors and population groups. Depending on the source of radiation exposure, these include involved and noninvolved workers, the offsite population, a maximally exposed individual (MEI), and an average individual within the offsite population. This section also summarizes impacts from possible chemical accidents and intentional destructive acts at DOE facilities. Details about the assumptions and methods used to evaluate the impacts of normal operations and postulated accidents at DOE facilities are presented in Appendices C and D, respectively, of this *SPD Supplemental EIS*. Details about the impacts associated with the pit disassembly and conversion options are described in Appendix F; plutonium disposition options in Appendix G; and principal plutonium support facilities in Appendix H. Details about the impacts associated with irradiating MOX fuel at TVA and generic reactor sites are addressed in Appendices I and J.

For the purposes of this *SPD Supplemental EIS*, an involved worker is an onsite worker directly or indirectly involved with operations at a facility that is part of the surplus plutonium disposition effort who receives an occupational radiation exposure from direct radiation (i.e., neutron, x-ray, beta, or gamma) or from radionuclides released to the environment as a part of normal operations. Direct exposure (to primarily americium-241 gamma radiation) from handled plutonium materials within a facility would be the chief source of potential occupational exposure to onsite workers. A noninvolved worker is a site worker outside of the facility who would not be subject to direct radiation exposure, but could be incidentally exposed to emissions from the surplus plutonium facilities.

The offsite population comprises members of the general public who live within 50 miles (80 kilometers) of a particular facility being evaluated. 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, the MEI is considered to be at the site boundary during normal operations at SRS, LANL, and the reactor sites, and also during postulated accidents at SRS and LANL. For postulated accidents at the reactor sites, the MEI is assumed to be at the exclusion area boundary, which defines the area within which the reactor licensee has the authority to determine all activities, including exclusion or removal of personnel and property from the area. An average individual is a hypothetical receptor whose dose is determined by dividing the population dose by the number of individuals in the exposed population.

The GENII 2 [GENII Environmental Dosimetry System, Version 2] computer code (Version 2.10) was used to evaluate the impacts on the MEI, offsite population, and average individual from normal operations at DOE sites as described in Appendix C of this *SPD Supplemental EIS*. Existing data were used to estimate the potential impacts from normal operations at reactor sites. The MACCS2 [MELCOR Accident Consequence Code System - 2], Version 1.13.1, computer code was used to evaluate the impacts on the MEI, offsite population, and onsite noninvolved worker from possible accidents as described in Appendices D and J.

For individuals or population groups, estimates of potential latent cancer fatalities (LCFs) are made using a 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 2003a) (see Appendix C, Section C.1.3). For acute doses to individuals equal to or greater than 20 rem, the factor is doubled (NCRP 1993).

4.1.2.1 Normal Operations

Radioactive materials released from the surplus plutonium operations considered in this *SPD Supplemental EIS* would be tritium or particulates (primarily plutonium and americium isotopes) in emissions that would pass through high-efficiency particulate air (HEPA) filters, sand filters, or both, prior to being released through stacks. For normal operations, the management controls and filter systems ensure minimal releases of radioactive materials and minimize the impacts on onsite personnel and offsite populations.

As shown by the results presented in this section for the MEI, the annual doses from normal releases under all alternatives are projected to represent small fractions of the annual doses the public would receive from natural background radiation at SRS (less than about 0.003 percent) and at LANL (less than about 0.02 percent). Public doses from background radiation at SRS and LANL are discussed in Chapter 3, Sections 3.1.6.1 and 3.2.6.1, respectively.

As indicated in the results for the SRS offsite MEI, the potential annual doses from normal filtered, particulate releases are on the order of 0.010 millirem. A conservative estimate of the dose to a noninvolved onsite SRS worker was calculated using the GENII 2 computer code. Assuming this worker was not shielded, was located 1,000 meters (3,300 feet) from the SRS facility with releases resulting in the highest offsite MEI dose, and was on site for 2,080 hours per year, the annual dose would be about 0.010 millirem. This dose is small and comparable to the dose received by the MEI. Thus, the small doses to noninvolved workers from normal facility operations were not evaluated further in this *SPD Supplemental EIS*. Doses to the offsite MEI, the offsite population, and the noninvolved worker under accident conditions were evaluated, however, as described in Appendix D of this *SPD Supplemental EIS*.

Workers at SRS may receive radiation doses slightly above those received by an individual at an offsite location. The average dose measured using thermoluminescent dosimeters near the burial grounds at the center of the site (E-Area) from 2007 through 2011 was 126 millirem; the average dose for this same 5-year period at an offsite control location (Highway 301) was 87 millirem. Because the onsite location is near active radioactive waste management operations, the dose may be conservatively high and not representative of other locations at the site. The 5-year average dose at another onsite monitoring location (D-Area) was 74 millirem, lower than the offsite location (WSRC 2008c; SRNS 2009b, 2010f, 2011, 2012b). This implies that there would be no significant difference between doses at onsite and offsite locations. Using the higher onsite location as a basis and adjusting the dose for a 2080-hour work-year, a worker could receive an annual dose of about 9 millirem from being on site at SRS. A 9-millirem dose is an increase of about 3 percent over the average annual dose one would receive from all sources of natural background radiation. The additional dose results in an increased annual risk of a latent fatal cancer of about 5×10^{-6}, or 1 chance in 200,000.

To compare the impacts among the alternatives, the total number of potential LCFs over the period of operations is reported. These estimates are generated by multiplying the annual number of potential LCFs associated with each facility by the total number of years the facility is projected to operate in support of surplus plutonium activities.

As discussed in Chapter 2, under each alternative, MOX fuel would be provided for use in domestic commercial nuclear power reactors. Appendix I describes the environmental impacts of using this MOX fuel. Although radiation levels at the surface of MOX fuel may be somewhat higher than those for LEU fuel, the occupational doses to plant workers during periods of MOX fuel loading and irradiation are expected to be similar to those for LEU fuel (TVA 2012). The only time an increase in dose would likely occur would be during acceptance inspections at the reactor when the fuel assemblies are first delivered to the plant and workers inspect the fuel assemblies to ensure that there are no apparent problems with them. 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. For MOX fuel use at the Browns Ferry and Sequoyah Nuclear Plants, however, TVA personnel have indicated that any potential increases in worker dose would be prevented through the continued implementation of aggressive programs to keep doses as low as reasonably achievable (ALARA). Worker doses at the reactors would continue to meet Federal regulatory dose limits as required by the U.S. Nuclear Regulatory Commission (NRC) in Title 10, *Code of Federal Regulations*, Part 20 (10 CFR Part 20).

As discussed in Appendix I potential doses to members of the public would result from emissions associated with reactor operations. No change in radiation dose to the public is expected from normal operation using a partial MOX fuel core compared to operations using a full LEU fuel core. This is consistent with findings in the *SPD EIS* (DOE 1999b).

4.1.2.1.1 No Action Alternative

Construction—Workers constructing PDCF in F-Area would be monitored (badged) as appropriate. As discussed in Section 4.1.2.1, construction workers at SRS may receive a small incremental dose associated with background doses at SRS. None of these exposures is expected to result in any additional LCFs to construction workforces.

Because there is no ground surface contamination in F-Area where PDCF would be constructed, there would be no additional radiological releases to the environment or impacts on the general population from construction activities at this location (DOE 1999b; NRC 2005a:4-7). The same condition applies to any other remaining F-Area construction activities, such as MFFF or WSB.

Operations—**Tables 4–3** and **4–4** summarize the annual and life-of-project (total) radiological impacts on operational workers and the public under the No Action Alternative and other alternatives being considered in this *SPD Supplemental EIS*.

The annual collective worker dose under the No Action Alternative (see Table 4–3), inclusive of all potential facility operations and processes, would be 300 person-rem at SRS and 29 person-rem at LANL, with no additional LCFs. Under this alternative, a comparatively small quantity of plutonium pits (2 metric tons [2.2 tons]) would be disassembled and converted to oxide at LANL. Over the life of the project, the collective dose to workers could result in an estimated 3 LCFs at SRS and none at LANL. The average annual dose per full-time-equivalent worker under this alternative would be 320 millirem at SRS and 340 millirem at LANL, with a corresponding risk of the worker developing a latent fatal cancer of about 2×10^{-4}, or 1 chance in 5,000, at both sites. The total latent cancer fatality risk per average full-time-equivalent worker over the life of this alternative would be about 3×10^{-3} at SRS, or about 1 chance in 330, and about 1×10^{-3} at LANL, or 1 chance in 1,000. At both sites, doses to actual workers would be monitored and maintained below administrative control levels through the implementation of engineered controls and management measures including implementation of administrative limits and as low as reasonably achievable programs.

Public. For normal operation of all facilities under the No Action Alternative, the annual population dose would be about 0.54 person-rem at SRS and 0.025 person-rem at LANL (see Table 4–4). These population doses are small fractions (about 0.0002 percent at SRS and 0.00001 percent at LANL) of the doses the same populations would receive from natural background radiation. Radiological emissions over the entire duration of the No Action Alternative are estimated to result in no LCFs in the populations surrounding SRS and LANL.

Table 4–3 Potential Radiological Impacts on Involved Workers from Operations by Alternative

Pit Disassembly and Conversion Option	*Alternative*				
	No Action	*Immobilization to DWPF*	*MOX Fuel*	*H-Canyon/HB-Line to DWPF*	*WIPP*
Total Workforce (number of radiation workers)					
PDCF					
at SRS	947	1,286	1,082	969	1,077
at LANL	85	85	85	85	85
PDC					
at SRS	N/A	N/A	1,082	969	1,077
at LANL			85	85	85
PF-4 and MFFF					
at SRS	N/A	938	734	621	729
at LANL		345	345	345	345
PF-4, H-Canyon/HB-Line, and MFFF [a]					
at SRS	N/A	1,088	884	771	879
at LANL		345	345	345	345
Annual Collective Worker Dose (person-rem per year)					
PDCF					
at SRS	300	620	320	310	360
at LANL	29	29	29	29	29
PDC					
at SRS	N/A	N/A	320	310	360
at LANL			29	29	29
PF-4 and MFFF					
at SRS	N/A	430	130	120	170
at LANL		190	190	190	190
PF-4, H-Canyon/HB-Line, and MFFF [a]					
at SRS	N/A	490	190	180	230
at LANL		190	190	190	190
Latent Cancer Fatalities from Annual Collective Worker Dose [b]					
PDCF					
at SRS	0 (0.2)	0 (0.4)	0 (0.2)	0 (0.2)	0 (0.2)
at LANL	0 (0.02)	0 (0.02)	0 (0.02)	0 (0.02)	0 (0.02)
PDC					
at SRS	N/A	N/A	0 (0.2)	0 (0.2)	0 (0.2)
at LANL			0 (0.02)	0 (0.02)	0 (0.02)
PF-4 and MFFF					
at SRS	N/A	0 (0.3)	0 (0.08)	0 (0.07)	0 (0.1)
at LANL		0 (0.1)	0 (0.1)	0 (0.1)	0 (0.1)
PF-4, H-Canyon/HB-Line, and MFFF [a]					
at SRS	N/A	0 (0.3)	0 (0.1)	0 (0.1)	0 (0.1)
at LANL		0 (0.1)	0 (0.1)	0 (0.1)	0 (0.1)
Latent Cancer Fatalities from Life-of-Project Collective Worker Dose [b]					
PDCF					
at SRS	3	5	3	3	3
at LANL	0 (0.1)	0 (0.1)	0 (0.1)	0 (0.1)	0 (0.1)
PDC					
at SRS	N/A	N/A	3	3	3
at LANL			0 (0.1)	0 (0.1)	0 (0.1)
PF-4 and MFFF					
at SRS	N/A	3	1	1	2
at LANL		3	3	3	3
PF-4, H-Canyon/HB-Line, and MFFF [a]					
at SRS	N/A	4	2	2	3
at LANL		3	3	3	3

Pit Disassembly and Conversion Option	Alternative				
	No Action	Immobilization to DWPF	MOX Fuel	H-Canyon/HB-Line to DWPF	WIPP
Average Annual Worker Dose (millirem) [c]					
PDCF					
at SRS	320	480	300	320	340
at LANL	340	340	340	340	340
PDC					
at SRS	N/A	N/A	300	320	340
at LANL			340	340	340
PF-4 and MFFF					
at SRS	N/A	460	180	190	240
at LANL		560	560	560	560
PF-4, H-Canyon/HB-Line, and MFFF [a]					
at SRS	N/A	450	210	230	260
at LANL		560	560	560	560
Latent Cancer Fatality Risk from Average Annual Worker Dose					
PDCF					
at SRS	2×10^{-4}	3×10^{-4}	2×10^{-4}	2×10^{-4}	2×10^{-4}
at LANL	2×10^{-4}	2×10^{-4}	2×10^{-4}	2×10^{-4}	2×10^{-4}
PDC					
at SRS	N/A	N/A	2×10^{-4}	2×10^{-4}	2×10^{-4}
at LANL			2×10^{-4}	2×10^{-4}	2×10^{-4}
PF-4 and MFFF					
at SRS	N/A	3×10^{-4}	1×10^{-4}	1×10^{-4}	1×10^{-4}
at LANL		3×10^{-4}	3×10^{-4}	3×10^{-4}	3×10^{-4}
PF-4, H-Canyon/HB-Line, and MFFF [a]					
at SRS	N/A	3×10^{-4}	1×10^{-4}	1×10^{-4}	2×10^{-4}
at LANL		3×10^{-4}	3×10^{-4}	3×10^{-4}	3×10^{-4}
Latent Cancer Fatality Risk from Life-of-Project Average Annual Worker Dose					
PDCF					
at SRS	3×10^{-3}	4×10^{-3}	3×10^{-3}	3×10^{-3}	3×10^{-3}
at LANL	1×10^{-3}	1×10^{-3}	1×10^{-3}	1×10^{-3}	1×10^{-3}
PDC					
at SRS	N/A	N/A	3×10^{-3}	3×10^{-3}	3×10^{-3}
at LANL			1×10^{-3}	1×10^{-3}	1×10^{-3}
PF-4 and MFFF					
at SRS	N/A	3×10^{-3}	2×10^{-3}	2×10^{-3}	3×10^{-3}
at LANL		7×10^{-3}	7×10^{-3}	7×10^{-3}	7×10^{-3}
PF-4, H-Canyon/HB-Line, and MFFF [a]					
at SRS	N/A	3×10^{-3}	2×10^{-3}	2×10^{-3}	3×10^{-3}
at LANL		7×10^{-3}	7×10^{-3}	7×10^{-3}	7×10^{-3}

DWPF = Defense Waste Processing Facility; LANL = Los Alamos National Laboratory; MFFF = Mixed Oxide Fuel Fabrication Facility; MOX = mixed oxide; N/A = not applicable; PDC = Pit Disassembly and Conversion Project; PDCF = Pit Disassembly and Conversion Facility; PF-4 = Plutonium Facility; SRS = Savannah River Site; WIPP = Waste Isolation Pilot Plant.

[a] Includes the contribution from the K-Area Complex glovebox pit disassembly activities prior to processing at H-Canyon/HB-Line.

[b] The number of excess LCFs in the population would occur as a whole number. If the number is zero, the value calculated by multiplying the dose by a risk factor of 0.0006 LCF per person-rem (DOE 2003a) is presented in parentheses.

[c] Engineering and administrative controls would be implemented to maintain individual worker doses below 2,000 millirem per year (DOE 2009a) and as low as reasonably achievable.

Note: Sums and products presented in the table may differ from those calculated from table entries here and in the appendices due to rounding. Values are derived from analyses presented in Appendix C. To convert metric tons to tons, multiply by 1.1023.

Table 4–4 Potential Radiological Impacts on the Public from Operations by Alternative

Pit Disassembly and Conversion Option	*Alternative*				
	No Action	*Immobilization to DWPF*	*MOX Fuel*	*H-Canyon/ HB-Line to DWPF*	*WIPP*
Population within 50 Miles (80 kilometers)					
Annual Population Dose (person-rem)					
PDCF					
at SRS at LANL	0.54 0.025	0.54 0.025	0.80 0.025	0.80 0.025	0.80 0.025
PDC					
at SRS at LANL	N/A	N/A	0.78 0.025	0.78 0.025	0.78 0.025
PF-4 and MFFF					
at SRS at LANL	N/A	0.45 0.21	0.71 0.21	0.71 0.21	0.71 0.21
PF-4, H-Canyon/HB-Line, and MFFF [a]					
at SRS at LANL	N/A	0.71 0.21	0.97 0.21	0.97 0.21	0.97 0.21
LCFs from Annual Population Dose					
PDCF					
at SRS at LANL	0 (3×10^{-4}) 0 (2×10^{-5})	0 (3×10^{-4}) 0 (2×10^{-5})	0 (5×10^{-4}) 0 (2×10^{-5})	0 (5×10^{-4}) 0 (2×10^{-5})	0 (5×10^{-4}) 0 (2×10^{-5})
PDC					
at SRS at LANL	N/A	N/A	0 (5×10^{-4}) 0 (2×10^{-5})	0 (5×10^{-4}) 0 (2×10^{-5})	0 (5×10^{-4}) 0 (2×10^{-5})
PF-4 and MFFF					
at SRS at LANL	N/A	0 (3×10^{-4}) 0 (1×10^{-4})	0 (4×10^{-4}) 0 (1×10^{-4})	0 (4×10^{-4}) 0 (1×10^{-4})	0 (4×10^{-4}) 0 (1×10^{-4})
PF-4, H-Canyon/HB-Line, and MFFF [a]					
at SRS at LANL	N/A	0 (4×10^{-4}) 0 (1×10^{-4})	0 (6×10^{-4}) 0 (1×10^{-4})	0 (6×10^{-4}) 0 (1×10^{-4})	0 (6×10^{-4}) 0 (1×10^{-4})
LCFs from Life-of-Project Population Dose [b]					
PDCF					
at SRS at LANL	0 (4×10^{-3}) 0 (1×10^{-4})	0 (4×10^{-3}) 0 (1×10^{-4})	0 (6×10^{-3}) 0 (1×10^{-4})	0 (6×10^{-3}) 0 (1×10^{-4})	0 (8×10^{-3}) 0 (1×10^{-4})
PDC					
at SRS at LANL	N/A	N/A	0 (6×10^{-3}) 0 (1×10^{-4})	0 (6×10^{-3}) 0 (1×10^{-4})	0 (8×10^{-3}) 0 (1×10^{-4})
PF-4 and MFFF					
at SRS at LANL	N/A	0 (5×10^{-3}) 0 (3×10^{-3})	0 (7×10^{-3}) 0 (3×10^{-3})	0 (8×10^{-3}) 0 (3×10^{-3})	0 (9×10^{-3}) 0 (3×10^{-3})
PF-4, H-Canyon/HB-Line, and MFFF [a]					
at SRS at LANL	N/A	0 (8×10^{-3}) 0 (3×10^{-3})	0 (9×10^{-3}) 0 (3×10^{-3})	0 (1×10^{-2}) 0 (3×10^{-3})	0 (1×10^{-2}) 0 (3×10^{-3})
Maximally Exposed Individual					
Annual MEI Dose (millirem) [c]					
PDCF					
at SRS at LANL	0.0066 0.0097	0.0066 0.0097	0.0091 0.0097	0.0091 0.0097	0.0091 0.0097
PDC					
at SRS at LANL	N/A	N/A	0.0097 0.0097	0.0097 0.0097	0.0097 0.0097
PF-4 and MFFF					
at SRS at LANL	N/A	0.0052 0.081	0.0077 0.081	0.0077 0.081	0.0077 0.081
PF-4, H-Canyon/HB-Line, and MFFF [a]					
at SRS at LANL	N/A	0.0076 0.081	0.010 0.081	0.010 0.081	0.010 0.081

Pit Disassembly and Conversion Option	Alternative				
	No Action	**Immobilization to DWPF**	**MOX Fuel**	**H-Canyon/ HB-Line to DWPF**	**WIPP**
LCF Risk from Annual MEI Dose					
PDCF					
at SRS	4×10^{-9}	4×10^{-9}	5×10^{-9}	5×10^{-9}	5×10^{-9}
at LANL	6×10^{-9}	6×10^{-9}	6×10^{-9}	6×10^{-9}	6×10^{-9}
PDC					
at SRS	N/A	N/A	6×10^{-9}	6×10^{-9}	6×10^{-9}
at LANL			6×10^{-9}	6×10^{-9}	6×10^{-9}
PF-4 and MFFF					
at SRS	N/A	3×10^{-9}	5×10^{-9}	5×10^{-9}	5×10^{-9}
at LANL		5×10^{-8}	5×10^{-8}	5×10^{-8}	5×10^{-8}
PF-4, H-Canyon/HB-Line, and MFFF [a]					
at SRS	N/A	5×10^{-9}	6×10^{-9}	6×10^{-9}	6×10^{-9}
at LANL		5×10^{-8}	5×10^{-8}	5×10^{-8}	5×10^{-8}
LCF Risk from Life-of-Project MEI Dose					
PDCF					
at SRS	5×10^{-8}	5×10^{-8}	7×10^{-8}	7×10^{-8}	9×10^{-8}
at LANL	4×10^{-8}	4×10^{-8}	4×10^{-8}	4×10^{-8}	4×10^{-8}
PDC					
at SRS	N/A	N/A	8×10^{-8}	8×10^{-8}	9×10^{-8}
at LANL			4×10^{-8}	4×10^{-8}	4×10^{-8}
PF-4 and MFFF					
at SRS	N/A	6×10^{-8}	8×10^{-8}	8×10^{-8}	1×10^{-7}
at LANL		1×10^{-6}	1×10^{-6}	1×10^{-6}	1×10^{-6}
PF-4, H-Canyon/HB-Line, and MFFF [a]					
at SRS	N/A	9×10^{-8}	1×10^{-7}	1×10^{-7}	1×10^{-7}
at LANL		1×10^{-6}	1×10^{-6}	1×10^{-6}	1×10^{-6}
Average Exposed Individual					
Annual Average Individual Dose (millirem)					
PDCF					
at SRS	0.00062	0.00062	0.00092	0.00092	0.00092
at LANL	0.000056	0.000056	0.000056	0.000056	0.000056
PDC					
at SRS	N/A	N/A	0.00093	0.00093	0.00093
at LANL			0.000056	0.000056	0.000056
PF-4 and MFFF					
at SRS	N/A	0.00051	0.00081	0.00081	0.00081
at LANL		0.00047	0.00047	0.00047	0.00047
PF-4, H-Canyon/HB-Line, and MFFF [a]					
at SRS	N/A	0.00081	0.0011	0.0011	0.0011
at LANL		0.00047	0.00047	0.00047	0.00047
LCF Risk from Annual Average Individual Dose					
PDCF					
at SRS	4×10^{-10}	4×10^{-10}	6×10^{-10}	5×10^{-10}	5×10^{-10}
at LANL	3×10^{-11}	3×10^{-11}	3×10^{-11}	3×10^{-11}	3×10^{-11}
PDC					
at SRS	N/A	N/A	6×10^{-10}	6×10^{-10}	6×10^{-10}
at LANL			3×10^{-11}	3×10^{-11}	3×10^{-11}
PF-4 and MFFF					
at SRS	N/A	3×10^{-10}	5×10^{-10}	5×10^{-10}	5×10^{-10}
at LANL		3×10^{-10}	3×10^{-10}	3×10^{-10}	3×10^{-10}
PF-4, H-Canyon/HB-Line, and MFFF [a]					
at SRS	N/A	5×10^{-10}	7×10^{-10}	7×10^{-10}	7×10^{-10}
at LANL		3×10^{-10}	3×10^{-10}	3×10^{-10}	3×10^{-10}

Pit Disassembly and Conversion Option	Alternative: No Action	Immobilization to DWPF	MOX Fuel	H-Canyon/ HB-Line to DWPF	WIPP
LCF Risk from Life-of-Project Average Individual Dose					
PDCF					
at SRS at LANL	4×10^{-9} 2×10^{-10}	5×10^{-9} 2×10^{-10}	7×10^{-9} 2×10^{-10}	7×10^{-9} 2×10^{-10}	9×10^{-9} 2×10^{-10}
PDC					
at SRS at LANL	N/A	N/A	7×10^{-9} 2×10^{-10}	7×10^{-9} 2×10^{-10}	9×10^{-9} 2×10^{-10}
PF-4 and MFFF					
at SRS at LANL	N/A	6×10^{-9} 6×10^{-9}	8×10^{-9} 6×10^{-9}	9×10^{-9} 6×10^{-9}	1×10^{-8} 6×10^{-9}
PF-4, H-Canyon/HB-Line, and MFFF [a]					
at SRS at LANL	N/A	9×10^{-9} 6×10^{-9}	1×10^{-8} 6×10^{-9}	1×10^{-8} 6×10^{-9}	1×10^{-8} 6×10^{-9}

DWPF = Defense Waste Processing Facility; LANL = Los Alamos National Laboratory; LCF = latent cancer fatality; MEI = maximally exposed individual; MFFF = Mixed Oxide Fuel Fabrication Facility; MOX = mixed oxide; N/A = not applicable; PDC = Pit Disassembly and Conversion Project; PDCF = Pit Disassembly and Conversion Facility; PF-4 = Plutonium Facility; SRS = Savannah River Site; WIPP = Waste Isolation Pilot Plant.

[a] Under the PF-4, H-Canyon/HB-Line, and MFFF Option, potential doses to members of the public from pit disassembly activities using the K-Area Complex glovebox would be extremely small (less than those from operation of the K-Area Interim Surveillance capability) (SRNL 2013). The potential doses that would be incurred from such operations would essentially be in the form of direct (gamma or neutron) exposure and, thus, facility workers would be the only viable receptors.

[b] The number of excess LCFs in the population would occur as a whole number. If the number is zero, the value calculated by multiplying the dose by a risk factor of 0.0006 LCF per person-rem (DOE 2003a) is presented in parentheses.

[c] The regulatory limit for dose to a member of the public from all DOE sources, due to release of radioactive material other than radon into the air, is 10 millirem per year (40 CFR Part 61, Subpart H).

Note: Sums and products presented in the table may differ from those calculated from table entries here and in the appendices due to rounding. Values are derived from analyses presented in Appendix C. To convert metric tons to tons, multiply by 1.1023.

The dose to the MEI is determined by conservatively assuming the MEI receives the maximum dose from each of the facilities from concurrent annual operations. The MEI dose at SRS from 1 year of operations would be 0.0066 millirem, or about 0.002 percent of the dose from natural background radiation. The risk of a latent fatal cancer associated with the dose from 1 year of operations would be about 4×10^{-9}, or 1 chance in 250 million. The MEI dose at LANL from 1 year of operations would be 0.0097 millirem, or about 0.002 percent of the dose from natural background radiation. The risks of a latent fatal cancer associated with the dose from 1 year of operations would be about 6×10^{-9}, or about 1 chance in 170 million. At SRS, the total risk of a latent fatal cancer to the MEI from the dose received over the life of the No Action Alternative would be about 5×10^{-8}. Accordingly, there is 1 chance in 20 million that the MEI would develop an LCF from exposures received over the life of the project. The total risk of a latent fatal cancer to the MEI at LANL from the dose received over the life of the No Action Alternative would be about 4×10^{-8}. In other words, there is 1 chance in 25 million that the LANL MEI would develop a latent fatal cancer from exposures received over the life of the project.

Activities at E-Area in support of this alternative are expected to result in negligible incremental impacts on both workers and the public from the staging of TRU waste awaiting shipment to WIPP, as well as any potential low-level radioactive waste (LLW) or mixed low-level radioactive waste (MLLW) pending offsite shipment, or disposal of LLW (SRNL 2013). Similarly, activities at TA-54 or TA-63 at LANL in support of pit disassembly and conversion activities at that site would result in no incremental impacts on either workers or the public (LANL 2013a).

4.1.2.1.2 Immobilization to DWPF Alternative

Construction—Under the Immobilization to DWPF Alternative, construction of the new immobilization capability at K-Area and minor modifications to DWPF to accommodate receipt of can-in-canisters would be required. The majority of the construction activities would occur in areas having dose rates close to background levels, although there would be existing equipment at K-Area that would require decontamination and removal. The external dose rates from this equipment would be low. Annual dose rates to the workforce during the 2 years of decontamination and equipment removal at K-Area would be about 3.3 person-rem per year; the average individual dose rate would be about 46 millirem per year for a construction workforce of 72 workers (SRNS 2012a). Minimal worker doses would result from minor modifications to DWPF (WSRC 2008a). As shown in **Table 4–5**, the total construction workforce dose over the 2-year period of decontamination and equipment removal at K-Area would be 6.6 person-rem. Table 4–5 shows other construction activities, including facility modifications, necessary to implement certain pit disassembly and conversion options and to implement certain disposition options. As shown in the table, the construction activities apply under some alternatives, but not others.

Table 4–5 Workforce Dose for Individual Facility Construction and Modification Activities

Facility Constructed or Modified (Site)	*Duration (years)*	*Total Workforce Dose (person-rem)*	*LCFs From Total Workforce Dose* [a]	*Alternatives*				
				No Action	*Immobilization to DWPF*	*MOX Fuel*	*H-Canyon/ HB-Line to DWPF*	*WIPP*
Pit Disassembly and Conversion Option Facilities								
PDC (SRS)	2	1.0	6×10^{-4}			✓	✓	✓
K-Area glovebox for pit disassembly (SRS)	2	4.0	2×10^{-3}		✓	✓	✓	✓
H-Canyon/HB-Line for dissolution and oxidation (SRS)	2	2.0	1×10^{-3}		✓	✓	✓	✓
PF-4 (for 35 metric tons plutonium throughput) (LANL)	8	140	8×10^{-2}		✓	✓	✓	✓
Disposition Option Facilities								
Immobilization capability in K-Area (SRS)	2	6.6	4×10^{-3}		✓			
H-Canyon/HB-Line for preparation for WIPP disposal (SRS)	2	1.2	7×10^{-4}					✓

DWPF = Defense Waste Processing Facility; LANL = Los Alamos National Laboratory; LCF = latent cancer fatality; MOX = mixed oxide; PDC = Pit Disassembly and Conversion Project; PF-4 = Plutonium facility; SRS = Savannah River Site; WIPP = Waste Isolation Pilot Plant.

[a] LCFs are estimated using a risk factor of 0.0006 LCF per person-rem (DOE 2003a).

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

Additional construction worker doses could occur depending on the pit disassembly and conversion option.

Under the PDCF Option and as addressed in Section 4.1.2.1.1, there would be no doses to workers constructing PDCF other than those associated with background doses at SRS.

Under the PF-4, H-Canyon/HB-Line, and MFFF Option, modifications would be required to the K-Area Complex (for pit disassembly) and H-Canyon/HB-Line (for conversion). At the K-Area Complex, a glovebox would be decontaminated and equipment replaced, resulting in a collective dose of 2.0 person-rem per year to a construction workforce of 20 workers; this would yield an average construction worker dose of 100 millirem per year. The total construction worker dose received over the 2 years required to complete modifications would be 4.0 person-rem. Modifications to H-Canyon/HB-Line would result in a collective dose of up to 1.0 person-rem per year to a construction workforce of 10; this results in an average construction worker dose of 100 millirem per year. The total construction worker dose received over the 2 years required to complete modifications would be 2.0 person-rem.

Under the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option, metal oxidation furnaces would be added to MFFF. Because the oxidation furnaces would be installed in an area set aside in MFFF, construction workers would not be expected to receive any occupational radiation doses.

At SRS, total worker doses for construction or modification of all applicable facilities would range from about 6.6 to 13 person-rem, depending on the pit disassembly and conversion option. No LCFs (4×10^{-3} to 8×10^{-3}) among construction workers would be expected from these doses.

At LANL under the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option, PF-4 modification activities (e.g., glovebox installations, modifications, and installation of uncontaminated equipment) could result in a collective dose of 18 person-rem per year to a construction workforce of 60 workers. The average construction worker dose would be 300 millirem per year. Modifications would continue over 8 years, resulting in a total workforce dose of 140 person-rem. No LCFs (8×10^{-2}) among construction workers would be expected from these doses.

At both SRS and LANL, the public would receive no doses or associated LCFs as the result of construction activities.

Operations—The potential annual and life-of-project (total) radiological impacts on workers and the public from normal operations under this alternative are summarized in Tables 4–3 and 4–4. Under this alternative, the impacts would vary depending on the pit disassembly and conversion option employed.

Workers. The annual collective dose to SRS workers under the Immobilization to DWPF Alternative (see Table 4–3), inclusive of all potential facility operations and processes, would range from 430 to 620 person-rem. The annual collective dose to LANL workers would range from 29 to 190 person-rem. Over the life of the project, the collective dose to SRS workers could result in an estimated 3 to 5 LCFs. At LANL over the life of the project, the collective dose to LANL workers would result in an estimated 0 to 3 LCFs. The average annual dose per full-time-equivalent SRS worker under this alternative would range from approximately 450 to 480 millirem, with a corresponding risk of the worker developing a latent fatal cancer of about 3×10^{-4}, or about 1 chance in 3,300. The average annual dose per full-time-equivalent LANL worker would range from approximately 340 millirem to 560 millirem, with a corresponding risk of the worker developing a latent fatal cancer of 2×10^{-4} (1 chance in 5,000) to 3×10^{-4} (about 1 chance in 3,300). Over the life of the project, the total average LCF risk per full-time-equivalent SRS worker would range from about 3×10^{-3}, or about 1 chance in 330, to 4×10^{-3}, or 1 chance in 250. Over the life of the project, the total average LCF risk per full-time-equivalent worker at LANL would range from about 1×10^{-3}, or 1 chance in 1,000, to 7×10^{-3}, or about 1 chance in 140. Doses to actual workers would be monitored and maintained below administrative control levels through the implementation of engineered controls, administrative limits, and ALARA programs.

Public. Potential radiological impacts on members of the public are summarized in Table 4–4. For normal operations under the Immobilization to DWPF Alternative, the annual population dose would range from 0.45 to 0.71 person-rem at SRS, and 0.025 to 0.21 person-rem at LANL, depending on the pit disassembly and conversion option. These population doses are a small fraction (about 0.0003 percent at SRS and 0.0001 percent at LANL) of the dose the same populations would receive from natural background radiation. Activities occurring over the entire duration of the Immobilization to DWPF Alternative are estimated to result in no LCFs in the population at either SRS or LANL.

The annual dose to the MEI at SRS would range from 0.0052 to 0.0076 millirem, or less than about 0.002 percent of the dose from natural background radiation, depending on the pit disassembly and conversion option. The risk of a latent fatal cancer associated with the dose from 1 year of operations would range from 3×10^{-9} to 5×10^{-9}. The risk of a latent fatal cancer to the MEI from surplus plutonium activities at SRS over the entire duration of this alternative would range from 5×10^{-8} to 9×10^{-8}. Thus, there is less than 1 chance in about 11 million that the dose received by the SRS MEI would result in a latent fatal cancer.

At LANL, the annual dose to the MEI from surplus plutonium operations at PF-4 would range from about 0.0097 millirem to 0.081 millirem, or less than about 0.02 percent of the dose from natural background radiation. The risk of a latent fatal cancer associated with the dose from 1 year of operations would range from 6×10^{-9} to 5×10^{-8}. The risk of a latent fatal cancer to this hypothetical individual from surplus plutonium operations at LANL over the entire duration of this alternative would range from 4×10^{-8}

to 1×10^{-6}. Thus, there is 1 chance in 1 million, or less, that the dose received by the LANL MEI over the life of the project would result in a latent fatal cancer.

4.1.2.1.3 MOX Fuel Alternative

Construction—Under all pit disassembly and conversion options, there would be minor modifications to H-Canyon/HB-Line to support the potential disposition of 2 metric tons (2.2 tons) of plutonium to WIPP. These minor modifications would be made as part of normal operations. More extensive modifications to allow processing larger quantities of plutonium for potential disposal at WIPP are addressed in Section 4.1.2.1.5, WIPP Alternative. Additional construction worker doses could occur depending on the pit disassembly and conversion option.

Under the PDCF Option, as addressed in Section 4.1.2.1.1, there would be no doses to workers constructing PDCF other than those associated with background doses at SRS.

Under the PDC Option, decontamination and equipment removal would be required at the K-Area Complex as part of construction activities. An average workforce of 28 would perform the decontamination and equipment removal in 2 years. The average worker dose from this activity would be 18 millirem per year. The collective worker dose would be 0.5 person-rem per year, or 1 person-rem to complete the decontamination and equipment removal.

Under the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option, metal oxidation furnaces would be added to MFFF as addressed under the Immobilization to DWPF Alternative (Section 4.1.2.1.2) with no occupational radiation doses among construction workers.

Under the PF-4, H-Canyon/HB-Line, and MFFF Option, doses to workers from modifications to the K-Area Complex and H-Area to support pit disassembly and conversion would be the same as those for this option under the Immobilization to DWPF Alternative (Section 4.1.2.1.2).

At SRS, total worker doses from construction or modification of all applicable facilities would range from negligible to about 6.0 person-rem, depending on the pit disassembly and conversion option. No LCFs (up to 4×10^{-3}) among construction workers would be expected from these doses.

At LANL under the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option, PF-4 modification activities would result in the same doses and risks among construction workers as those under the Immobilization to DWPF Alternative (Section 4.1.2.1.2).

At both SRS and LANL, there would be no doses and associated LCFs in the public as the result of construction activities.

Operations—The potential annual and life-of-project (total) radiological impacts on workers and the public from normal operations under the MOX Fuel Alternative are summarized in Tables 4–3 and 4–4. Under this alternative, a range of impacts is possible, depending on the pit disassembly and conversion option.

Workers. The annual collective dose to workers under the MOX Fuel Alternative (see Table 4–3), inclusive of all potential facility operations and processes, would range from 130 to 320 person-rem at SRS, depending on the pit disassembly and conversion option, and from 29 to 190 person-rem at LANL. Over the life of the project, the collective dose to workers could result in 1 to 3 LCFs at SRS and 0 to 3 LCFs at LANL. The average annual dose per full-time-equivalent SRS worker would range from 180 to 300 millirem, with a corresponding risk of the worker developing a latent fatal cancer of 1×10^{-4} (1 chance in 10,000) to 2×10^{-4} (1 chance in 5,000). The average annual dose per full-time-equivalent LANL worker would range from approximately 340 to 560 millirem, with a corresponding risk of the worker developing a latent fatal cancer ranging from 2×10^{-4} (1 chance in 5,000) to 3×10^{-4} (about 1 chance in 3,300). Over the life of the project, the total average latent cancer fatality risk per full-time-equivalent worker would range from about 2×10^{-3} (1 chance in 500) to 3×10^{-3} (about 1 chance in 330) at SRS and range from about 1×10^{-3} (1 chance in 1,000) to 7×10^{-3} (about 1 chance in 140) at

LANL. Doses to actual workers would be monitored and maintained below administrative control levels through the implementation of engineered controls, administrative limits, and ALARA programs.

Public. For normal operations of the facilities under the MOX Fuel Alternative (see Table 4–4), the annual population dose at SRS would range from 0.71 to 0.97 person-rem, depending on the pit disassembly and conversion option. These doses are small fractions (less than about 0.0004 percent) of the doses the same population would receive from natural background radiation. Activities occurring over the entire duration of the MOX Fuel Alternative are estimated to result in no LCFs in the population.

The annual dose to the MEI at SRS would range from 0.0077 to 0.010 millirem, or less than about 0.003 percent of the dose from natural background radiation. The risk of a latent fatal cancer associated with the dose from 1 year of operations would be 5×10^{-9} to 6×10^{-9}. The risk of a latent fatal cancer to the MEI from surplus plutonium activities at SRS over the entire duration of this alternative would range from 7×10^{-8} to 1×10^{-7}. Thus, there is 1 chance in 10 million, or less, that the dose received by the SRS MEI would result in a latent fatal cancer.

At LANL, the ranges in doses and risks to the surrounding population and MEI from surplus plutonium operations would be the same as those for the Immobilization to DWPF Alternative (Section 4.1.2.1.2).

4.1.2.1.4 H-Canyon/HB-Line to DWPF Alternative

Construction—Under all pit disassembly and conversion options, there would be minor modifications at H-Canyon/HB-Line to support dissolution of 6 metric tons (6.6 tons) of non-pit plutonium as a precursor for vitrification at DWPF. These modifications would be made as part of normal operations at H-Canyon/HB-Line. Any additional worker radiation doses and risks from construction activities under the pit disassembly and conversion options would be the same as those for these options under the MOX Fuel Alternative (Section 4.1.2.1.3). Total worker doses and risks at SRS for construction or modification of all applicable facilities would also be the same as those under the MOX Fuel Alternative.

At LANL under the PF-4 and MFFF or PF-4, H-Canyon/HB-Line, and MFFF Option, PF-4 modification activities would result in the same doses and risks among construction workers as those under the Immobilization to DWPF Alternative (Section 4.1.2.1.2).

At both SRS and LANL, there would be no doses and associated LCFs in the public as the result of construction activities.

Operations—The potential annual and life-of-project (total) radiological impacts on workers and the public from normal operations under the H-Canyon/HB-Line to DWPF Alternative are summarized in Tables 4–3 and 4–4. Under this alternative, a range of impacts is possible depending on the pit disassembly and conversion option.

Workers. The annual collective dose to SRS workers under the H-Canyon/HB-Line to DWPF Alternative (see Table 4–3), inclusive of all potential facility operations/processes would range from 120 to 310 person-rem. Over the life of the project, the collective dose to SRS workers would result in an estimated 1 to 3 LCFs. The average annual dose per full-time-equivalent SRS worker could range from approximately 190 to 320 millirem, with a corresponding annual risk of the worker developing a latent fatal cancer of about 1×10^{-4} (1 chance in 10,000) to 2×10^{-4} (1 chance in 5,000). Over the life of the project, the total average latent cancer fatality risk per full-time-equivalent SRS worker would range from about 2×10^{-3} (1 chance in 500) to 3×10^{-3} (about 1 chance in 330). Doses and risks to LANL workers would be the same as those presented for the MOX Fuel Alternative (Section 4.1.2.1.3). At both sites, doses to actual workers would be monitored and maintained below administrative control levels through the implementation of engineered controls, administrative limits, and ALARA programs.

Public. For normal operations of SRS facilities under the H-Canyon/HB-Line to DWPF Alternative (see Table 4–4), the annual population dose would range from 0.71 to 0.97 person-rem depending on the pit disassembly and conversion option. This dose is a small fraction (less than about 0.0004 percent) of the dose the same population would receive from natural background radiation. Activities occurring over the entire duration of the H-Canyon/HB-Line to DWPF Alternative are estimated to result in no LCFs in the population in the SRS vicinity.

The annual dose to the MEI at SRS would range from 0.0077 to 0.010 millirem, or about 0.003 percent of the dose from natural background radiation. The risk of a latent fatal cancer associated with the dose from 1 year of operations would range from 5×10^{-9} to 6×10^{-9}. The risk of a latent fatal cancer to the MEI from surplus plutonium activities at SRS over the entire duration of this alternative would range from about 7×10^{-8} to 1×10^{-7}. Thus, there is 1 chance in 10 million, or less, that the dose received by the SRS MEI would result in a latent fatal cancer.

At LANL, the ranges in doses and risks to the surrounding population and MEI from surplus plutonium operations at PF-4 would be the same as those presented for the Immobilization to DWPF Alternative (Section 4.1.2.1.2).

4.1.2.1.5 WIPP Alternative

Construction—Under all pit disassembly and conversion options, some radiation doses and risks could occur among SRS workers from modifications to the HB-Line to support preparation of 6 metric tons (6.6 tons) of non-pit plutonium and 7.1 metric tons (7.8 tons) of pit plutonium for potential disposal at WIPP. These activities are estimated to result in an annual collective dose of 0.58 person-rem per year to a construction workforce of 10. Over the 2 years required for the modifications, the workforce would receive a total collective dose of 1.2 person-rem. Any additional worker radiation doses and risks from construction activities under the pit disassembly and conversion options would be the same as those for these options under the MOX Fuel Alternative (Section 4.1.2.1.3).

At SRS, total worker doses for construction or modification of all applicable facilities would range from about 1.2 to 7.2 person-rem, depending on the pit disassembly and conversion option. No LCFs (7×10^{-4} to 4×10^{-3}) among construction workers would be expected from these doses.

At LANL under the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option, PF-4 modifications to enhance LANL's pit disassembly and conversion capability would result in the same doses and risks among construction workers as those under the Immobilization to DWPF Alternative (Section 4.1.2.1.2). Enhancing the LANL capability to prepare, characterize, and stage plutonium for potential WIPP disposal is not expected to result in substantial additional radiological doses and risks among workers.

At both SRS and LANL, there would be no doses and associated LCFs in the public as the result of construction activities.

Operations—The potential annual and life-of-project (total) radiological impacts on workers and the public from normal operations under the WIPP Alternative are summarized in Tables 4–3 and 4–4. Under this alternative, a range of impacts is possible depending on the pit disassembly and conversion option.

Workers. The annual collective dose to SRS workers under the WIPP Alternative (see Table 4–3), inclusive of all potential facility operations and processes, would range from 170 to 360 person-rem per year, with no corresponding additional LCFs. Over the life of the project, the collective dose to SRS workers could result in an estimated 2 to 3 LCFs. The average annual dose per full-time-equivalent SRS worker under this alternative would range from approximately 240 to 340 millirem, with a corresponding risk of the worker developing a latent fatal cancer of about 1×10^{-4} (1 chance in 10,000) to 2×10^{-4} (1 chance in 5,000). Over the life of the project, the total average latent cancer fatality risk per full-time-equivalent SRS worker would be about 3×10^{-3} (about 1 chance in 330). Under the PF-4 and MFFF and PF-4, H-Canyon/HB-Line, and MFFF Options, pit plutonium could be prepared at LANL for potential WIPP disposal rather than at SRS. If this were to occur, there would be a commensurate reduction in the life-of-project doses and risks to workers at SRS.

Conversely, if pit plutonium were prepared at LANL for potential WIPP disposal, there could be worker exposure at LANL in addition to that evaluated in Section 4.1.2.1.2 and Table 4–3. Should the Department proceed with this approach, more detailed information would be developed regarding the levels of exposure that could be experienced by workers engaged in WIPP preparation activities at LANL, and the number of operational workers that could be required. It is expected, however, that workers at TA-55 facilities preparing plutonium for potential WIPP disposal could receive radiation doses comparable to those estimated in Appendix G, Table G–3, for workers preparing plutonium for potential WIPP disposal at H-Canyon/HB-Line at SRS. That is, the average worker involved in this activity at H-Canyon/HB-Line is estimated to receive an annual dose of approximately 460 millirem with a calculated risk of an LCF of 3×10^{-4}, and with 130 occupationally exposed workers receiving an annual collective dose of 60 person-rem with an annual collective risk of an LCF of 4×10^{-2}. These annual doses and risks at SRS are expected to envelope those doses and risks that could be experienced by workers performing WIPP preparation activities at TA-55. There could also be additional annual worker exposures at the principal LANL support facilities as part of characterizing and staging additional CH-TRU waste for offsite disposal. The total dose and risk experienced by LANL workers over the life of the project would depend on the total quantity of pit plutonium prepared at LANL for potential WIPP disposal.

At both sites, doses to actual workers would be monitored and maintained below administrative control levels through the implementation of engineered controls, administrative limits, and ALARA programs.

Public. For normal operations of SRS facilities under the WIPP Alternative (see Table 4–4), the annual population dose would range from 0.71 to 0.97 person-rem, depending on the pit disassembly and conversion option. This dose is a small fraction (less than 0.0004 percent) of the dose the same population would receive from natural background radiation. Activities occurring over the entire duration of the WIPP Alternative are estimated to result in no LCFs in the population

The annual dose to the MEI at SRS would range from 0.0077 to 0.010 millirem, or less than 0.003 percent of the dose from natural background radiation. The risk of a latent fatal cancer associated with the dose from 1 year of operations would range from about 5×10^{-9} to 6×10^{-9}. The risk of a latent fatal cancer to this hypothetical individual from surplus plutonium disposition activities at SRS over the entire duration of this alternative would range from about 9×10^{-8} to 1×10^{-7}. Thus, there is 1 chance in 10 million, or less, that the dose received by the SRS MEI would result in a latent fatal cancer.

To the extent under the PF-4 and MFFF and PF-4, H-Canyon/HB-Line, and MFFF Options that pit plutonium was prepared at LANL for potential WIPP disposal rather than at SRS, annual impacts to the public in the SRS region are expected to be essentially unchanged; however, life-of-project public impacts in the SRS region would be reduced.

At LANL, assuming under the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option that 7.1 metric tons (7.8 tons) of pit plutonium were shipped to SRS for preparation for WIPP disposal, the ranges in doses and risks to the surrounding population and MEI from surplus plutonium operations at PF-4 would be the same as those presented for the Immobilization to DWPF Alternative (Section 4.1.2.1.2). Preparation of some or all of this pit plutonium at LANL for potential WIPP disposal is not expected to result in significant additional annual public doses and risks in the LANL region. Although detailed information is not available about the design and operation of an enhanced WIPP preparation capability, preparation of pit plutonium at LANL for potential WIPP disposal is expected to represent a minor variation on operations at PF-4 involving pit disassembly and conversion, and a minor increase in operations at the principal LANL support facilities. The LANL surplus plutonium disposition program could be extended by a few years, however, as could the life-of-project public risks summarized in Table 4–4.

4.1.2.2 DOE Facility Radiological Accidents

The potential consequences of high-consequence accidents from facility operations under each of the alternatives are reported in this section. Accident analyses are based primarily on accident scenarios and source terms reported in previous NEPA analyses, including the *SPD EIS* (DOE 1999b), and current safety documents (WGI 2005a; WSMS 2007; WSRC 2006c, 2006d, 2006e, 2007c, 2007d, 2007e, 2007h, 2007i, 2007j, 2007k, 2009). For facilities not directly evaluated in the *SPD EIS* (MSA, KIS, PDC, H-Canyon/HB-Line, and DWPF at SRS, and PF-4 at LANL), accident scenarios and source terms were taken from NEPA (and safety) analyses supporting their operations. More details on methodology, potential accidents, source terms, and consequences are presented in Appendix D of this *SPD Supplemental EIS*.

Documented safety analyses (DSAs) have been prepared for a number of the facilities evaluated in this *SPD Supplemental EIS*. A central focus of the DSA process is to demonstrate that sufficient safety controls have been put in place, as opposed to quantifying an absolute value of risk. In general, DSAs do not attempt to establish best estimates of the probabilities or consequences of potential accidents. Consistent with their purpose, source terms and other assumptions used for bounding DSA frequency and consequence estimates are conservative. In other words, the DSA process accounts for the inherent uncertainties associated with quantifying risk by requiring conservative assumptions be made to ensure the final safety control set is comprehensive and adequate. In reality, the actual risk of the scenarios may be much lower than portrayed in DSAs.

This situation presents a challenge for the selection of accidents for this *SPD Supplemental EIS* and reporting their likelihood and consequences, because the goal of the accident analysis in this *SPD Supplemental EIS* is to present consistent estimates of accident risks between facilities so that fair comparisons can be made among alternatives. If, for example, the accident risks between facilities or alternatives are based on differing levels of conservatism, balanced comparisons are not possible. For this *SPD Supplemental EIS*, attempts were made to ensure consistent assumptions across facilities and sites.

The design-basis accident descriptions and source terms used in this *SPD Supplemental EIS* are from recent SRS or LANL facility DSAs and are based on unmitigated design-basis accidents. Each of the plutonium facilities evaluated in this *SPD Supplemental EIS* has been designed and would be operated to reduce the likelihood of these accidents to the extent practicable. The design features and operating procedures would also limit the extent of any accident and mitigate the consequences for workers, the public, and the environment. For all facilities, it is expected that sufficient safety controls would be in place so that the likelihood of any of these accidents happening would be "extremely unlikely" or lower and, if the accidents were initiated, source terms and consequences of the magnitudes reported in the facility DSAs and this *SPD Supplemental EIS* would be very conservative.

Frequency Bin	*Estimated Probability Per Year*
Anticipated	$\geq 1 \times 10^{-2}$
Unlikely	1×10^{-2} to 1×10^{-4}
Extremely unlikely	1×10^{-4} to 1×10^{-6}
Beyond extremely unlikely	$< 1 \times 10^{-6}$

Accident frequencies are generally grouped into the bins of "anticipated," "unlikely," "extremely unlikely," and "beyond extremely unlikely," with estimated annual frequencies of greater than or equal to 1 in 100 ($\geq 1 \times 10^{-2}$), 1 in 100 to 1 in 10,000 (1×10^{-2} to 1×10^{-4}), 1 in 10,000 to 1 in 1 million (1×10^{-4} to 1×10^{-6}), and less than 1 in 1 million (1×10^{-6}), respectively. The evaluated accidents represent a spectrum of accident frequencies and consequences ranging from low-frequency/high-consequence to high-frequency/low-consequence events (see Appendix D).

Unless otherwise noted, the approaches, methods, and assumptions used in this *SPD Supplemental EIS* are the same as those presented in detail in Appendix M of the *SPD EIS* and used throughout the *SPD EIS* analysis (DOE 1999b). The key assumptions and any new information used in this *SPD Supplemental EIS* are discussed in Appendix D.

For each potential accident, information is provided on impacts for three types of receptors: a noninvolved worker, an MEI, and the offsite population within 50 miles (80 kilometers). The first receptor, a noninvolved worker, is a hypothetical individual working on site, but not involved in the proposed activity. Consistent with the *SPD EIS* (DOE 1999b), the noninvolved worker at SRS was assumed to be downwind at the area boundary, which is taken as a point about 3,300 feet (1,000 meters) from the accident. Such a person outside of the area is assumed to be unaware of the accident or of emergency actions needed for protection, and is assumed to remain in a radioactive plume for its entire passage. At LANL, because of the differences in geography of the area, the noninvolved worker was assumed to be exposed to the full release, without any protection, located at the technical area boundary, a distance of about 720 feet (220 meters) from PF-4. Workers within the vicinity of the surplus plutonium facilities would be trained in how to respond to an emergency and are expected to take proper actions to limit their exposure to a radioactive plume. If they failed to take proper actions, they could receive higher doses. For the accidents addressed in this *SPD Supplemental EIS*, postulated releases would be through filter media to tall stacks for all design-basis accidents. Maximum doses within the area where the plume first touches down could be 1.4 to 2.9 times higher than the doses at 3,300 feet (1,000 meters).

The second and third receptors are an MEI and the offsite population as discussed in Section 4.1.2. The population projected for year 2020 was assumed for the analysis.

Consequences for potential receptors as a result of plume passage were determined without regard for emergency response measures and, thus, are more conservative than those that might actually be experienced if evacuation and sheltering occurred. It was assumed that potential receptors would be fully exposed in fixed positions for the duration of plume passage, thereby maximizing their exposure to the plume. As discussed in Appendix D, Section D.1.4.2, a conservative estimate of total risk was obtained by assuming that all released radionuclides contributed to the inhalation dose rather than being removed from the plume by surface deposition.

Consequences for workers directly involved in the processes under consideration are addressed generically, without an attempt at a scenario-specific quantification of consequences. The uncertainties involved in quantifying accident consequences for an involved worker are quite large for most radiological accidents due to the high sensitivity of results to assumptions about the details of the release and the location and behavior of the affected workers.

No major consequences for the involved worker are expected from leaks, spills, and smaller fires. These accidents are such that involved workers would be able to evacuate immediately or would be unaffected by the events. Explosions could result in immediate injuries from flying debris, as well as the uptake of radioactive particulates through inhalation. If a criticality occurred, workers in the immediate vicinity could receive very high to fatal radiation exposures from the initial burst. The dose would strongly depend on the magnitude of the criticality (number of fissions), the distances of the exposed workers from the criticality, and the amount of shielding provided by structures and equipment between workers and the accident. The design-basis and beyond-design-basis earthquake accidents could also have substantial consequences, ranging from workers being killed by debris from collapsing structures to high radiation exposure and uptake of radionuclides. For most accidents, immediate emergency response actions would likely reduce the consequences for workers near the accident. Established emergency management programs would be activated in the event of an accident.

The following sections present the consequences of selected accidents for each alternative by pit disassembly and conversion option. Impacts are presented in terms of the projected number of LCFs among the general population if the accident were to occur, the probability that the dose received by the MEI would cause an LCF, and the probability that the dose received by a noninvolved worker downwind of the facility would cause an LCF. The selected accident scenarios represent low-frequency/high-consequence design-basis operational accidents and an extremely low-frequency/high-consequence beyond-design-basis accident scenario involving building collapse for which the accident was assumed to be caused by a catastrophic earthquake. For SRS, results are presented for the limiting design-basis (non-earthquake) accident, a design-basis earthquake with fire accident, and a beyond-design-basis earthquake with fire accident. For LANL, results are presented for the limiting design-basis (non-earthquake) accident, a design-basis earthquake with spill plus fire accident, and a beyond-design-basis accident – earthquake-induced collapse plus fire.[6] At both SRS and LANL, the limiting design-basis accident[7] is the highest-consequence accident at any of the facilities associated with a given alternative. For the design-basis and beyond-design-basis earthquake with fire accidents at SRS, the population and MEI impacts reflect contributions from all of the surplus plutonium facilities; the noninvolved worker impacts reflect the largest impacts from a single facility. For the design-basis and beyond-design-basis earthquake accidents at LANL, the population, MEI, and noninvolved worker impacts reflect those from PF-4. More-detailed discussions of the accident analyses, including additional accident scenarios, doses, and accident frequencies, are presented in Appendix D.

Impacts from potential accidents at commercial nuclear power reactors using a 40 percent MOX fuel core and a full LEU core are addressed in Section 4.1.2.4 and Appendices I and J. The analysis indicates little difference in potential impacts between the two types of reactor cores.

4.1.2.2.1 No Action Alternative

Potential consequences of the postulated accidents under the No Action Alternative are presented in **Table 4–6** for the offsite population, **Table 4–7** for the MEI, and **Table 4–8** for the noninvolved worker.

The most severe consequences of a design-basis accident for any of the facilities are for accidents in the extremely unlikely or extremely unlikely to beyond extremely unlikely categories. These are accidents that are not expected to occur over the life of a facility, and could only occur if initiated by severe natural events such as major earthquakes, external events such as aircraft crashes, or multiple failures of independent safety systems. Even so, the magnitudes of the consequences would likely be much less than those estimated in this *SPD Supplemental EIS*. At each of the facilities where there would be enough plutonium for a nuclear criticality to theoretically occur, a criticality could be fatal to workers in the immediate vicinity, and present high doses as far as hundreds of yards away. This type of accident is well understood, and programs and procedures are in place at SRS and LANL to ensure that a criticality accident would not occur.

A large fire within any of the plutonium facilities is considered a threat because such an accident has the potential to make plutonium airborne and to threaten the integrity of building confinement systems. Facility design considerations and limits on the quantities of combustible materials and ignition sources at a facility prevent or greatly reduce the potential for large fires to occur. Furthermore, the potential consequences would be mitigated by designing the structures to limit the spread of a fire, contain any airborne plutonium, and filter any release to the environment.

The most severe consequences would be associated with beyond-design-basis accidents, especially earthquakes. Such seismic events would be so severe that most structures would be subjected to major damage, including collapse. Widespread injuries and fatalities could be expected from falling debris, collapsing structures, and possible resulting fires. Although there would be the potential for LCFs resulting from inhalation of radioactive materials made airborne in the earthquake, the greatest risk of harm would be from the immediate physical threats.

[6] *At SRS, the design-basis and beyond-design-basis earthquakes are postulated to be of sufficient magnitudes to initiate fires within most affected facilities. At LANL, the design-basis earthquake is postulated to be of sufficient magnitude to result in spills of nuclear material followed by fires. For purposes of this* SPD Supplemental EIS*, a seismically induced collapse of the roof and first floor of the PF-4 building, with widespread damage to containers causing spills and impacts from debris, followed by widespread fires involving much of the material at risk on the first floor, basement, and vaults, is identified as the "Beyond-Design-Basis Accident – Earthquake-Induced Collapse plus Fire" scenario. Details of the accident are provided in Appendix D.*

[7] *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 on the surrounding population, with the exception of accidents involving earthquakes. Accidents involving earthquakes are addressed separately.*

Table 4–6 Population[a] Impacts from Selected Accidents by Alternative (number of latent cancer fatalities if the accident were to occur[b])

Pit Disassembly and Conversion Option	Alternative: No Action	Immobilization to DWPF	MOX Fuel	H-Canyon/ HB-line to DWPF	WIPP
PDCF					
SRS – Limiting design-basis accident (facility)	0 (1×10^{-1}) (PDCF)	0 (4×10^{-1}) (Immobilization)	0 (2×10^{-1}) (HC/HBL)	0 (2×10^{-1}) (HC/HBL)	0 (2×10^{-1}) (HC/HBL)
SRS – Design-basis earthquake with fire	0 (5×10^{-2})	0 (6×10^{-2})	0 (2×10^{-1})	0 (2×10^{-1})	0 (2×10^{-1})
SRS – Beyond-design-basis earthquake with fire	7	7	16	16	16
LANL – Limiting design-basis accident (facility)	0 (2×10^{-2}) (PF-4)	0 (2×10^{-2}) (PF-4)	0 (2×10^{-2}) (PF-4)	0 (2×10^{-2}) (PF-4)	0 (2×10^{-2}) (PF-4)
LANL – Design-basis earthquake with spill plus fire	0 (3×10^{-2})	0 (3×10^{-2})	0 (3×10^{-2})	0 (3×10^{-2})	0 (3×10^{-2})
LANL – Beyond-design-basis accident – earthquake-induced collapse plus fire	2	2	2	2	2
PDC					
SRS – Limiting design-basis accident (facility)	N/A	N/A	0 (2×10^{-1}) (HC/HBL)	0 (2×10^{-1}) (HC/HBL)	0 (2×10^{-1}) (HC/HBL)
SRS – Design-basis earthquake with fire	N/A	N/A	0 (2×10^{-1})	0 (2×10^{-1})	0 (2×10^{-1})
SRS – Beyond-design-basis earthquake with fire	N/A	N/A	14	14	14
LANL – Limiting design-basis accident (facility)	N/A	N/A	0 (2×10^{-2}) (PF-4)	0 (2×10^{-2}) (PF-4)	0 (2×10^{-2}) (PF-4)
LANL – Design-basis earthquake with spill plus fire	N/A	N/A	0 (3×10^{-2})	0 (3×10^{-2})	0 (3×10^{-2})
LANL – Beyond-design-basis accident – earthquake-induced collapse plus fire	N/A	N/A	2	2	2
PF-4 and MFFF					
SRS - Limiting design-basis accident (facility)	N/A	0 (4×10^{-1}) (Immobilization)	0 (2×10^{-1}) (HC/HBL)	0 (2×10^{-1}) (HC/HBL)	0 (2×10^{-1}) (HC/HBL)
SRS – Design-basis earthquake with fire	N/A	0 (7×10^{-3})	0 (2×10^{-1})	0 (2×10^{-1})	0 (2×10^{-1})
SRS – Beyond-design-basis earthquake with fire	N/A	3	12	12	12
LANL – Limiting design-basis accident (facility)	N/A	0 (2×10^{-2}) (PF-4)	0 (2×10^{-2}) (PF-4)	0 (2×10^{-2}) (PF-4)	0 (2×10^{-2}) (PF-4)
LANL – Design-basis earthquake with spill plus fire	N/A	0 (4×10^{-2})	0 (4×10^{-2})	0 (4×10^{-2})	0 (4×10^{-2})
LANL – Beyond-design-basis accident – earthquake-induced collapse plus fire	N/A	3	3	3	3
PF-4, H-Canyon/HB-Line, and MFFF					
SRS – Limiting design-basis accident (facility)	N/A	0 (4×10^{-1}) (Immobilization)	0 (2×10^{-1}) (HC/HBL)	0 (2×10^{-1}) (HC/HBL)	0 (2×10^{-1}) (HC/HBL)
SRS – Design-basis earthquake with fire	N/A	0 (2×10^{-1})	0 (2×10^{-1})	0 (2×10^{-1})	0 (2×10^{-1})
SRS – Beyond-design-basis earthquake with fire	N/A	12	12	12	12
LANL – Limiting design-basis accident (facility)	N/A	0 (2×10^{-2}) (PF-4)	0 (2×10^{-2}) (PF-4)	0 (2×10^{-2}) (PF-4)	0 (2×10^{-2}) (PF-4)
LANL – Design-basis earthquake with spill plus fire	N/A	0 (4×10^{-2})	0 (4×10^{-2})	0 (4×10^{-2})	0 (4×10^{-2})
LANL – Beyond-design-basis accident – earthquake-induced collapse plus fire	N/A	3	3	3	3

DWPF = Defense Waste Processing Facility; HC/HBL = H-Canyon/HB-Line; Immobilization = immobilization capability; LANL = Los Alamos National Laboratory; MFFF = Mixed Oxide Fuel Fabrication Facility; MOX = mixed oxide; N/A = not applicable; PDC = Pit Disassembly and Conversion Project; PDCF = Pit Disassembly and Conversion Facility; PF-4 = Plutonium Facility; SRS = Savannah River Site; WIPP = Waste Isolation Pilot Plant.

[a] Impacts on populations within 50 miles (80 kilometers) of the postulated accident.

[b] The number of excess LCFs in the population would occur as a whole number. If the value calculated by multiplying the dose by the risk factor of 0.0006 LCF per person-rem (DOE 2003a) is less than 1, then that value is presented in parentheses.

Note: Values are derived from analyses presented in Appendix D.

Table 4–7 Maximally Exposed Individual Impacts from Selected Accidents by Alternative (risk of a latent cancer fatality if the accident were to occur)

Pit Disassembly and Conversion Option	*Alternative*				
	No Action	*Immobilization to DWPF*	*MOX Fuel*	*H-Canyon/ HB-line to DWPF*	*WIPP*
PDCF					
SRS – Limiting design-basis accident (facility)	3×10^{-4} (PDCF)	1×10^{-3} (Immobilization)	3×10^{-4} (PDCF)	3×10^{-4} (PDCF)	3×10^{-4} (PDCF)
SRS – Design-basis earthquake with fire	1×10^{-4}	1×10^{-4}	3×10^{-4}	3×10^{-4}	3×10^{-4}
SRS – Beyond-design-basis earthquake with fire	2×10^{-2}	2×10^{-2}	5×10^{-2}	5×10^{-2}	5×10^{-2}
LANL – Limiting design-basis accident (facility)	7×10^{-5} (PF-4)	7×10^{-5} (PF-4)	7×10^{-5} (PF-4)	7×10^{-5} (PF-4)	7×10^{-5} (PF-4)
LANL – Design-basis earthquake with spill plus fire	1×10^{-4}	1×10^{-4}	1×10^{-4}	1×10^{-4}	1×10^{-4}
LANL – Beyond-design-basis accident – earthquake-induced collapse plus fire	1×10^{-2}	1×10^{-2}	1×10^{-2}	1×10^{-2}	1×10^{-2}
PDC					
SRS –Limiting design-basis accident (facility)	N/A	N/A	2×10^{-4} (HC/HBL)	2×10^{-4} (HC/HBL)	2×10^{-4} (HC/HBL)
SRS –Design-basis earthquake with fire	N/A	N/A	3×10^{-4}	3×10^{-4}	3×10^{-4}
SRS –Beyond-design-basis earthquake with fire	N/A	N/A	7×10^{-2}	7×10^{-2}	7×10^{-2}
LANL – Limiting design-basis accident (facility)	N/A	N/A	7×10^{-5} (PF-4)	7×10^{-5} (PF-4)	7×10^{-5} (PF-4)
LANL – Design-basis earthquake with spill plus fire	N/A	N/A	1×10^{-4}	1×10^{-4}	1×10^{-4}
LANL – Beyond-design-basis accident – earthquake-induced collapse plus fire	N/A	N/A	1×10^{-2}	1×10^{-2}	1×10^{-2}
PF-4 and MFFF					
SRS – Limiting design-basis accident (facility)	N/A	1×10^{-3} (Immobilization)	2×10^{-4} (HC/HBL)	2×10^{-4} (HC/HBL)	2×10^{-4} (HC/HBL)
SRS – Design-basis earthquake with fire	N/A	2×10^{-5}	2×10^{-4}	2×10^{-4}	2×10^{-4}
SRS – Beyond-design-basis earthquake with fire	N/A	7×10^{-3}	4×10^{-2}	4×10^{-2}	4×10^{-2}
LANL – Limiting design-basis accident (facility)	N/A	7×10^{-5} (PF-4)	7×10^{-5} (PF-4)	7×10^{-5} (PF-4)	7×10^{-5} (PF-4)
LANL – Design-basis earthquake with spill plus fire	N/A	2×10^{-4}	2×10^{-4}	2×10^{-4}	2×10^{-4}
LANL – Beyond-design-basis accident – earthquake-induced collapse plus fire	N/A	1×10^{-2}	1×10^{-2}	1×10^{-2}	1×10^{-2}
PF-4, H-Canyon/HB-Line, and MFFF					
SRS – Limiting design-basis accident (facility)	N/A	1×10^{-3} (Immobilization)	2×10^{-4} (HC/HBL)	2×10^{-4} (HC/HBL)	2×10^{-4} (HC/HBL)
SRS – Design-basis earthquake with fire	N/A	3×10^{-4}	2×10^{-4}	2×10^{-4}	2×10^{-4}
SRS – Beyond-design-basis earthquake with fire	N/A	4×10^{-2}	4×10^{-2}	4×10^{-2}	4×10^{-2}
LANL – Limiting design-basis accident (facility)	N/A	7×10^{-5} (PF-4)	7×10^{-5} (PF-4)	7×10^{-5} (PF-4)	7×10^{-5} (PF-4)
LANL – Design-basis earthquake with spill plus fire	N/A	2×10^{-4}	2×10^{-4}	2×10^{-4}	2×10^{-4}
LANL – Beyond-design-basis accident – earthquake-induced collapse plus fire	N/A	1×10^{-2}	1×10^{-2}	1×10^{-2}	1×10^{-2}

DWPF = Defense Waste Processing Facility; HC/HBL = H-Canyon/LB-Line; Immobilization = immobilization capability; LANL = Los Alamos National Laboratory; MFFF = Mixed Oxide Fuel Fabrication Facility; MOX = mixed oxide; N/A = not applicable; PDC = Pit Disassembly and Conversion Project; PDCF = Pit Disassembly and Conversion Facility; PF-4 = Plutonium Facility; SRS = Savannah River Site; WIPP = Waste Isolation Pilot Plant.

Note: Values are derived from analyses presented in Appendix D.

Table 4–8 Noninvolved Worker Impacts from Selected Accidents by Alternative (risk of a latent cancer fatality if the accident were to occur)

Pit Disassembly and Conversion Option	*Alternatives*				
	No Action	*Immobilization to DWPF*	*MOX Fuel*	*H-Canyon/ HB-line to DWPF*	*WIPP*
PDCF					
SRS –Limiting design-basis accident (facility)	3×10^{-3} (PDCF)	3×10^{-2} (Immobilization)	3×10^{-3} (PDCF)	3×10^{-3} (PDCF)	3×10^{-3} (PDCF)
SRS –Design-basis earthquake with fire	1×10^{-3}	1×10^{-3}	1×10^{-3}	1×10^{-3}	1×10^{-3}
SRS –Beyond-design-basis earthquake with fire	9×10^{-1}	9×10^{-1}	1	1	1
LANL – Limiting design-basis accident (facility)	2×10^{-3} (PF-4)	2×10^{-3} (PF-4)	2×10^{-3} (PF-4)	2×10^{-3} (PF-4)	2×10^{-3} (PF-4)
LANL – Design-basis earthquake with spill plus fire	4×10^{-3}	4×10^{-3}	4×10^{-3}	4×10^{-3}	4×10^{-3}
LANL – Beyond-design-basis accident –earthquake-induced collapse plus fire	1	1	1	1	1
PDC					
SRS – Limiting design-basis accident (facility)	N/A	N/A	3×10^{-3} (KIS)	3×10^{-3} (KIS)	3×10^{-3} (KIS)
SRS – Design-basis earthquake with fire	N/A	N/A	9×10^{-4}	9×10^{-4}	9×10^{-4}
SRS – Beyond-design-basis earthquake with fire	N/A	N/A	1	1	1
LANL – Limiting design-basis accident (facility)	N/A	N/A	2×10^{-3} (PF-4)	2×10^{-3} (PF-4)	2×10^{-3} (PF-4)
LANL – Design-basis earthquake with spill plus fire	N/A	N/A	4×10^{-3}	4×10^{-3}	4×10^{-3}
LANL – Beyond-design-basis accident –earthquake-induced collapse plus fire	N/A	N/A	1	1	1
PF-4 and MFFF					
SRS – Limiting design-basis accident (facility)	N/A	3×10^{-2} (Immobilization)	3×10^{-3} (KIS)	3×10^{-3} (KIS)	3×10^{-3} (KIS)
SRS – Design-basis earthquake with fire	N/A	3×10^{-4}	9×10^{-4}	9×10^{-4}	9×10^{-4}
SRS – Beyond-design-basis earthquake with fire	N/A	4×10^{-1}	1	1	1
LANL – Limiting design-basis accident (facility)	N/A	2×10^{-3} (PF-4)	2×10^{-3} (PF-4)	2×10^{-3} (PF-4)	2×10^{-3} (PF-4)
LANL – Design-basis earthquake with spill plus fire	N/A	6×10^{-3}	6×10^{-3}	6×10^{-3}	6×10^{-3}
LANL – Beyond-design-basis accident – earthquake-induced collapse plus fire	N/A	1	1	1	1
PF-4, H-Canyon/HB-Line, and MFFF					
SRS – Limiting design-basis accident (facility)	N/A	3×10^{-2} (Immobilization)	3×10^{-3} (KIS)	3×10^{-3} (KIS)	3×10^{-3} (KIS)
SRS – Design-basis earthquake with fire	N/A	9×10^{-4}	9×10^{-4}	9×10^{-4}	9×10^{-4}
SRS – Beyond-design-basis earthquake with fire	N/A	1	1	1	1
LANL – Limiting design-basis accident (facility)	N/A	2×10^{-3} (PF-4)	2×10^{-3} (PF-4)	2×10^{-3} (PF-4)	2×10^{-3} (PF-4)
LANL – Design-basis earthquake with spill plus fire	N/A	6×10^{-3}	6×10^{-3}	6×10^{-3}	6×10^{-3}
LANL – Beyond-design-basis accident – earthquake-induced collapse plus fire	N/A	1	1	1	1

DWPF = Defense Waste Processing Facility; Immobilization = immobilization capability; KIS = K-Area Interim Surveillance capability; LANL = Los Alamos National Laboratory; MFFF = Mixed Oxide Fuel Fabrication Facility; MOX = mixed oxide; N/A = not applicable; PDC = Pit Disassembly and Conversion Project; PDCF = Pit Disassembly and Conversion Facility; PF-4 = Plutonium Facility; SRS = Savannah River Site; WIPP = Waste Isolation Pilot Plant.
Note: Values are derived from analyses presented in Appendix D.

At SRS, the limiting design-basis accident would be an overpressurization of an oxide storage can at PDCF. If this accident were to occur, the impacts would be no additional LCFs in the population, a risk of the MEI developing an LCF of 3×10^{-4} (about 1 chance in 3,300), and a risk of the noninvolved worker developing an LCF of 3×10^{-3} (about 1 chance in 330). Impacts of a design-basis earthquake with fire would be no LCFs in the population and impacts on the MEI and noninvolved worker would be slightly less than those for the limiting design-basis accident. The beyond-design-basis earthquake with fire accident is projected to result in 7 LCFs in the offsite population; the LCF risk to the MEI would be 2×10^{-2} (1 chance in 50) and the LCF risk to the noninvolved worker would be 9×10^{-1}.

At LANL, the limiting design-basis accident would be from a hydrogen deflagration incident resulting from the dissolution of plutonium metal at PF-4. If the accident were to occur, the impacts would be no additional LCFs in the population, a risk of the MEI developing an LCF of 7×10^{-5} (about 1 chance in 14,000), and a risk of a noninvolved worker developing an LCF of 2×10^{-3} (1 chance in 500). A design-basis earthquake with spill plus fire accident would result in no LCFs in the population and LCF risks to the MEI and noninvolved worker of 1×10^{-4} (1 chance in 10,000) and 4×10^{-3} (1 chance in 250), respectively. The beyond-design-basis accident – earthquake-induced collapse plus fire is projected to result in 2 LCFs in the offsite population; the LCF risks to the MEI would be 1×10^{-2} (1 chance in 100) and the noninvolved worker could experience an LCF.

4.1.2.2.2 Immobilization to DWPF Alternative

Under the Immobilization to DWPF Alternative, in addition to disposition of 34 metric tons (37.5 tons) of surplus plutonium as MOX fuel as under the No Action Alternative, 13.1 metric tons (14.4 tons) of surplus pit and non-pit plutonium would be dispositioned by immobilization in a new K-Area immobilization capability with subsequent combination with vitrified HLW at DWPF. To accomplish this, additional options for pit disassembly and for conversion of pit and metallic plutonium to oxide are considered.

Accident impacts were analyzed for two pit disassembly and conversion options in addition to the PDCF Option identified under the No Action Alternative. These options involve the use of other facilities at SRS as well as expanded PF-4 capabilities at LANL.

The potential consequences of the postulated accidents for the three pit disassembly and conversion options under the Immobilization to DWPF Alternative are presented in Tables 4–6, 4–7, and 4–8.

Under all pit disassembly and conversion options, the limiting design-basis accident at SRS would be an explosion in a metal oxidation furnace at the K-Area immobilization capability. If this accident were to occur, the impacts on the public would be no additional LCFs in the population and a risk of the MEI developing a latent fatal cancer of 1×10^{-3} (1 chance in 1,000). The risk that the noninvolved worker would develop a latent fatal cancer would be 3×10^{-2} (about 1 chance in 33). Impacts of a design-basis earthquake would vary, depending on the pit disassembly and conversion option. A design-basis earthquake with fire accident is projected to result in no LCFs in the population under any option. The risk of an LCF would range from 2×10^{-5} (1 chance in 50,000) to 3×10^{-4} (about 1 chance in 3,300) for the MEI and 3×10^{-4} (about 1 chance in 3,300) to 1×10^{-3} of (1 chance in 1,000) for the noninvolved worker. The beyond-design-basis earthquake with fire accident is projected to result in 3 to 12 LCFs in the offsite population; the LCF risks to an MEI would range from 7×10^{-3} (about 1 chance in 140) to 4×10^{-2} (1 chance in 25), and the LCF risk to the noninvolved worker would range from 4×10^{-1} (1 chance in 2.5) to 1.

At LANL, the limiting design-basis accident would be from a hydrogen deflagration incident resulting from the dissolution of plutonium metal at PF-4. If the accident were to occur, the impacts for all pit disassembly and conversion options would be no additional LCFs in the population, a risk of the MEI developing a latent fatal cancer of 7×10^{-5} (about 1 chance in 14,000), and a risk of a noninvolved worker developing a latent fatal cancer of 2×10^{-3} (1 chance in 500). The impacts are the same for all options because the material at risk is assumed to be the same.

For the design-basis and beyond-design-basis earthquake accidents, impacts would be somewhat different among the pit disassembly and conversion options because the quantity of material at risk is different, as are the factors that affect the amount of material released to the environment. For the PDCF Option, the impacts of a design-basis earthquake with spill plus fire accident would be no LCFs in the population and LCF risks to the MEI and noninvolved worker of 1×10^{-4} (1 chance in 10,000) and 4×10^{-3} (1 chance in 250), respectively. For the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option, the impacts of a design-basis earthquake with spill plus fire accident would be no LCFs in the population and LCF risks to the MEI and noninvolved worker of 2×10^{-4} (1 chance in 5,000) and 6×10^{-3} (about 1 chance in 170), respectively. For the PDCF Option, the beyond-design-basis accident – earthquake-induced collapse plus fire is projected to result in 2 LCFs in the offsite population; the LCF risk to the MEI would be 1×10^{-2} (1 chance in 100) and the noninvolved worker would likely develop an LCF. For the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option, the beyond-design-basis accident – earthquake-induced collapse plus fire is projected to result in 3 LCFs in the offsite population; the LCF risk to the MEI would be 1×10^{-2} (1 chance in 100) and the noninvolved worker would likely develop an LCF.

4.1.2.2.3 MOX Fuel Alternative

Under the MOX Fuel Alternative, in addition to the pit disassembly and conversion options considered under the Immobilization to DWPF Alternative, the PDC Option is considered. The potential consequences of the postulated accidents for the four pit disassembly and conversion options under the MOX Fuel Alternative are presented in Tables 4–6, 4–7, and 4–8.

At SRS, the limiting design-basis accident is different, depending on the pit disassembly and conversion option and the receptor. For impacts on the offsite population, the limiting design-basis accident would be a level-wide fire in HB-Line for all options. Regardless of the option, no additional LCFs are expected in the population as a result of the accident. The risk of an LCF for the MEI would be about 3×10^{-4} (about 1 chance in 3,300) for the PDCF Option, where the limiting design-basis accident would be an overpressurization of an oxide storage container at PDCF. For the other options, the impact on the MEI would be about 2×10^{-4} (1 chance in 5,000) with the source being a level-wide fire in HB-Line. For a noninvolved worker, the limiting design-basis accident would be an overpressurization of an oxide storage container at PDCF under the PDCF Option or a fire in the KIS vault that causes a rupture of a DOE-STD-3013 container[8] under the other options, each with an associated risk of an LCF of 3×10^{-3} (about 1 chance in 330).

Impacts of a design-basis earthquake with fire would vary depending on the pit disassembly and conversion option. There would be no LCFs in the population under any pit disassembly and conversion option. The risk of an LCF for the MEI would range from 2×10^{-4} (1 chance in 5,000) to 3×10^{-4} (about 1 chance in 3,300). Under the pit disassembly and conversion options, the risk of an LCF for the noninvolved worker would range from 9×10^{-4} (about 1 chance in 1,100) to 1×10^{-3} (1 chance in 1,000). Depending on the option, the beyond-design-basis earthquake with fire accident is projected to result in about 12 to 16 LCFs in the offsite population; under any of the options, the risk of an LCF for an MEI would range from 4×10^{-2} (1 chance in 25) to 7×10^{-2} (about 1 chance in 14), and the noninvolved worker would likely develop an LCF.

At LANL, accident impacts under the PF-4 and MFFF, and PF-4, H-Canyon/HB-Line, and MFFF Options would be the same as those in Section 4.1.2.2.2 under the Immobilization to DWPF Alternative. Impacts under both the PDCF and PDC Options would be the same as those for the PDCF Option under the Immobilization to DWPF Alternative.

[8] *A DOE-STD-3013 container is a container that meets the specifications in DOE-STD-3013,* Stabilization, Packaging, and Storage of Plutonium-Bearing Materials, *DOE-STD-3013-2012 (DOE 2012a).*

4.1.2.2.4 H-Canyon/HB-Line to DWPF Alternative

Under the H-Canyon/HB-Line to DWPF Alternative, the same pit disassembly and conversion options would be considered as those under the MOX Fuel Alternative. The potential consequences of the postulated accidents for the pit disassembly and conversion options under the H-Canyon/HB-Line to DWPF Alternative are presented in Tables 4–6, 4–7, and 4–8. Under this alternative, the impacts of these accidents would be the same as those under the MOX Fuel Alternative (Section 4.1.2.2.3).

4.1.2.2.5 WIPP Alternative

Under the WIPP Alternative, the same pit disassembly and conversion options would be considered as those under the MOX Fuel Alternative. The potential consequences of the postulated accidents for the pit disassembly and conversion options under the WIPP Alternative are presented in Tables 4–6, 4–7, and 4–8. Under this alternative, except as noted below, the impacts of these accidents would be the same as those under the MOX Fuel Alternative (Section 4.1.2.2.3).

At LANL, although detailed design and operational information is not available, enhancement of the capability at TA-55 to prepare surplus plutonium for potential WIPP disposal is not expected to result in substantial accident impacts and risks in addition to those presented in Tables 4–6, 4–7, and 4–8. This is because the enhanced capability is not expected to change the limiting design basis accident at PF-4, which is a hydrogen deflagration incident associated with the dissolution of plutonium metal, nor change the quantity of material at risk in TA-55 potentially impacted by a design-basis and beyond-design-basis earthquake accident.

4.1.2.3 DOE Facility Chemical Accidents

The potential for accidents involving hazardous chemicals associated with the proposed surplus plutonium disposition operations to affect noninvolved workers or the public is quite limited.

At SRS, the potential for hazardous chemical impacts on noninvolved workers and the public has been evaluated for many of the facilities that might use larger quantities of hazardous chemicals (SRNS 2010d; WGI 2005c) and no substantial impacts were found for noninvolved workers or the public. For the proposed pit disassembly and conversion project, potential hazardous chemicals were screened to determine if any of the proposed chemicals or amounts that might be used pose a threat to collocated workers 100 meters (330 feet) from a spill or to an offsite individual. All potential concentrations from spills were found to be below the applicable protective guidelines (DOE/NNSA 2012).

Existing SRS facilities are evaluated for hazardous chemical impacts and controls, such as inventory controls, are in place to limit those impacts. For example, the F/H-Area Laboratory safety analysis report indicates that chemical inventories are low enough when compared to emergency response planning guidelines to classify the facility as a general use facility in accordance with SRS guidelines (SRNS 2010d).

Inventories of hazardous chemicals are maintained for each facility. The inventories for most chemicals are small, and because of SRS's remote location and large size, there is no risk of chemical exposure to the surrounding public population resulting from normal site operations or accidents. Nevertheless, monitoring efforts and baseline studies are regularly performed.

At LANL, the research nature of PF-4 operations requires the use, handling, and storage of a large variety of chemicals, but in relatively small quantities (for example, a few kilograms or a few hundred liters). As such, there is an extensive list of chemicals that may be present for programmatic purposes, with quantities of regulated chemicals far below the threshold quantities set by EPA (40 CFR 68.130). The hazards associated with these chemicals are well understood and, because of the small quantities, can be managed using standard hazardous material and/or chemical handling programs. They pose minimal potential hazards to public health and the environment in an accident condition. Activity-level probabilistic hazards analyses would be performed to ensure that no onsite inventory exceeds the screening criterion of DOE-STD-1189, *Integration of Safety into the Design Process* (DOE 2008d).

There are limited quantities of chemicals stored at PF-4, and no bulk quantities would be needed to support the surplus plutonium disposition activities.

At both SRS and LANL, accidents involving chemicals would primarily present a risk to the involved worker in the immediate vicinity of the accident. DOE safety programs are in place to minimize the risks to workers from both routine operations and accidents involving these materials. Regarding risks from handling toxic or hazardous chemicals, worker safety programs are enforced via required adherence to Federal and state laws; DOE orders and regulations; Occupational Safety and Health Administration and EPA guidelines; and plans and procedures for performing work, including training, monitoring, use of personal protective equipment, and administrative controls.

4.1.2.4 Reactor Accidents

The reactor accident analyses included in Appendix I, Section I.2.2.2.2, of this *SPD Supplemental EIS*, and Chapter 4, Section 4.28.2.5, of the *SPD EIS* (DOE 1999b), indicate that, in the event of a postulated reactor accident, the doses to the public would be somewhat different for different reactors. The results of these accident analyses differ for each reactor based on a number of factors, including the size of the population surrounding the reactor, the distance from the reactor to the surrounding population, and site-specific meteorological conditions. The five sets of commercial nuclear power reactors analyzed in these documents include reactors located near large cities such as Charlotte, North Carolina, as well as reactors located in relatively less-populated areas. The reactors include boiling water reactors and pressurized water reactors.

Table 4–9 presents a comparison of projected radiological impacts from a series of design-basis and beyond-design-basis accidents that were analyzed in this *SPD Supplemental EIS* and the *SPD EIS.* The comparison is presented as the ratio of the accident impacts involving partial MOX fuel cores to those using full LEU fuel cores. Impacts were estimated for a member of the general public at the exclusion area boundary at the time of the accident (i.e., the MEI) or to the general population residing within 50 miles (80 kilometers) of the reactor. The numbers in parentheses are the calculated ratios (impacts for a partial MOX core divided by impacts for an LEU core); the range of numbers reflects the results for the five sets of reactors that were evaluated. A ratio less than 1 indicates that the MOX fuel core could result in smaller impacts than the same accident with an LEU fuel core. A value of 1 indicates that the estimated impacts are the same for both fuel core types. A ratio larger than 1 indicates that the MOX fuel core could result in larger impacts than the same accident with an LEU fuel core. Outside the parentheses, the table shows a ratio of 1 for all accident scenarios. This is a rounded value because when modeling and analytical uncertainties are considered, the precision of the results is no more than one significant figure.

Table 4–9 Ratio of Doses for Reactor Accidents Involving a Partial Mixed Oxide Fuel Core Compared to a Full Low-Enriched Uranium Fuel Core (partial mixed oxide fuel core dose/full low-enriched uranium fuel core dose) [a, b]

Accident	*MEI*	*Population within 50 Miles (80 kilometers)*
Design-Basis Accidents		
LOCA	1 (0.87 to 1.03)	1 (0.96 to 1.03)
Used-fuel-handling accident	1 (0.90 to 1.00)	1 (0.94 to 1.01)
Beyond-Design-Basis Accidents		
Steam generator tube rupture [c]	1 (1.06 to 1.24)	1 (1.04 to 1.09)
Early containment failure	1 (1.00 to 1.22)	1 (0.98 to 1.05)
Late containment failure	1 (1.01 to 1.10)	1 (0.95 to 1.09)
ISLOCA	1 (0.93 to 1.22)	1 (0.95 to 1.14)

ISLOCA = interfacing systems loss-of-coolant accident; LOCA = loss-of-coolant accident; MEI = maximally exposed individual.

[a] Reactor accidents involving the use of partial MOX fuel cores were assumed to involve reactor cores with approximately 40 percent MOX fuel and 60 percent LEU fuel.

[b] When modeling and analytical uncertainties are considered, the precision of the results is no more than one significant figure.

[c] Steam generator tube rupture is not applicable for boiling water reactors since they do not use steam generators.

Source: Appendix I, Table I–11.

4.1.2.5 Intentional Destructive Acts

DOE's National Nuclear Security Administration (NNSA) has prepared a classified analysis of the potential impacts of intentional destructive acts as part of this *SPD Supplemental EIS*. Substantive details of intentional destructive act scenarios, security countermeasures, and potential impacts are not released to the public because disclosure of this information could be exploited by enemies to plan attacks.

NNSA's strategy for the mitigation of environmental impacts resulting from extreme events, including intentional destructive acts, has three distinct components: (1) prevent or deter successful attacks; (2) plan and provide timely and adequate response to emergency situations; and (3) progress to recovery through long-term response in the form of monitoring, remediation, and support for affected communities and their environments.

Depending on the intentional destructive act, impacts could be similar to or exceed the impacts of accidents analyzed in this *SPD Supplemental EIS*. Classified analyses of intentional destructive acts related to plutonium operations at LANL and storage of plutonium pits at Pantex were prepared for the 2008 *Final Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico (LANL SWEIS)* (DOE 2008f) and the *Final Complex Transformation Supplemental Programmatic Environmental Impact Statement (Complex Transformation SPEIS)* (DOE 2008j), respectively. Information from those analyses and analyses specific to the proposed facilities at SRS is included in the classified appendix of this *SPD Supplemental EIS*. These analyses provide NNSA with information on which to base, in part, decisions regarding surplus plutonium. The classified appendix evaluates several scenarios involving intentional destructive acts, and calculates consequences for the noninvolved worker, MEI, and population in terms of physical injuries, radiation doses, and LCFs. Although the results of the analyses cannot be disclosed, the following general conclusions can be drawn: the potential consequences of intentional destructive acts are highly dependent upon the distance to the site boundary and the size and distribution of the surrounding population. That is, the closer and higher density of the surrounding population, the higher the consequences. In addition, it is generally easier and more cost-effective to protect newer than older facilities, because new security features can be incorporated into their design. In other words, protective forces needed to defend new facilities may be smaller than those needed in older facilities due to the inherent security features of newer facilities. Newer facilities can, as a result of design features, better prevent attacks and reduce the impacts of attacks.

4.1.3 Socioeconomics

Socioeconomic impacts that could result from implementation of the alternatives addressed in this *SPD Supplemental EIS* include impacts on the regional economic characteristics, population and housing, and traffic within the region of influence (ROI). The socioeconomic ROI for SRS is defined as the four-county area of Columbia and Richmond Counties in Georgia, and Aiken and Barnwell Counties in South Carolina. The socioeconomic ROI for LANL is defined as the four-county area of Los Alamos, Rio Arriba, Sandoval, and Santa Fe Counties in New Mexico. **Tables 4–10** and **4–11** provide summaries of construction and operations impacts, respectively, by alternative.

As described in Appendix I, the use of a 40 percent MOX fuel core in domestic commercial nuclear power reactors is not expected to change the socioeconomic impacts that currently occur due to the use of a 100 percent LEU fuel core. Therefore, the impacts from irradiating MOX fuel at domestic commercial nuclear power reactors are not discussed further in this section.

Table 4–10 Summary of Socioeconomic Impacts Related to Facility Construction

Resource	Pit Disassembly and Conversion Option [a]	Alternative				
		No Action	Immobilization to DWPF	MOX Fuel	HC/HBL to DWPF	WIPP
Direct employment (number of personnel in peak year)	PDCF	722 (SRS) 0 (LANL)	943 (SRS) 0 (LANL)	722 (SRS) 0 (LANL)	722 (SRS) 0 (LANL)	722 (SRS) 0 (LANL)
	PDC	N/A	N/A	741 (SRS) 0 (LANL)	741 (SRS) 0 (LANL)	741 (SRS) 0 (LANL)
	PF-4 and MFFF	N/A	275 (SRS) 46 (LANL)	275 (SRS) 46 (LANL)	275 (SRS) 46 (LANL)	285 (SRS) 46 (LANL)
	PF-4, HC/HBL, and MFFF	N/A	285 (SRS) 46 (LANL)	285 (SRS) 46 (LANL)	285 (SRS) 46 (LANL)	295 (SRS) 46 (LANL)
Indirect employment (number of personnel in peak year) [b]	PDCF	455 (SRS) 0 (LANL)	595 (SRS) 0 (LANL)	455 (SRS) 0 (LANL)	455 (SRS) 0 (LANL)	455 (SRS) 0 (LANL)
	PDC	N/A	N/A	467 (SRS) 0 (LANL)	467 (SRS) 0 (LANL)	467 (SRS) 0 (LANL)
	PF-4 and MFFF	N/A	173 (SRS) 26 (LANL)	173 (SRS) 26 (LANL)	173 (SRS) 26 (LANL)	180 (SRS) 26 (LANL)
	PF-4, HC/HBL, and MFFF	N/A	180 (SRS) 26 (LANL)	180 (SRS) 26 (LANL)	180 (SRS) 26 (LANL)	186 (SRS) 26 (LANL)
Direct earnings in peak year ($ in millions)	PDCF	44 (SRS) 0 (LANL)	57 (SRS) 0 (LANL)	44 (SRS) 0 (LANL)	44 (SRS) 0 (LANL)	44 (SRS) 0 (LANL)
	PDC	N/A	N/A	45 (SRS) 0 (LANL)	45 (SRS) 0 (LANL)	45 (SRS) 0 (LANL)
	PF-4 and MFFF	N/A	17 (SRS) 2.4 (LANL)	17 (SRS) 2.4 (LANL)	17 (SRS) 2.4 (LANL)	17 (SRS) 2.4 (LANL)
	PF-4, HC/HBL, and MFFF	N/A	17 (SRS) 2.4 (LANL)	17 (SRS) 2.4 (LANL)	17 (SRS) 2.4 (LANL)	18 (SRS) 2.4 (LANL)
Direct output in peak year ($ in millions)	PDCF	71 (SRS) 0 (LANL)	92 (SRS) 0 (LANL)	71 (SRS) 0 (LANL)	71 (SRS) 0 (LANL)	71 (SRS) 0 (LANL)
	PDC	N/A	N/A	72 (SRS) 0 (LANL)	72 (SRS) 0 (LANL)	72 (SRS) 0 (LANL)
	PF-4 and MFFF	N/A	27 (SRS) 4.4 (LANL)	27 (SRS) 4.4 (LANL))	27 (SRS) 4.4 (LANL)	28 (SRS) 4.4 (LANL)
	PF-4, HC/HBL, and MFFF	N/A	28 (SRS) 4.4 (LANL)	28 (SRS) 4.4 (LANL)	28 (SRS) 4.4 (LANL)	29 (SRS) 4.4 (LANL)
Value added in peak year ($ in millions)	PDCF	67 (SRS) 0 (LANL)	87 (SRS) 0 (LANL)	67 (SRS) 0 (LANL)	67 (SRS) 0 (LANL)	67 (SRS) 0 (LANL)
	PDC	N/A	N/A	68 (SRS) 0 (LANL)	68 (SRS) 0 (LANL)	68 (SRS) 0 (LANL)
	PF-4 and MFFF	N/A	25 (SRS) 3.8 (LANL)	25 (SRS) 3.8 (LANL)	25 (SRS) 3.8 (LANL)	26 (SRS) 3.8 (LANL)
	PF-4, HC/HBL, and MFFF	N/A	26 (SRS) 3.8 (LANL)	26 (SRS) 3.8 (LANL)	26 (SRS) 3.8 (LANL)	27 (SRS) 3.8 (LANL)
Projected personal income of ROI in peak year ($ in millions)	PDCF	19,500 (SRS) N/A (LANL)	19,800 (SRS) N/A (LANL)	19,500 (SRS) N/A (LANL)	19,500 (SRS) N/A (LANL)	19,500 (SRS) N/A (LANL)
	PDC	N/A	N/A	19,500 (SRS) N/A (LANL)	19,500 (SRS) N/A (LANL)	19,500 (SRS) N/A (LANL)
	PF-4 and MFFF	N/A	18,300 (SRS) 13,900 (LANL)	18,300 (SRS) 13,900 (LANL)	18,300 (SRS) 13,900 (LANL)	18,300 (SRS) 13,900 (LANL)
	PF-4, HC/HBL, and MFFF	N/A	18,300 (SRS) 13,900 (LANL)	18,300 (SRS) 13,900 (LANL)	18,300 (SRS) 13,900 (LANL)	18,300 (SRS) 13,900 (LANL)
Projected labor force of ROI in peak year	PDCF	258,000 (SRS) N/A (LANL)	261,000 (SRS) N/A (LANL)	258,000 (SRS) N/A (LANL)	258,000 (SRS) N/A (LANL)	258,000 (SRS) N/A (LANL)
	PDC	N/A	N/A	258,000 (SRS) N/A (LANL)	258,000(SRS) N/A (LANL)	258,000 (SRS) N/A (LANL)
	PF-4 and MFFF	N/A	247,000 (SRS) 185,000 (LANL)	247,000 (SRS) 185,000 (LANL)	247,000 (SRS) 185,000 (LANL)	247,000 (SRS) 185,000 (LANL)
	PF-4, HC/HBL, and MFFF	N/A	247,000 (SRS) 185,000 (LANL)	247,000 (SRS) 185,000 (LANL)	247,000 (SRS) 185,000 (LANL)	247,000 (SRS) 185,000 (LANL)

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; N/A = not applicable; PDC = Pit Disassembly and Conversion Project; PDCF = Pit Disassembly and Conversion Facility; PF-4 = Plutonium Facility; ROI = region of interest; SRS = Savannah River Site; WIPP = Waste Isolation Pilot Plant.

[a] As described in Appendix H, no new construction would be needed at any of the principal SRS and LANL plutonium support facilities, with no impact on employment.

[b] Indirect employment was estimated using a direct-effect employment multiplier of 1.63 for SRS and 1.58 for LANL.

Table 4–11 Summary of Socioeconomic Impacts Related to Facility Operations

Resource	Pit Disassembly and Conversion Option	Alternative				
		No Action	Immobilization to DWPF	MOX Fuel	HC/HBL to DWPF	WIPP
Direct employment (number of personnel in peak year)	PDCF	1,677 (SRS) 149 (LANL)	2,111 (SRS) 149 (LANL)	1,636 (SRS) 149 (LANL)	1,676 (SRS) 149 (LANL)	1,766 (SRS) 149 (LANL)
	PDC	N/A	N/A	1,716 (SRS) 149 (LANL)	1,667 (SRS) 149 (LANL)	1,716 (SRS) 149 (LANL)
	PF-4 and MFFF	N/A	1,596 (SRS) 493 (LANL)	1,357 (SRS) 493 (LANL)	1,202 (SRS) 493 (LANL)	1,257 (SRS) 493 (LANL)
	PF-4, HC/HBL, and MFFF	N/A	1,736 (SRS) 493 (LANL)	1,397 (SRS) 493 (LANL)	1,342 (SRS) 493 (LANL)	1,397 (SRS) 493 (LANL)
Indirect employment (number of personnel in peak year) [a]	PDCF	1,995 (SRS) 151 (LANL)	2,511 (SRS) 151 (LANL)	1,946 (SRS) 151 (LANL)	1,993 (SRS) 151 (LANL)	2,100 (SRS) 151 (LANL)
	PDC	N/A	N/A	2,041 (SRS) 151 (LANL)	1,983 (SRS) 151 (LANL)	2,041 (SRS) 151 (LANL)
	PF-4 and MFFF	N/A	1,898 (SRS) 499 (LANL)	1,614 (SRS) 499 (LANL)	1,430 (SRS) 499 (LANL)	1,495 (SRS) 499 (LANL)
	PF-4, HC/HBL, and MFFF	N/A	2,065 (SRS) 499 (LANL)	1,662 (SRS) 499 (LANL)	1,596 (SRS) 499 (LANL)	1,662 (SRS) 499 (LANL)
Direct earnings in peak year ($ in millions)	PDCF	140 (SRS) 13 (LANL)	180 (SRS) 13 (LANL)	140 (SRS) 13 (LANL)	140 (SRS) 13 (LANL)	150 (SRS) 13 (LANL)
	PDC	N/A	N/A	150 (SRS) 13 (LANL)	140 (SRS) 13 (LANL)	150 (SRS) 13 (LANL)
	PF-4 and MFFF	N/A	140 (SRS) 43 (LANL)	120 (SRS) 43 (LANL)	100 (SRS) 43 (LANL)	110 (SRS) 43 (LANL)
	PF-4, HC/HBL, and MFFF	N/A	150 (SRS) 43 (LANL)	120 (SRS) 43 (LANL)	120 (SRS) 43 (LANL)	120 (SRS) 43 (LANL)
Direct output in peak year ($ in millions)	PDCF	300 (SRS) 19 (LANL)	380 (SRS) 19 (LANL)	290 (SRS) 19 (LANL)	300 (SRS) 19 (LANL)	310 (SRS) 19 (LANL)
	PDC	N/A	N/A	310 (SRS) 19 (LANL)	300 (SRS) 19 (LANL)	310 (SRS) 19 (LANL)
	PF-4 and MFFF	N/A	280 (SRS) 64 (LANL)	240 (SRS) 64 (LANL)	210 (SRS) 64 (LANL)	220 (SRS) 64 (LANL)
	PF-4, HC/HBL, and MFFF	N/A	310 (SRS) 64 (LANL)	250 (SRS) 64 (LANL)	240 (SRS) 64 (LANL)	250 (SRS) 64 (LANL)
Value added in peak year ($ in millions)	PDCF	250 (SRS) 19 (LANL)	320 (SRS) 19 (LANL)	250 (SRS) 19 (LANL)	250 (SRS) 19 (LANL)	270 (SRS) 19 (LANL)
	PDC	N/A	N/A	260 (SRS) 19 (LANL)	250 (SRS) 19 (LANL)	260 (SRS) 19 (LANL)
	PF-4 and MFFF	N/A	240 (SRS) 63 (LANL)	200 (SRS) 63 (LANL)	180 (SRS) 63 (LANL)	190 (SRS) 63 (LANL)
	PF-4, HC/HBL, and MFFF	N/A	260 (SRS) 63 (LANL)	210 (SRS) 63 (LANL)	200 (SRS) 63 (LANL)	210 (SRS) 63 (LANL)
Projected personal income of ROI in peak year ($ in millions)	PDCF	22,300 (SRS) 13,400 (LANL)	22,300 (SRS) 13,400 (LANL)	22,300 (SRS) 13,400 (LANL)	22,300 (SRS) 13,400 (LANL)	22,300 (SRS) 13,400 (LANL)
	PDC	N/A	N/A	20,700 (SRS) 13,400 (LANL)	20,700 (SRS) 13,400 (LANL)	20,700 (SRS) 13,400 (LANL)
	PF-4 and MFFF	N/A	21,000 (SRS) 15,600 (LANL)	19,200 (SRS) 15,600 (LANL)	20,100 (SRS) 15,600 (LANL)	19,200 (SRS) 15,600 (LANL)
	PF-4, HC/HBL, and MFFF	N/A	21,000 (SRS) 15,600 (LANL)	19,200 (SRS) 15,600 (LANL)	20,100 (SRS) 15,600 (LANL)	19,200 (SRS) 15,600 (LANL)
Projected labor force of ROI in peak year	PDCF	282,000 (SRS) 179,000 (LANL)	282,000 (SRS) 179,000 (LANL)	282,000 (SRS) 179,000 (LANL)	282,000 (SRS) 179,000 (LANL)	282,000 (SRS) 179,000 (LANL)
	PDC	N/A	N/A	269,000 (SRS) 179,000 (LANL)	269,000 (SRS) 179,000 (LANL)	269,000 (SRS) 179,000 (LANL)
	PF-4 and MFFF	N/A	271,000 (SRS) 202,000 (LANL)	255,000 (SRS) 202,000 (LANL)	263,000 (SRS) 202,000 (LANL)	255,000 (SRS) 202,000 (LANL)
	PF-4, HC/HBL, and MFFF	N/A	271,000 (SRS) 202,000 (LANL)	255,000 (SRS) 202,000 (LANL)	263,000 (SRS) 202,000 (LANL)	255,000 (SRS) 202,000 (LANL)

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; N/A = not applicable; PDC = Pit Disassembly and Conversion Project; PDCF = Pit Disassembly and Conversion Facility; PF-4 = Plutonium Facility; ROI = region of interest; SRS = Savannah River Site; WIPP = Waste Isolation Pilot Plant.

[a] Indirect employment was estimated using a direct-effect multiplier of 2.19 for SRS and approximately 2 for LANL.

4.1.3.1 Regional Economic Characteristics

Impacts on the regional economy are measured by the projected changes in employment, earnings, and economic output resulting from activities at SRS and LANL. Both short-term, transient construction employment and long-term employment for facility operations would result from the proposed activities. Estimates of the potential impacts on economic output, employment, and earnings under each alternative are derived using multipliers provided from the Regional Input-Output Modeling System (RIMS II) developed by the U.S. Bureau of Economic Analysis (BEA 2012). To focus the potential impacts on the ROIs, the estimated value added resulting from the economic output is measured against the projected personal income of each ROI. Changes in employment are measured against the projected labor force of the ROIs to realize the magnitude of the potential labor impacts.

4.1.3.1.1 No Action Alternative

Construction—Construction employment at SRS under the No Action Alternative is expected to peak in 2017. Approximately 722 people would be directly employed during the construction of PDCF, resulting in an estimated 455 indirect jobs. The peak construction employment under the No Action Alternative is estimated to represent approximately 0.5 percent of the projected SRS ROI labor force.

During the peak year of construction activities, the value added from the direct economic activity to the local economy in the form of final goods and services is estimated to be approximately $67 million, or 0.3 percent of projected personal income in the SRS ROI. Approximately $44 million of the value added would be in the form of earnings of construction workers.

No additional modifications to PF-4 would be required under the No Action Alternative; therefore, there would be no socioeconomic impacts from construction at LANL.

Operations—Employment under the No Action Alternative would peak in 2026. It is estimated that approximately 1,677 people would be directly employed from plutonium storage at the K-Area Complex and operation of KIS, WSB, PDCF, and MFFF. Additional indirect employment of approximately 1,995 jobs is expected to be generated in the SRS ROI. The total additional employment under this alternative is estimated to represent approximately 1.3 percent of the projected SRS ROI labor force. All surplus plutonium disposition activities would be completed by the end of 2036, with the exception of surplus plutonium storage, surveillance, stabilization, and repackaging activities, which would continue until 2051.

During the peak year of operations, the value added from the direct economic activity to the local economy in the form of final goods and services is estimated to be approximately $250 million, or about 1.1 percent of the projected personal income in the SRS ROI. Approximately $140 million of the value added to the local economy would be in the form of earnings of SRS employees.

Surplus plutonium-related activities would continue at SRS through 2051 under the No Action Alternative. The total number of worker-years is estimated to be about 36,200. The total value added from the direct economic activity to the local economy in the form of final goods and services over the life of the project is estimated to be approximately $5.4 billion.

Under the No Action Alternative, additional direct employment at PF-4 would peak at 149 workers annually starting in 2013. Another 151 indirect jobs are expected to be generated in the LANL ROI during this time. Total employment related to PF-4 operations under the No Action Alternative is estimated to represent approximately 0.1 percent of the projected LANL ROI labor force.

During the peak year of pit disassembly and conversion operations at PF-4, it is estimated that the value added from the direct economic activity to the local economy would be approximately $19 million, or about 0.1 percent of the projected personal income of the LANL ROI. Approximately $13 million of the value added would be in the form of earnings of workers at PF-4. The total worker-years needed at LANL over the life of the project would be approximately 1,040. The total value added from the direct economic activity to the local economy in the LANL ROI in the form of final goods and services over the life of the project is estimated to be approximately $130 million.

4.1.3.1.2 Immobilization to DWPF Alternative

Construction—There are multiple pit disassembly and conversion options under the Immobilization to DWPF Alternative. In addition to the option of building a new PDCF, other options are being considered for pit disassembly and conversion whereby existing facilities at LANL and SRS would be modified. These options would result in lower construction requirements compared to those for construction of PDCF (see Appendix F).

Under the PDCF Option, construction employment under the Immobilization to DWPF Alternative is expected to peak in 2018. Approximately 943 people would be directly employed during construction of PDCF and the K-Area immobilization capability. Another 595 indirect jobs are expected to be generated in the SRS ROI. The peak construction employment under the Immobilization to DWPF Alternative is estimated to represent approximately 0.6 percent of the projected ROI labor force.

During the peak year of construction activities, it is estimated that the value added from the direct economic activity to the local economy would be approximately $87 million, or about 0.4 percent of the projected personal income in the SRS ROI. Approximately $57 million of the value added would be in the form of earnings of construction workers.

Under the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option, PDCF would not be constructed. Construction employment at SRS would peak in 2013 under the PF-4 and MFFF Option. Approximately 275 people would be directly employed during installation of the metal oxidation furnaces in MFFF. Another 173 indirect jobs are expected to be generated in the SRS ROI. Total employment related to construction activities under the Immobilization to DWPF Alternative with the PF-4 and MFFF Option is estimated to represent approximately 0.2 percent of the projected SRS ROI labor force.

During the peak year of construction activities at SRS under the PF-4 and MFFF Option, the value added from the direct economic activity to the local economy in the form of final goods and services is estimated to be approximately $25 million, and represent approximately 0.1 percent of the projected personal income in the SRS ROI. It is estimated that approximately $17 million of the value added would be in the form of earnings of construction workers.

Construction employment at SRS under the PF-4, H-Canyon/HB-Line, and MFFF Option would peak in 2013. Approximately 285 people would be directly employed during installation of the metal oxidation furnaces in MFFF. Another 180 indirect jobs are expected to be generated in the SRS ROI. Total employment related to construction activities under the Immobilization to DWPF Alternative with the PF-4, H-Canyon/HB-Line, and MFFF Option is estimated to represent about 0.2 percent of the projected SRS ROI labor force.

During the peak year of construction activities at SRS under the PF-4, H-Canyon/HB-Line, and MFFF Option, the value added from the direct economic activity to the local economy in the form of final goods and services is estimated to be about $26 million, and represent about 0.1 percent of the projected personal income in the SRS ROI. It is estimated that about $17 million of the value added would be in the form of earnings of construction workers.

Modification of PF-4 would be required under the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option. Construction employment during PF-4 modifications would peak at 46 workers. Another 26 indirect jobs are expected to be generated in the LANL ROI during this time. Peak employment related to modification of PF-4 is estimated to represent approximately 0.04 percent of the projected LANL ROI labor force.

During the peak year of PF-4 modification, it is estimated that the value added from the direct economic activity to the local economy would be approximately $3.8 million, or about 0.03 percent of the projected personal income of the LANL ROI. It is estimated that approximately $2.4 million of the value added would be in the form of earnings of construction workers.

Operations—Employment resulting from implementation of the PDCF Option under the Immobilization to DWPF Alternative would peak during 2026. Approximately 2,111 additional people would be directly employed at SRS at the K-Area immobilization capability, WSB, K-Area storage, KIS, MFFF, and PDCF. Additional indirect employment of approximately 2,511 workers would be generated in the SRS ROI during the peak year of operations. The total additional employment associated with operations under this alternative is estimated to represent approximately 1.6 percent of the projected SRS ROI labor force.

During the peak year of operations at SRS, the value added from the direct economic output to the local economy in the form of final goods and services is estimated to be approximately $320 million, or about 1.4 percent of the projected personal income in the ROI. Approximately $180 million of the value added to the local economy would be in the form of earnings of SRS employees.

All surplus plutonium activities at SRS would be completed by the end of 2037. When compared with the No Action Alternative, the PDCF Option under the Immobilization to DWPF Alternative is expected to decrease the operational timeframe for surplus plutonium activities at SRS by approximately 14 years, while increasing the total number of SRS worker-years needed over the life of the project by approximately 4,800 to 41,000. The total value added from the direct economic activity to the local economy in the form of final goods and services over the life of the project is estimated to be approximately $6.2 billion.

The socioeconomic impacts from operations at LANL under the PDCF Option would be the same as those in Section 4.1.3.1.1 under the No Action Alternative.

Under both the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option, employment at SRS resulting from implementing the Immobilization to DWPF Alternative with pit disassembly and conversion at LANL would peak during 2022.

Under the PF-4 and MFFF Option, approximately 1,596 additional people would be directly employed by SRS operations at the K-Area immobilization capability, WSB, K-Area storage, KIS, and MFFF. Additional indirect employment of approximately 1,898 workers would be generated in the SRS ROI during the peak year of operations. The total additional employment associated with operations under this option is estimated to represent approximately 1.3 percent of the projected SRS ROI labor force.

During the peak year of operations at SRS under the PF-4 and MFFF Option, the value added from the direct economic output to the local economy in the form of final goods and services is estimated to be approximately $240 million, or about 1.1 percent of the projected personal income in the SRS ROI. Approximately $140 million of the value added to the local economy would be in the form of earnings of SRS employees.

Under the PF-4, H-Canyon/HB-Line, and MFFF Option, approximately 1,736 additional people would be directly employed by SRS operations at the K-Area immobilization capability, H-Canyon/HB-Line, WSB, K-Area storage, KIS, K-Area Complex pit disassembly, and MFFF. Additional indirect employment of approximately 2,065 workers is expected in the SRS ROI during the peak year of operations. The total additional employment associated with operations under the Immobilization to DWPF Alternative with the PF-4, H-Canyon/HB-Line, and MFFF Option is estimated to represent approximately 1.4 percent of the projected SRS ROI labor force.

During the peak year of operations at SRS under the PF-4, H-Canyon/HB-Line, and MFFF Option, the value added from the direct economic output to the local economy in the form of final goods and services is estimated to be approximately $260 million, or about 1.2 percent of the projected personal income in the SRS ROI. Approximately $150 million of the value added to the local economy would be in the form of earnings of SRS employees.

Under both the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option, all surplus plutonium activities at SRS would be completed by the end of 2038.

When compared with the No Action Alternative, the PF-4 and MFFF Option under the Immobilization to DWPF Alternative is expected to decrease the operational timeframe for surplus plutonium activities at SRS by approximately 13 years, while decreasing the total number of SRS worker-years needed over the life of the project by approximately 5,700 to 30,500. The total value added from the direct economic activity to the local economy in the form of final goods and services over the life of the project is estimated to be approximately $4.6 billion.

The PF-4, H-Canyon/HB-Line, and MFFF Option under the Immobilization to DWPF Alternative is expected to decrease the operational timeframe for surplus plutonium activities at SRS by approximately 13 years when compared to the No Action Alternative, while decreasing the total number of SRS worker-years needed over the life of the project by approximately 3,800 to 32,400. The total value added from the direct economic activity to the local economy in the form of final goods and services over the life of the project is estimated to be approximately $4.9 billion.

Under both the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option, additional direct employment at PF-4 would peak at 493 workers annually starting in 2021. Another 499 indirect jobs are expected to be generated in the LANL ROI during this time. Peak employment related to this change in PF-4 operations is estimated to represent approximately 0.5 percent of the projected LANL ROI labor force.

During the peak year of pit disassembly and conversion operations at PF-4, it is estimated that the value added from the direct economic activity to the local economy would be approximately $63 million, or about 0.4 percent of the projected personal income of the LANL ROI. Approximately $43 million of the value added would be in the form of earnings of workers at PF-4. When compared to the No Action Alternative, the total worker-years needed at LANL over the life of the project would increase by about 7,400 to 8,400. The total value added from the direct economic activity to the local economy in the LANL ROI in the form of final goods and services over the life of the project is estimated to be approximately $1.1 billion.

4.1.3.1.3 MOX Fuel Alternative

Construction—There are multiple options for pit disassembly and conversion operations under the MOX Fuel Alternative. Two options include constructing a new PDCF at F-Area or constructing a new PDC at K-Area. Additionally, two options are being considered for pit disassembly and conversion whereby existing facilities at LANL and SRS would be modified to support pit disassembly and conversion activities. These options are expected to result in lower construction requirements compared to those under the PDCF and PDC Options (see Appendix F).

Peak socioeconomic impacts at SRS from construction under the PDCF Option would be the same as those for the PDCF Option under the No Action Alternative (Section 4.1.3.1.1). There would be no construction at LANL under the PDCF Option.

Construction employment at SRS under the PDC Option, is expected to peak in 2017. Approximately 741 people would be directly employed during the peak year of construction. Another 467 indirect jobs would be generated under this option. Total employment related to construction activities under the PDC Option is estimated to represent about 0.5 percent of the projected SRS ROI labor force. There would be no construction at LANL under the PDC Option.

During the peak year of construction under the PDC Option, the value added from the direct economic activity to the local economy of the SRS ROI in the form of final goods and services is estimated to be approximately $68 million, and represent approximately 0.3 percent of the projected personal income in the SRS ROI. Approximately $45 million of the value added would be in the form of earnings of construction workers.

Peak socioeconomic impacts at SRS from construction under the PF-4 and MFFF and the PF-4, H-Canyon/HB-Line, and MFFF Options would be the same as those for these options under the Immobilization to DWPF Alternative (Section 4.1.3.1.2).

Socioeconomic impacts from modification of PF-4 at LANL to support increased pit disassembly and conversion operations under the PF-4 and MFFF and PF-4, H-Canyon/HB-Line, and MFFF Options would be the same as those for these options under the Immobilization to DWPF Alternative (Section 4.1.3.1.2).

Operations—Employment under the PDCF Option is expected to peak during 2026. Additional direct employment is estimated to peak at approximately 1,636 workers, generating an estimated 1,946 indirect jobs in the SRS ROI. The total additional employment associated with this alternative is estimated to represent approximately 1.3 percent of the projected SRS ROI labor force in the peak year of operations.

During the peak year of operations under the PDCF Option, the value added from the direct economic activity to the local economy of the SRS ROI in the form of final goods and services is estimated to be approximately $250 million, and represent approximately 1.1 percent of projected personal income in the SRS ROI. Approximately $140 million of the value added to the local economy would be in the form of earnings of SRS employees.

Surplus plutonium activities would be completed by the end of 2039. When compared with the No Action Alternative, the MOX Fuel Alternative under the PDCF Option is expected to decrease the operational timeframe for surplus plutonium activities by approximately 12 years, while increasing the total number of SRS worker-years needed over the life of the project by approximately 4, 300 to 40,500. The total value added from the direct economic activity to the local economy of the SRS ROI in the form of final goods and services over the life of the project is estimated to be approximately $6.1 billion.

The socioeconomic impacts from operations at LANL under the PDCF Option would be the same as those in Section 4.1.3.1.1 under the No Action Alternative.

Employment under the MOX Fuel Alternative with the PDC Option is expected to peak during 2021 Additional direct employment is estimated to peak at approximately 1,716 workers, generating an estimated 2,041 indirect jobs in the SRS ROI. The total additional employment associated with this alternative is estimated to represent approximately 1.4 percent of the projected SRS ROI labor force in the peak year of operations.

During the peak year of operations, the value added from the direct economic activity to the local economy in the form of final goods and services is estimated to be approximately $260 million, and represent approximately 1.3 percent of projected personal income in the ROI in the peak year of operations. Approximately $150 million of the value added to the local economy would be in the form of earnings of SRS employees.

Surplus plutonium activities would be completed by the end of 2039. When compared with the No Action Alternative, implementing the PDC Option under the MOX Fuel Alternative is expected to decrease the operational timeframe for surplus plutonium activities by approximately 12 years, while increasing the total number of SRS worker-years needed over the life of the project by approximately 4,700 to 40,900. The total value added from the direct economic activity to the local economy of the SRS ROI in the form of final goods and services over the life of the project is estimated to be approximately $6.1 billion.

The socioeconomic impacts for this alternative from operations at LANL under the PDC Option would be the same as those in Section 4.1.3.1.1 for the PDCF Option under the No Action Alternative.

Under the PF-4 and MFFF Option, direct employment at SRS is expected to peak during 2016 at approximately 1,357 workers. The direct employment would generate an estimated 1,614 indirect jobs in the SRS ROI. The total additional employment at SRS associated with this alternative is estimated to represent approximately 1.2 percent of the projected SRS ROI labor force in the peak year of operations.

During the peak year of SRS operations under the PF-4 and MFFF Option, the value added from the direct economic activity to the local economy in the form of final goods and services is estimated to be approximately $200 million, and represent approximately 1.0 percent of projected personal income in the SRS ROI in the peak year of operations. Approximately $120 million of the value added to the local economy would be in the form of earnings of SRS employees.

Surplus plutonium activities under the PF-4 and MFFF Option would be completed by the end of 2039. When compared with the No Action Alternative, the PF-4 and MFFF Option under the MOX Fuel Alternative is expected to decrease the operational timeframe for surplus plutonium activities by approximately 12 years, while decreasing the total number of SRS worker-years needed over the life of the project by approximately 6,300 to 29,900. The total value added from the direct economic activity to the local economy of the SRS ROI in the form of final goods and services over the life of the project is estimated to be approximately $4.5 billion.

The socioeconomic impacts from pit disassembly and conversion operations in PF-4 at LANL under the PF-4 and MFFF Option would be the same as those for this option under the Immobilization to DWPF Alternative (Section 4.1.3.1.2).

Under the PF-4, H-Canyon/HB-Line, and MFFF Option, direct employment at SRS is expected to peak during 2016 at approximately 1,397 workers. The direct employment would generate an estimated 1,662 indirect jobs in the SRS ROI. The total additional employment at SRS associated with this alternative is estimated to represent approximately 1.2 percent of the projected SRS ROI labor force in the peak year of operations.

During the peak year of SRS operations under the PF-4, H-Canyon/HB-Line, and MFFF Option, the value added from the direct economic activity to the local economy in the form of final goods and services is estimated to be approximately $210 million, and represent approximately 1.1 percent of projected personal income in the SRS ROI in the peak year of operations. Approximately $120 million of the value added to the local economy would be in the form of earnings of SRS employees.

Surplus plutonium disposition activities at SRS under the PF-4, H-Canyon/HB-Line, and MFFF Option would be completed by the end of 2039. When compared with the No Action Alternative, the PF-4, H-Canyon/HB-Line, and MFFF Option under the MOX Fuel Alternative is expected to decrease the operational timeframe for surplus plutonium activities by approximately 12 years, while decreasing the total number of SRS worker-years needed over the life of the project by approximately 5,000 to 31,200. The total value added from the direct economic activity to the local economy of the SRS ROI in the form of final goods and services over the life of the project is estimated to be approximately $4.7 billion.

The socioeconomic impacts from pit disassembly and conversion operations in PF-4 at LANL under the PF-4, H-Canyon/HB-Line, and MFFF Option would be the same as those for this option under the Immobilization to DWPF Alternative (Section 4.1.3.1.2).

4.1.3.1.4 H-Canyon/HB-Line to DWPF Alternative

Construction—Similar to the MOX Fuel Alternative, there are multiple options for pit disassembly and conversion under the H-Canyon/HB-Line to DWPF Alternative. Options for pit disassembly and conversion at SRS include constructing a new PDCF at F-Area or constructing a new PDC at K-Area. Additionally, two options are being considered for pit disassembly and conversion whereby existing facilities at LANL and SRS would be modified to support pit disassembly and conversion activities. These options would result in lower construction requirements compared to those under the PDCF and PDC Options (see Appendix F).

The peak socioeconomic impacts at SRS and LANL from construction under the PDCF Option would be the same as those for this option under the No Action Alternative (Section 4.1.3.1.1).

The peak socioeconomic impacts at SRS and LANL from construction under the PDC Option would be the same as those for this option under the MOX Fuel Alternative (Section 4.1.3.1.3).

The peak socioeconomic impacts at SRS and LANL under the PF-4 and MFFF Option would be the same as those for this option under the Immobilization to DWPF Alternative (Section 4.1.3.1.2).

The peak socioeconomic impacts at SRS and LANL from construction under the PF-4, H-Canyon/HB-Line and MFFF Option would be the same as those for this option under the Immobilization to DWPF Alternative (Section 4.1.3.1.2).

Operations—Employment at SRS under the PDCF Option is expected to peak during 2026. Additional direct employment is estimated to peak at approximately 1,676 workers, generating an estimated 1,993 indirect jobs in the SRS ROI. The total additional employment associated with this alternative is estimated to represent approximately 1.3 percent of the projected ROI labor force in the peak year of operations.

During the peak year of operations, the value added from the direct economic activity to the local economy in the form of final goods and services is estimated to be approximately $250 million, and represent approximately 1.1 percent of projected personal income in the ROI in the peak year of operations. Approximately $140 million of the value added to the local economy would be in the form of earnings of SRS employees.

Surplus plutonium activities would be completed by the end of 2038. When compared with the No Action Alternative, the PDCF Option under the H-Canyon/HB-Line to DWPF Alternative is expected to decrease the operational timeframe for surplus plutonium activities by approximately 13 years, while increasing the total number of SRS worker-years needed over the life of the project by approximately 1,900 to 38,100. The total value added from the direct economic activity to the local economy in the SRS ROI in the form of final goods and services over the life of the project is estimated to be approximately $5.7 billion.

The socioeconomic impacts at LANL from operations under the PDCF Option would be the same as those for this option under the No Action Alternative (Section 4.1.3.1.1).

Employment under the PDC Option, is expected to peak during 2021. Additional direct employment is estimated to peak at approximately 1,667 workers, generating additional indirect employment in the SRS ROI of approximately 1,983. The total additional employment associated with this alternative is estimated to represent approximately 1.4 percent of the projected ROI labor force in the peak year of operations.

During the peak year of operations, the value added from the direct economic output to the local economy in the form of final goods and services would be approximately $250 million, or approximately 1.2 percent of projected personal income in the SRS ROI in the respective peak year of operations. Approximately $140 million of the value added to the local economy would be in the form of earnings of SRS employees.

Surplus plutonium activities would be completed by the end of 2038. When compared with the No Action Alternative, the PDC Option under the H-Canyon/HB-Line to DWPF Alternative is expected to decrease the operational timeframe for surplus plutonium activities by approximately 13 years, while increasing the total number of SRS worker-years needed over the life of the project by approximately 2,400 to 38,600. The total value added from the direct economic activity to the local economy in the SRS ROI in the form of final goods and services over the life of the project is estimated to be approximately $5.8 billion.

The socioeconomic impacts at LANL from operations under the PDC Option would be the same as those for this option under the MOX Fuel Alternative (Section 4.1.3.1.3).

Employment at SRS under the PF-4 and MFFF Option is expected to peak during 2019. Additional direct employment is estimated to peak at approximately 1,202 workers, generating an estimated 1,430 indirect jobs in the SRS ROI. The total additional employment associated with this alternative is estimated to represent approximately 1.0 percent of the projected ROI labor force in the peak year of operations.

During the peak year of operations, the value added from the direct economic activity to the local economy in the form of final goods and services is estimated to be approximately $180 million, and represent approximately 0.9 percent of projected personal income in the SRS ROI in the peak year of operations. Approximately $100 million of the value added to the local economy would be in the form of earnings of SRS employees.

Surplus plutonium activities would be completed by the end of 2038. When compared with the No Action Alternative, the PF-4 and MFFF Option under the H-Canyon/HB-Line to DWPF Alternative is expected to decrease the operational timeframe for surplus plutonium activities by approximately 13 years, while decreasing the total number of SRS worker-years needed over the life of the project by approximately 8,700 to 27,500. The total value added from the direct economic activity to the local economy of the SRS ROI in the form of final goods and services over the life of the project is estimated to be approximately $4.1 billion.

The socioeconomic impacts at LANL from operations under the PF-4 and MFFF Option would be the same as those for this option under the Immobilization to DWPF Alternative (Section 4.1.3.1.2).

Employment at SRS under the PF-4, H-Canyon/HB-Line, and MFFF Option is expected to peak during 2019. Additional direct employment is estimated to peak at approximately 1,342 workers, generating an estimated 1,596 indirect jobs in the SRS ROI. The total additional employment associated with this option is estimated to represent approximately 1.1 percent of the projected SRS ROI labor force in the peak year of operations.

During the peak year of operations, the value added from the direct economic activity to the local economy in the form of final goods and services is estimated to be approximately $200 million, and represent approximately 1 percent of projected personal income in the SRS ROI. Approximately $120 million of the value added to the local economy would be in the form of earnings of SRS employees.

Surplus plutonium disposition activities would be completed by the end of 2038. When compared with the No Action Alternative, the PF-4, H-Canyon/HB-Line, and MFFF Option under the H-Canyon/HB-Line to DWPF Alternative is expected to decrease the operational timeframe for surplus plutonium activities by approximately 13 years, while decreasing the total number of SRS worker-years needed over the life of the project by approximately 6,700 to 29,500. The total value added from the direct economic activity to the local economy of the SRS ROI in the form of final goods and services over the life of the project is estimated to be approximately $4.4 billion.

The socioeconomic impacts at LANL from operations under the PF-4, H-Canyon/HB-Line, and MFFF Option would be the same as those for this option under the Immobilization to DWPF Alternative (Section 4.1.3.1.2).

4.1.3.1.5 WIPP Alternative

Construction—Similar to the MOX Fuel Alternative, there are multiple options for pit disassembly and conversion operations under the WIPP Alternative. Options for pit disassembly and conversion at SRS include constructing a new PDCF at F-Area or constructing a new PDC facility at K-Area. Additionally, options are being considered for pit disassembly and conversion whereby existing facilities at LANL and SRS would be modified to enhance pit disassembly and conversion capabilities. These options would result in lower construction requirements compared to those under the PDCF and PDC Options (see Appendix F).

The peak socioeconomic impacts at SRS and LANL from construction under the PDCF Option would be the same as those for this option under the No Action Alternative (Section 4.1.3.1.1).

The peak socioeconomic impacts at SRS and LANL from construction under the PDC Option would be the same as those for this option under the MOX Fuel Alternative (Section 4.1.3.1.3).

Construction employment at SRS under the PF-4 and MFFF Option would peak during 2013 with direct employment of 285 workers. The direct employment would generate an additional 180 indirect jobs within the SRS ROI. Total employment related to construction activities under the PF-4 and MFFF Option is estimated to represent about 0.2 percent of the projected SRS ROI labor force.

During the peak year of construction activities, the value added from the direct economic activity to the local economy in the form of final goods and services is estimated to be approximately $26 million, and represent approximately 0.1 percent of the projected personal income in the SRS ROI. It is estimated that approximately $17 million of the value added would be in the form of earnings of construction workers.

The socioeconomic impacts at LANL from construction under the PF-4 and MFFF Option would be essentially the same as those for this option under the Immobilization to DWPF Alternative (Section 4.1.3.1.2). These impacts would not substantially change if modifications were made to existing facilities in TA-55 and planned facilities in TA-63 to support preparation, staging, and shipment of surplus plutonium for potential WIPP disposal.

Construction employment at SRS under the PF-4, H-Canyon/HB-Line, and MFFF Option would peak during 2013 with direct employment of 295 workers. The direct employment would generate an additional 186 indirect jobs within the SRS ROI. Total employment related to construction activities under the PF-4 H-Canyon/HB-Line, and MFFF Option is estimated to represent about 0.2 percent of the projected SRS ROI labor force.

During the peak year of construction activities, the value added from the direct economic activity to the local economy in the form of final goods and services is estimated to be approximately $27 million, and represent approximately 0.15 percent of the projected personal income in the SRS ROI. It is estimated that approximately $18 million of the value added would be in the form of earnings of construction workers.

The socioeconomic impacts at LANL from construction under the PF-4, H-Canyon/HB-Line, and MFFF Option would be essentially the same as those for this option under the Immobilization to DWPF Alternative (Section 4.1.3.1.2). These impacts would not substantially change if modifications were made to existing facilities in TA-55 and planned facilities in TA-63 to support preparation, staging, and shipment of surplus plutonium for potential WIPP disposal.

Operations—Employment under the PDCF Option is expected to peak during 2026. Additional direct employment is estimated to peak at approximately 1,766 workers, generating an estimated 2,100 indirect jobs in the SRS ROI. The total additional employment associated with this alternative is estimated to represent approximately 1.4 percent of the projected SRS ROI labor force in the peak year of operations.

During the peak year of operations under the PDCF Option, the value added from the direct economic activity to the local economy of the SRS ROI in the form of final goods and services is estimated to be approximately $270 million, and represent approximately 1.2 percent of projected personal income in the SRS ROI. Approximately $140 million of the value added to the local economy would be in the form of earnings of SRS employees.

Surplus plutonium activities would be completed by the end of 2037. When compared with the No Action Alternative, the PDCF Option under the WIPP Alternative is expected to decrease the operational timeframe for surplus plutonium activities by approximately 14 years while increasing the total number of SRS worker-years needed over the life of the project by approximately 2,300 to 38,500. The total value added from the direct economic activity to the local economy in the SRS ROI in the form of final goods and services over the life of the project is estimated to be approximately $5.8 billion.

Socioeconomic impacts during the peak year of operations under the PDC Option would be the same as those for this option under the MOX Fuel Alternative (Section 4.1.3.1.3).

Surplus plutonium activities would be completed by the end of 2037. When compared with the No Action Alternative, the WIPP Alternative under the PDC Option is expected to decrease the operational timeframe for surplus plutonium activities by approximately 14 years while increasing the total number of SRS worker-years needed over the life of the project by approximately 2,800 to 39,000. The total value added from the direct economic activity to the local economy in the SRS ROI in the form of final goods and services over the life of the project is estimated to be approximately $5.9 billion.

Employment at SRS under the PF-4 and MFFF Option is expected to peak during 2016. Additional direct employment is estimated to peak at approximately 1,257 workers, generating an estimated 1,495 indirect jobs in the SRS ROI. The total additional employment associated with this alternative is estimated to represent approximately 1.1 percent of the projected SRS ROI labor force in the peak year of operations.

During the peak year of operations, the value added from the direct economic activity to the local economy in the form of final goods and services is estimated to be approximately $190 million, and represent approximately 1 percent of projected personal income in the SRS ROI. Approximately $110 million of the value added to the local economy would be in the form of earnings of SRS employees.

Surplus plutonium disposition activities would be completed by the end of 2038. When compared with the No Action Alternative, the PF-4 and MFFF Option is expected to decrease the operational timeframe for surplus plutonium activities by approximately 13 years, while decreasing the total number of SRS worker-years needed over the life of the project by approximately 8,300 to 27,900. The total value added from the direct economic activity to the local economy of the SRS ROI in the form of final goods and services over the life of the project is estimated to be approximately $4.2 billion.

To the extent under the PF-4 and MFFF Option that pit plutonium was prepared at LANL for potential WIPP disposal rather than at SRS, peak annual socioeconomic impacts at SRS would be unchanged, although the overall time required at SRS to prepare plutonium for potential WIPP disposal could be reduced, with a commensurate reduction in the total number of SRS worker-years and total value added over the life of the project.

Assuming 7.1 metric tons (7.8 tons) of pit plutonium are prepared at SRS for potential WIPP disposal, the socioeconomic impacts at LANL from operations under the PF-4 and MFFF Option would be the same as those for this option under the Immobilization to DWPF Alternative (Section 4.1.3.1.2). But to the extent that pit plutonium was prepared at LANL for potential WIPP disposal, additional LANL employment could be required. Detailed information is not available regarding the levels of employment that could be required. It is expected, however, that any additional direct employment at LANL would be enveloped by that estimated for SRS for performing the same WIPP preparation activities, which involves the direct employment of 130 workers. Any additional direct employment at LANL would be expected to result in approximately the same number of indirect jobs in the LANL ROI. In addition, additional employment could be required at the principal LANL support facilities. The period of plutonium disposition operations at LANL could be extended by a few years, resulting in continued annual socioeconomic impacts over this period.

Employment at SRS under the PF-4, H-Canyon/HB-Line, and MFFF Option is expected to peak during 2016. Additional direct employment is estimated to peak at approximately 1,397 workers, generating an estimated 1,662 indirect jobs in the SRS ROI. The total additional employment associated with this alternative is estimated to represent approximately 1.2 percent of the projected SRS ROI labor force in the peak year of operations.

During the peak year of operations, the value added from the direct economic activity to the local economy in the form of final goods and services is estimated to be approximately $210 million, and represent approximately 1.1 percent of projected personal income in the SRS ROI. Approximately $120 million of the value added to the local economy would be in the form of earnings of SRS employees.

Surplus plutonium disposition activities would be completed by the end of 2038. When compared with the No Action Alternative, the PF-4, H-Canyon/HB-Line, and MFFF Option is expected to decrease the operational timeframe for surplus plutonium activities by approximately 13 years, while decreasing the total number of SRS worker-years needed over the life of the project by approximately 6,300 to 29,000. The total value added from the direct economic activity to the local economy of the SRS ROI in the form of final goods and services over the life of the project is estimated to be approximately $4.5 billion.

To the extent under the PF-4, H-Canyon/HB-Line, and MFFF Option that pit plutonium was prepared at LANL for potential WIPP disposal rather than at SRS, peak annual socioeconomic impacts at SRS would be unchanged, although the overall time required at H-Canyon/HB-Line to prepare plutonium for potential WIPP disposal could be reduced, with a commensurate reduction in the total number of SRS worker-years and total value added over the life of the project.

The socioeconomic impacts at LANL from operations under the PF-4, H-Canyon/HB-Line, and MFFF Option would be the same as those under this alternative for the PF-4 and MFFF Option.

4.1.3.2 Population and Housing

Population and housing impacts for each alternative were analyzed using an estimate of the potential for in-migration of workers under each alternative. The in-migration of workers was measured against the projected populations of the SRS and LANL ROIs. Impacts on housing availability were analyzed using the estimated impacts on the population.

4.1.3.2.1 No Action Alternative

The peak construction employment required under this alternative would represent approximately 0.5 percent of the projected labor force. As discussed in Section 4.1.3.1.1, the total change in peak operations employment (direct plus indirect) associated with implementation of the No Action Alternative is estimated to represent about 1.3 percent of the projected SRS ROI labor force. The new jobs created at SRS due to surplus plutonium activities would help to offset any negative impacts generated from recent workforce reductions of approximately 1,240 employees (Pavey 2011). In 2011, the unemployment rate in the SRS ROI was approximately 9.1 percent (BLS 2012). Any in-migration of workers into the ROI due to implementing this alternative is expected to be small when compared to the projected population of the ROI. Furthermore, any in-migration would be well within the historical trends of population growth in this area. Due to the low potential for impacts on the population, impacts on the availability of housing under this alternative are expected to be small.

Operations at LANL under the No Action Alternative would represent 0.1 percent of the projected labor force of the LANL ROI. Employees engaged in pit disassembly and conversion activities at PF-4 would be drawn from the existing LANL workforce and would help to offset any negative impacts generated from recent announcements of workforce reductions at LANL (LANL 2012d). No in-migration of workers is expected under this alternative. Therefore, no impacts on populations and the availability of housing are expected within the LANL ROI under the No Action Alternative.

4.1.3.2.2 Immobilization to DWPF Alternative

The peak construction employment at SRS under this alternative is estimated to represent up to 0.6 percent of the projected labor force of the SRS ROI. As discussed in Section 4.1.3.1.2, the total change in peak operations employment at SRS under any of the pit disassembly and conversion options is estimated to represent up to 1.6 percent of the projected ROI labor force. The new jobs created at SRS due to surplus plutonium activities would help to offset any negative impacts generated from recent workforce reductions of approximately 1,240 employees (Pavey 2011). Any in-migration of workers into the ROI due to implementing this alternative is expected to be small when compared to the projected population of the ROI. Furthermore, any in-migration would be well within the historical trends of population growth in this area. Due to the low potential for impacts on the population, impacts on the availability of housing under this alternative are expected to be small.

The potential socioeconomic impacts at LANL on population and housing under the PDCF Option would be the same as those in Section 4.1.3.2.1 under the No Action Alternative.

Under the pit disassembly and conversion options that involve modification of PF-4 at LANL and increased pit disassembly and conversion activities, the peak construction employment required for modification of PF-4 would represent approximately 0.04 percent of the projected LANL ROI labor force. The increased employment to support PF-4 operations would represent approximately 0.5 percent of the projected LANL ROI labor force. The additional employment to support increased pit disassembly and conversion operations would help to offset any negative impacts generated from an expected workforce reduction at LANL (LANL 2012d). Little to no in-migration of workers is expected to support modification and operations of PF-4, because these employees would be drawn from the existing LANL workforce. Impacts on the availability of housing under this alternative in the area surrounding LANL are expected to be minimal.

4.1.3.2.3 MOX Fuel Alternative

Potential impacts on population and housing in the SRS and LANL ROIs under the MOX Fuel Alternative would be less than those under the Immobilization to DWPF Alternative (Section 4.1.3.2.2), due to the smaller potential for changes to employment.

4.1.3.2.4 H-Canyon/HB-Line to DWPF Alternative

Potential impacts on population and housing under the H-Canyon/HB-Line to DWPF Alternative would be less than those under the Immobilization to DWPF Alternative (Section 4.1.3.2.2), due to the smaller potential for changes in employment.

4.1.3.2.5 WIPP Alternative

Potential impacts on population and housing under the WIPP Alternative would be less than those under the Immobilization to DWPF Alternative (Section 4.1.3.2.2), due to the smaller potential for changes in employment.

4.1.3.3 Traffic

Factors that could influence the level of service of the local transportation system include additional commuter traffic due to changes in employment, an increased number of industrial vehicles due to shipments of nuclear materials to and from SRS and LANL, transportation of MOX fuel to existing domestic commercial nuclear power reactors, transportation of waste shipments, and transportation of construction materials. It was assumed that materials transportation could occur 365 days a year; therefore, the annual shipments were calculated to represent potential impacts on peak average annual daily traffic. It was also assumed that daily commuter traffic would include only direct employees, because indirect employment could occur anywhere throughout the four-county ROIs and would not necessarily affect transportation corridors to and from the site. Transportation of materials and wastes would likely take place during off-peak hours; however, it was assumed that the shipments could be on the road during the peak morning or afternoon commute. This results in traffic impacts likely being overestimated. The estimated number of vehicles traveling to and from SRS was adjusted to account for the impacts of recent workforce reductions of approximately 1,240 employees.

Peak transportation impacts would vary, depending on the pit disassembly and conversion option under each of the alternatives. Under all alternatives, traffic impacts at SRS would be the greatest under the PDCF or PDC Options, because these options result in the largest employment levels at SRS. When the estimated baseline vehicles traveling to and from SRS under the PDCF Option are accounted for, cumulative peak traffic impacts would occur between 2017 and 2018 under all alternatives except under the Immobilization to DWPF Alternative; in this event, cumulative peak traffic volumes would occur during 2026. This increased number of vehicles would not be of sufficient magnitude to adversely affect the level of service of roads in the SRS ROI. Local traffic under all of the alternatives and the flow of commuters into SRS during peak driving times are expected to remain largely unchanged. The largest potential increase would be less than about 3 percent related to SRS traffic under the MOX Fuel and WIPP Alternatives. There would be no need for enhancements to the local transportation system surrounding SRS due to surplus plutonium activities under any alternative.

Under the action alternatives, optional modification and operation of PF-4 at LANL to support increased pit disassembly and conversion operations would have the potential to increase the daily number of vehicles commuting to and from LANL on local roads by up to 392. This peak would occur in 2021 when modification is complete and operations at PF-4 would reach full capacity. After completion of modifications at PF-4, the increased daily number of vehicles on local roads from PF-4 operations is estimated to be 169. When compared to the baseline of an estimated 8,983 vehicles commuting to and from LANL, this small increase in the number of vehicles would not be of sufficient magnitude to adversely affect the level of service of roads in the LANL ROI.

4.1.4 Waste Management

This section analyzes impacts on waste management facilities for the alternatives and pit disassembly and conversion options. Waste generation quantities are presented in the aggregate for each alternative for the pit disassembly and conversion options. Quantities of waste from individual facilities are presented in Appendix F for pit disassembly and conversion facilities, Appendix G for plutonium disposition facilities, and Appendix H for principal plutonium support facilities. Waste types include CH-TRU and mixed CH-TRU waste (analyzed collectively), solid LLW, solid MLLW, solid hazardous waste, solid nonhazardous waste, liquid LLW, and liquid nonhazardous waste. All solid waste quantities presented in this section are containerized and ready for secure storage, onsite disposal, or transportation for offsite disposal taking into account appropriate packaging efficiencies.

As described in Appendix I, the use of a 40 percent MOX fuel core in domestic commercial nuclear power reactors is not expected to change the annual volumes of LLW, MLLW, hazardous waste, and nonhazardous waste that currently occur due to the use of 100 percent LEU fuel core. It is expected, however, that use of a 40 percent MOX fuel core would increase the amount of used fuel that would be generated in a TVA reactor by about 8 to 10 percent compared to that from a 100 percent LEU core, and in a generic reactor by about 2 to 16 percent. Used MOX fuel would be managed in the same manner as LEU used fuel, and the additional used fuel is not expected to affect used fuel management at the reactor sites (TVA 2012). Therefore, the impacts of the alternatives from irradiation of MOX fuel at domestic commercial nuclear power reactors are not discussed further in this section.

Waste management facilities at SRS and LANL are described in Chapter 3, Sections 3.1.10 and 3.2.10, respectively. Waste management impacts are evaluated as a percentage of a site's treatment, storage, or disposal capacity. For LANL, impacts are evaluated for solid LLW, solid MLLW, solid hazardous waste, and solid nonhazardous waste as a percentage increase in existing waste generation rates as reported for 2009. These capacities or current generation rates are discussed in detail in Chapter 3 and are summarized in **Tables 4–12** and **4–13** for SRS and LANL, respectively.

Table 4–12 Summary of Waste Management Capacities at the Savannah River Site

Waste Type	*Annual Capacity*	*Disposition Method*	*Impact Criteria*
Transuranic	13,200 cubic meters	Onsite storage pads	As a percent of storage capacity
Solid LLW	37,000 cubic meters [a]	Onsite disposal slits or engineered trenches	As a percent of disposal capacity
Solid MLLW	296 cubic meters [b]	Onsite storage pads	As a percent of storage capacity
Solid HW	296 cubic meters [b]	Onsite storage pads	As a percent of storage capacity
Solid Non-HW	4,200,000 cubic meters	Regional municipal landfill disposal	As a percent of permitted disposal capacity
Liquid LLW	590,000,000 liters	Onsite F/H-Area Effluent Treatment Project	As a percent of treatment capacity
Liquid Non-HW	1,500,000,000 liters	Onsite Central Sanitary Wastewater Treatment Facility	As a percent of treatment capacity

HW = hazardous waste; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste.

[a] As of February 2012, the estimated unused disposal capacity remaining is approximately 23,000 cubic meters for the slit trenches and 14,000 cubic meters for the engineered trenches.

[b] Pad 26-E is permitted to store a maximum of 296 cubic meters in aggregate for solid MLLW and solid hazardous waste.

Note: To convert cubic meters to cubic feet, multiply by 35.314; liters to gallons, multiply by 0.26418.

Source: Chapter 3, Section 3.1.10.

Table 4–13 Summary of Waste Management Capacities at Los Alamos National Laboratory

Waste Type	*Annual Capacity or Generation Rate*	*Disposition Method*	*Impact Criteria* [a]
Transuranic [b]	17,000 drum equivalents (3,400 cubic meters) [c]	Onsite storage pads	As a percent of storage capacity
Solid LLW	3,772 cubic meters	Onsite disposal or offsite disposal at Federal or commercial facilities	As a percent increase of existing generation rates
Solid MLLW	13.5 cubic meters	Offsite commercial disposal	As a percent increase of existing generation rates
Solid HW	1,723 metric tons	Offsite commercial disposal	As a percent increase of existing generation rates
Solid Non-HW	2,562 metric tons	Offsite commercial landfill disposal	As a percent increase of existing generation rates
Liquid LLW	4,000,000 liters	Onsite Radioactive Liquid Waste Treatment Facility	As a percent of treatment capacity
Liquid Non-HW	840,000,000 liters	Onsite Sanitary Wastewater System	As a percent of treatment capacity

Drum equivalent = one 55-gallon drum; HW = hazardous waste; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste.

[a] Impact criteria for solid LLW, solid MLLW, solid hazardous waste, and solid nonhazardous waste are calculated as a percent increase over generation rates reported in 2009; impact criteria for other wastes are calculated as a percent of onsite storage or treatment capacity.

[b] The listed value is based on current safety basis analyses (see Chapter 3, Section 3.2.10.2).

[c] One 55-gallon drum contains approximately 0.2 cubic meters of waste.

Note: To convert cubic meters to cubic feet, multiply by 35.314; liters to gallons, multiply by 0.26418; metric tons to tons, multiply by 1.1023.

Source: Chapter 3, Section 3.2.10.

CH-TRU waste would be generated at SRS and LANL under all alternatives, as discussed in the following subsections. CH-TRU waste generated from surplus plutonium disposition activities would potentially use a large percentage of the WIPP unsubscribed disposal capacity. Decisions about disposal of TRU waste would be made within the context of the needs of the entire DOE complex. For purposes of analyses in this *SPD Supplemental EIS*, it was assumed that CH-TRU waste generation would extend to 2036 under the No Action Alternative and up to 2038 under the action alternatives. It was assumed for analysis in the *WIPP SEIS II* (DOE 1997b) that TRU waste would be received at WIPP over about a 35-year period, through approximately 2033. Because the total quantity of TRU waste that may be disposed of at WIPP is statutorily established by the Waste Isolation Pilot Plant Land Withdrawal Act, the actual operating period for WIPP will depend on the volumes of TRU waste that may be disposed of at WIPP by all DOE waste generators. Waste minimization efforts across the DOE complex could extend the WIPP operating period. It is assumed for analysis purposes in this *SPD Supplemental EIS* that WIPP would be available for the duration of the surplus plutonium activities under each alternative.

The total WIPP capacity for TRU waste disposal is set at 175,600 cubic meters (6.2 million cubic feet) pursuant to the Waste Isolation Pilot Plant Land Withdrawal Act. Based on agreements between DOE and the State of New Mexico limiting the remote-handled TRU waste volume to 7,080 cubic meters (250,000 cubic feet), a design limit of 168,485 cubic meters (5.95 million cubic feet) of CH-TRU waste was set (DOE 2008k:16). Based on estimates in the *Annual Transuranic Waste Inventory Report – 2012*, approximately 24,700 cubic meters (872,000 cubic feet) of unsubscribed CH-TRU waste capacity[9] could support the actions analyzed in this *SPD Supplemental EIS*.[10]

CH-TRU waste generation estimates in the following subsections do not include any reduction in volume that could be realized due to implementation of waste minimization practices. For example, it is possible that compaction could be performed or plutonium could be recycled as part of MFFF operations; additional technical reviews would be needed to determine the viability of these approaches.

Tables 4–14 and **4–15** present peak annual waste generation rates expected for construction or modifications of various facilities under the alternatives and pit disassembly and conversion options at SRS and LANL, respectively. **Tables 4–16** and **4–17** present the total waste quantities expected during the entire construction phase at SRS and LANL, respectively.

Tables 4–18 and **4–19** present peak annual waste generation rates projected from operations at various facilities under the alternatives and pit disassembly and conversion options, at SRS and LANL, respectively. **Tables 4–20** and **4–21** present the total waste quantities expected during the entire operations phase at SRS and LANL, respectively.

These tables present waste generation for site-specific activities under each alternative for purposes of evaluating impact s at SRS and LANL separately. To compare or evaluate the total waste generation between alternatives, the values in the tables for SRS and LANL are additive. For example, to determine total waste volumes generated under an alternative, the values in Table 4–14 would need to be added to Table 4–15. The same applies to the values in Tables 4–16 and 4–17, Tables 4–18 and 4–19, and Tables 4–20 and 4–21.

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[9] *The term "unsubscribed" refers to that portion of the total WIPP capacity that is not being used or needed for the disposal of DOE's currently estimated inventory of transuranic waste.*

[10] *Calculations performed based on data in the* Annual Transuranic Waste Inventory Report – 2012 *estimates that approximately 147,340 cubic meters (5.2 million cubic feet) of CH-TRU waste would be disposed of at WIPP (emplaced and anticipated volumes) (DOE 2011d, 2012e). This includes approximately 3,560 cubic meters (126,000 cubic feet) of CH-TRU waste from MFFF and WSB (DOE 2012e). Subtracting the 3,560 cubic meters (126,000 cubic feet) of CH-TRU waste associated with MFFF and WSB operations from the 2012 estimates because these are already included in the* SPD Supplemental EIS *analysis, results in approximately 143,780 cubic meters (5.1 million cubic feet) of CH-TRU waste that could be disposed of at WIPP. Subtracting this figure from the total available WIPP CH-TRU waste capacity (i.e., 168,485 cubic meters [5.95 million cubic feet]) shows that approximately 24,700 cubic meters (872,000 cubic feet) of unsubscribed CH-TRU waste capacity remains available to support the* SPD Supplemental EIS *alternatives.*

Table 4–14 Peak Annual Construction Waste Generation at the Savannah River Site

Waste Type	*Pit Disassembly and Conversion Option*	*Alternative*				
		No Action	***Immobilization to DWPF***	***MOX Fuel***	***HC/HBL to DWPF***	***WIPP***
TRU Waste (m^3/yr)	PDCF ***(Percent of SRS Capacity)***	negligible	negligible	5 (<0.1)	negligible	5 ***(<0.1)***
	PDC ***(Percent of SRS Capacity)***	N/A	N/A	5 (<0.1)	negligible	5 ***(<0.1)***
	PF-4 and MFFF ***(Percent of SRS Capacity)***	N/A	negligible	5 (<0.1)	negligible	5 ***(<0.1)***
	PF-4, HC/HBL, and MFFF ***(Percent of SRS Capacity)***	N/A	12 ***(0.1)***	17 ***(0.1)***	12 ***(0.1)***	17 ***(0.1)***
Solid LLW (m^3/yr)	PDCF ***(Percent of SRS Capacity)***	negligible	420 ***(1.1)***	negligible	negligible	negligible
	PDC ***(Percent of SRS Capacity)***	N/A	N/A	1,300 ***(3.5)***	1,300 ***(3.5)***	1,300 ***(3.5)***
	PF-4 and MFFF ***(Percent of SRS Capacity)***	N/A	420 ***(1.1)***	negligible	negligible	negligible
	PF-4, HC/HBL, and MFFF ***(Percent of SRS Capacity)***	N/A	440 ***(1.2)***	21 ***(<0.1)***	21 ***(<0.1)***	21 ***(<0.1)***
Solid MLLW (m^3/yr)	PDCF ***(Percent of SRS Capacity)***	negligible	17 ***(5.7)***	negligible	negligible	negligible
	PDC ***(Percent of SRS Capacity)***	N/A	N/A	19 ***(6.4)***	19 ***(6.4)***	19 ***(6.4)***
	PF-4 and MFFF ***(Percent of SRS Capacity)***	N/A	17 ***(5.7)***	negligible	negligible	negligible
	PF-4, HC/HBL, and MFFF ***(Percent of SRS Capacity)***	N/A	17 ***(5.7)***	negligible	negligible	negligible
Solid HW (m^3/yr)	PDCF ***(Percent of SRS Capacity)***	6 ***(1.9)***	23 ***(7.6)***	6 ***(1.9)***	6 ***(1.9)***	6 ***(1.9)***
	PDC ***(Percent of SRS Capacity)***	N/A	N/A	820 ***(280)***	820 ***(280)***	820 ***(280)***
	PF-4 and MFFF ***(Percent of SRS Capacity)***	N/A	17 ***(5.7)***	negligible	negligible	negligible
	PF-4, HC/HBL, and MFFF ***(Percent of SRS Capacity)***	N/A	17 ***(5.7)***	negligible	negligible	negligible
Solid Non-HW (m^3/yr)	PDCF ***(Percent of SRS Capacity)***	130 ***(<0.1)***	550 ***(<0.1)***	130 ***(<0.1)***	130 ***(<0.1)***	130 ***(<0.1)***
	PDC ***(Percent of SRS Capacity)***	N/A	N/A	860 ***(<0.1)***	860 ***(<0.1)***	860 ***(<0.1)***
	PF-4 and MFFF ***(Percent of SRS Capacity)***	N/A	420 ***(<0.1)***	negligible	negligible	negligible
	PF-4, HC/HBL, and MFFF ***(Percent of SRS Capacity)***	N/A	420 ***(<0.1)***	negligible	negligible	negligible
Liquid LLW (liters/yr)	PDCF ***(Percent of SRS Capacity)***	negligible	negligible	negligible	negligible	negligible
	PDC ***(Percent of SRS Capacity)***	N/A	N/A	negligible	negligible	negligible
	PF-4 and MFFF ***(Percent of SRS Capacity)***	N/A	negligible	negligible	negligible	negligible
	PF-4, HC/HBL, and MFFF ***(Percent of SRS Capacity)***	N/A	negligible	negligible	negligible	negligible
Liquid Non-HW (liters/yr)	PDCF ***(Percent of SRS Capacity)***	1,500,000 ***(0.1)***	1,500,000 ***(0.1)***	1,500,000 ***(0.1)***	1,500,000 ***(0.1)***	1,500,000 ***(0.1)***
	PDC ***(Percent of SRS Capacity)***	N/A	N/A	negligible	negligible	negligible
	PF-4 and MFFF ***(Percent of SRS Capacity)***	N/A	negligible	negligible	negligible	negligible
	PF-4, HC/HBL, and MFFF ***(Percent of SRS Capacity)***	N/A	negligible	negligible	negligible	negligible

DWPF = Defense Waste Processing Facility; HC/HBL = H-Canyon/HB-Line; HW = hazardous waste; LLW = low-level radioactive waste; MFFF = Mixed Oxide Fuel Fabrication Facility; MLLW = mixed low-level radioactive waste; m^3 = cubic meters; MOX = mixed oxide; N/A = not applicable; 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; yr = year.
Note: Values are rounded to two significant figures. To convert cubic meters to cubic yards, multiply by 1.308.
Source: Appendix F, Section F.4; Appendix G, Section G.4.

Table 4–15 Peak Annual Construction Waste Generation at Los Alamos National Laboratory

Waste Type	*Pit Disassembly and Conversion Option* [a]	*Alternative*				
		No Action [b]	*Immobilization to DWPF*	*MOX Fuel*	*HC/HBL to DWPF*	*WIPP*
TRU Waste (m^3/yr)	PF-4 and MFFF; and PF-4, HC/HBL, and MFFF *(Percent of LANL Capacity)*	N/A	2.4 *(<0.1)*	2.4 *(<0.1)*	2.4 *(<0.1)*	2.4 *(<0.1)*
Solid LLW (m^3/yr)	PF-4 and MFFF; and PF-4, HC/HBL, and MFFF *(Percent of 2009 LANL Generation Rate)*	N/A	4.6 *(0.12)*	4.6 *(0.12)*	4.6 *(0.12)*	4.6 *(0.12)*
Solid MLLW (m^3/yr)	PF-4 and MFFF; and PF-4, HC/HBL, and MFFF *(Percent of 2009 LANL Generation Rate)*	N/A	7 *(52)*	7 *(52)*	7 *(52)*	7 *(52)*
Solid HW (m^3/yr)	PF-4 and MFFF; and PF-4, HC/HBL, and MFFF *(Percent of 2009 LANL Generation Rate)*	N/A	negligible	negligible	negligible	negligible
Solid Non-HW (m^3/yr)	PF-4 and MFFF; and PF-4, HC/HBL, and MFFF *(Percent of 2009 LANL Generation Rate)*	N/A	negligible	negligible	negligible	negligible
Liquid LLW (liters/yr)	PF-4 and MFFF; and PF-4, HC/HBL, and MFFF *(Percent of LANL Capacity)*	N/A	negligible	negligible	negligible	negligible
Liquid Non-HW (liters/yr)	PF-4 and MFFF; and PF-4, HC/HBL, and MFF *(Percent of LANL Capacity)*	N/A	negligible	negligible	negligible	negligible

DWPF = Defense Waste Processing Facility; HC/HBL = H-Canyon/HB-Line; HW = hazardous waste; LANL = Los Alamos National Laboratory; LLW = low-level radioactive waste; MFFF = Mixed Oxide Fuel Fabrication Facility; MLLW = mixed low-level radioactive waste; MOX = mixed oxide; m^3 = cubic meters; N/A = not applicable; PF-4 = Plutonium Facility; TRU = transuranic; WIPP = Waste Isolation Pilot Plant; yr = year.

[a] There is no waste generation from construction or modification of facilities at LANL under the PDCF and PDC Options.

[b] There is no waste generation from construction or modification of facilities at LANL under the No Action Alternative.

Note: Values are rounded to two significant figures. To convert cubic meters to cubic yards, multiply by 1.308.

Source: Appendix F, Section F.4; Appendix G, Section G.4.

Table 4–16 Total Construction Waste Generation at the Savannah River Site

Waste Type	*Pit Disassembly and Conversion Option*	*Alternative*				
		No Action	*Immobilization to DWPF*	*MOX Fuel*	*HC/HBL to DWPF*	*WIPP*
TRU Waste (m^3)	PDCF	negligible	negligible	10	negligible	10
	PDC	N/A	N/A	10	negligible	10
	PF-4 and MFFF	N/A	negligible	10	negligible	10
	PF-4, HC/HBL, and MFFF	N/A	23	33	23	33
Solid LLW (m^3)	PDCF	negligible	2,500	negligible	negligible	negligible
	PDC	N/A	N/A	12,000	12,000	12,000
	PF-4 and MFFF	N/A	2,500	negligible	negligible	negligible
	PF-4, HC/HBL, and MFFF	N/A	2,500	41	41	41
Solid MLLW (m^3)	PDCF	negligible	100	negligible	negligible	negligible
	PDC	N/A	N/A	210	210	210
	PF-4 and MFFF	N/A	100	negligible	negligible	negligible
	PF-4, HC/HBL, and MFFF	N/A	100	negligible	negligible	negligible
Solid HW (m^3)	PDCF	56	160	56	56	56
	PDC	N/A	N/A	7,000	7,000	7,000
	PF-4 and MFFF	N/A	100	negligible	negligible	negligible
	PF-4, HC/HBL, and MFFF	N/A	100	negligible	negligible	negligible
Solid Non-HW (m^3)	PDCF	1,300	3,800	1,300	1,300	1,300
	PDC	N/A	N/A	6,800	6,800	6,800
	PF-4 and MFFF	N/A	2,500	negligible	negligible	negligible
	PF-4, HC/HBL, and MFFF	N/A	2,500	negligible	negligible	negligible

Waste Type	Pit Disassembly and Conversion Option	Alternative				
		No Action	Immobilization to DWPF	MOX Fuel	HC/HBL to DWPF	WIPP
Liquid LLW (liters)	PDCF	negligible	negligible	negligible	negligible	negligible
	PDC	N/A	N/A	negligible	negligible	negligible
	PF-4 and MFFF	N/A	negligible	negligible	negligible	negligible
	PF-4, HC/HBL, and MFFF	N/A	negligible	negligible	negligible	negligible
Liquid Non-HW (liters)	PDCF	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000
	PDC	N/A	N/A	negligible	negligible	negligible
	PF-4 and MFFF	N/A	negligible	negligible	negligible	negligible
	PF-4, HC/HBL, and MFFF	N/A	negligible	negligible	negligible	negligible

DWPF = Defense Waste Processing Facility; HC/HBL = H-Canyon/HB-Line; HW = hazardous waste; LLW = low-level radioactive waste; MFFF = Mixed Oxide Fuel Fabrication Facility; MLLW = mixed low-level radioactive waste; m^3 = cubic meters; MOX = mixed oxide; N/A = not applicable; PDC = Pit Disassembly and Conversion Project; PDCF = Pit Disassembly and Conversion Facility; PF-4 = Plutonium Facility; TRU = transuranic; WIPP = Waste Isolation Pilot Plant.
Note: Values are rounded to two significant figures. To convert cubic meters to cubic yards, multiply by 1.308.
Source: Appendix F, Section F.4; Appendix G, Section G.4.

Table 4–17 Total Construction Waste Generation at Los Alamos National Laboratory

Waste Type	Pit Disassembly and Conversion Option [a]	Alternative				
		No Action [a]	Immobilization to DWPF	MOX Fuel	HC/HBL to DWPF	WIPP
TRU Waste (m^3)	PF-4 and MFFF; and PF-4, HC/HBL, and MFFF	N/A	19	19	19	19
Solid LLW (m^3)	PF-4 and MFFF; and PF-4, HC/HBL, and MFFF	N/A	37	37	37	37
Solid MLLW (m^3)	PF-4 and MFFF; and PF-4, HC/HBL, and MFFF	N/A	56	56	56	56
Solid HW (m^3)	PF-4 and MFFF; and PF-4, HC/HBL, and MFFF	N/A	negligible	negligible	negligible	negligible
Solid Non-HW (m^3)	PF-4 and MFFF; and PF-4, HC/HBL, and MFFF	N/A	negligible	negligible	negligible	negligible
Liquid LLW (liters)	PF-4 and MFFF; and PF-4, HC/HBL, and MFFF	N/A	negligible	negligible	negligible	negligible
Liquid Non-HW (liters)	PF-4 and MFFF; and PF-4, HC/HBL, and MFFF	N/A	negligible	negligible	negligible	negligible

DWPF = Defense Waste Processing Facility; HC/HBL = H-Canyon/HB-Line; HW = hazardous waste; LLW = low-level radioactive waste; MFFF = Mixed Oxide Fuel Fabrication Facility; MLLW = mixed low-level radioactive waste; m^3 = cubic meters; MOX = mixed oxide; N/A = not applicable; PF-4 = Plutonium Facility; TRU = transuranic; WIPP = Waste Isolation Pilot Plant.
[a] There is no waste generation from construction or modification of facilities at LANL under the No Action Alternative, or under the PDCF and PDC Options under any of the action alternatives.
Note: Values are rounded to two significant figures. To convert cubic meters to cubic yards, multiply by 1.308.
Source: Appendix F, Section F.4; Appendix G, Section G.4.

Table 4–18 Peak Annual Operations Waste Generation at the Savannah River Site

Waste Type	Pit Disassembly and Conversion Option	Alternative				
		No Action	Immobilization to DWPF	MOX Fuel	HC/HBL to DWPF	WIPP [a]
TRU Waste (m^3/yr)	PDCF ***(Percent of SRS Capacity)***	640 ***(4.9)***	1,100 ***(8.3)***	1,000 ***(7.7)***	650 ***(4.9)***	1,400 ***(11)***
	PDC ***(Percent of SRS Capacity)***	N/A	N/A	1,000 ***(7.7)***	650 ***(4.9)***	1,400 ***(11)***
	PF-4 and MFFF ***(Percent of SRS Capacity)***	N/A	930 ***(7.0)***	840 ***(6.4)***	480 ***(3.6)***	1,200 ***(9.5)***
	PF-4, HC/HBL, and MFFF ***(Percent of SRS Capacity)***	N/A	970 ***(7.4)***	880 ***(6.7)***	520 ***(4.0)***	1,300 ***(9.7)***

Waste Type	*Pit Disassembly and Conversion Option*	*Alternative*				
		No Action	***Immobilization to DWPF***	***MOX Fuel***	***HC/HBL to DWPF***	***WIPP*** [a]
Solid LLW (m^3/yr)	PDCF ***(Percent of SRS Capacity)***	1,800 ***(4.8)***	2,000 ***(5.5)***	2,000 ***(5.5)***	1,900 ***(5.1)***	1,800 ***(5.0)***
	PDC ***(Percent of SRS Capacity)***	N/A	N/A	2,000 ***(5.5)***	1,900 ***(5.1)***	1,800 ***(5.0)***
	PF-4 and MFFF ***(Percent of SRS Capacity)***	N/A	1,100 ***(2.9)***	1,000 ***(2.8)***	940 ***(2.5)***	880 ***(2.4)***
	PF-4, HC/HBL, and MFFF ***(Percent of SRS Capacity)***	N/A	1,300 ***(3.5)***	1,300 ***(3.4)***	1,200 ***(3.1)***	1,100 ***(3.0)***
Solid MLLW (m^3/yr)	PDCF ***(Percent of SRS Capacity)***	negligible	80 ***(27)***	negligible	negligible	negligible
	PDC ***(Percent of SRS Capacity)***	N/A	N/A	negligible	negligible	negligible
	PF-4 and MFFF ***(Percent of SRS Capacity)***	N/A	80 ***(27)***	negligible	negligible	negligible
	PF-4, HC/HBL, and MFFF ***(Percent of SRS Capacity)***	N/A	80 ***(27)***	negligible	negligible	negligible
Solid HW (m^3/yr)	PDCF ***(Percent of SRS Capacity)***	0.7 ***(0.2)***	80 ***(27)***	0.7 ***(0.2)***	0.7 ***(0.2)***	0.7 ***(0.2)***
	PDC ***(Percent of SRS Capacity)***	N/A	N/A	0.7 ***(0.2)***	0.7 ***(0.2)***	0.7 ***(0.2)***
	PF-4 and MFFF ***(Percent of SRS Capacity)***	N/A	80 ***(27)***	0.6 ***(0.2)***	0.6 ***(0.2)***	0.6 ***(0.2)***
	PF-4, HC/HBL, and MFFF ***(Percent of SRS Capacity)***	N/A	80 ***(27)***	0.6 ***(0.2)***	0.6 ***(0.2)***	0.6 ***(0.2)***
Solid Non-HW (m^3/yr)	PDCF ***(Percent of SRS Capacity)***	3,300 ***(<0.1)***	3,400 ***(<0.1)***	3,300 ***(<0.1)***	3,300 ***(<0.1)***	3,300 ***(<0.1)***
	PDC ***(Percent of SRS Capacity)***	N/A	N/A	3,300 ***(<0.1)***	3,300 ***(<0.1)***	3,300 ***(<0.1)***
	PF-4 and MFFF ***(Percent of SRS Capacity)***	N/A	1,400 ***(<0.1)***	1,300 ***(<0.1)***	1,300 ***(<0.1)***	1,300 ***(<0.1)***
	PF-4, HC/HBL, and MFFF ***(Percent of SRS Capacity)***	N/A	1,400 ***(<0.1)***	1,300 ***(<0.1)***	1,300 ***(<0.1)***	1,300 ***(<0.1)***
Liquid LLW (liters/yr)	PDCF ***(Percent of SRS Capacity)***	9,800,000 ***(1.7)***	9,800,000 ***(1.7)***	9,800,000 ***(1.7)***	9,800,000 ***(1.7)***	9,800,000 ***(1.7)***
	PDC ***(Percent of SRS Capacity)***	N/A	N/A	9,700,000 ***(1.6)***	9,700,000 ***(1.6)***	9,700,000 ***(1.6)***
	PF-4 and MFFF ***(Percent of SRS Capacity)***	N/A	9,700,000 ***(1.6)***	9,700,000 ***(1.6)***	9,700,000 ***(1.6)***	9,700,000 ***(1.6)***
	PF-4, HC/HBL, and MFFF ***(Percent of SRS Capacity)***	N/A	9,700,000 ***(1.6)***	9,700,000 ***(1.6)***	9,700,000 ***(1.6)***	9,700,000 ***(1.6)***
Liquid Non-HW (liters/yr)	PDCF ***(Percent of SRS Capacity)***	380,000,000 ***(25)***	380,000,000 ***(25)***	380,000,000 ***(25)***	380,000,000 ***(25)***	380,000,000 ***(25)***
	PDC ***(Percent of SRS Capacity)***	N/A	N/A	380,000,000 ***(25)***	380,000,000 ***(25)***	380,000,000 ***(25)***
	PF-4 and MFFF ***(Percent of SRS Capacity)***	N/A	350,000,000 ***(23)***	350,000,000 ***(23)***	350,000,000 ***(23)***	350,000,000 ***(23)***
	PF-4, HC/HBL, and MFFF ***(Percent of SRS Capacity)***	N/A	350,000,000 ***(23)***	350,000,000 ***(23)***	350,000,000 ***(23)***	350,000,000 ***(23)***

DWPF = Defense Waste Processing Facility; HC/HBL = H-Canyon/HB-Line; HW = hazardous waste; LLW = low-level radioactive waste; MFFF = Mixed Oxide Fuel Fabrication Facility; MLLW = mixed low-level radioactive waste; m^3 = cubic meters; MOX = mixed oxide; N/A = not applicable; 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; yr = year.

[a] The values are presented for this alternative assuming 7.1 metric tons (7.8 tons) of pit plutonium are prepared at SRS for potential WIPP disposal. If, under the PF-4 and MFFF or PF-4, HC/HBL, and MFFF Option, some or all of this pit plutonium was instead prepared at LANL for potential WIPP disposal, the TRU waste volume generated at SRS would be reduced while the TRU waste volume generated at LANL would increase. The total TRU waste volume as summed over both sites would remain approximately the same.

Note: Values are rounded to two significant figures. To convert cubic meters to cubic yards, multiply by 1.308.

Source: Appendix F, Section F.4; Appendix G, Section G.4; Appendix H, Sections H.1.4 and H.2.

Table 4–19 Peak Annual Operations Waste Generation at Los Alamos National Laboratory

Waste Type	Pit Disassembly and Conversion Option [a]	Alternative				
		No Action	Immobilization to DWPF	MOX Fuel	HC/HBL to DWPF	WIPP [b]
TRU Waste (m^3/yr)	PDCF *(Percent of LANL Capacity)*	18 *(0.5)*	18 *(0.5)*	18 *(0.5)*	18 *(0.5)*	18 *(0.5)*
	PDC *(Percent of LANL Capacity)*	N/A	N/A	18 *(0.5)*	18 *(0.5)*	18 *(0.5)*
	PF-4 and MFFF *(Percent of LANL Capacity)*	N/A	170 *(5.0)*	170 *(5.0)*	170 *(5.0)*	170 *(5.0)*
	PF-4, HC/HBL, and MFFF *(Percent of LANL Capacity)*	N/A	170 *(5.0)*	170 *(5.0)*	170 *(5.0)*	170 *(5.0)*
Solid LLW (m^3/yr)	PDCF *(Percent of 2009 LANL Generation Rate)*	30 *(0.8)*	30 *(0.8)*	30 *(0.8)*	30 *(0.8)*	30 *(0.8)*
	PDC *(Percent of 2009 LANL Generation Rate)*	N/A	N/A	30 *(0.8)*	30 *(0.8)*	30 *(0.8)*
	PF-4 and MFFF *(Percent of 2009 LANL Generation Rate)*	N/A	290 *(7.7)*	290 *(7.7)*	290 *(7.7)*	290 *(7.7)*
	PF-4, HC/HBL, and MFFF *(Percent of 2009 LANL Generation Rate)*	N/A	290 *(7.7)*	290 *(7.7)*	290 *(7.7)*	290 *(7.7)*
Solid MLLW (m^3/yr)	PDCF *(Percent of 2009 LANL Generation Rate)*	0.3 *(2.2)*	0.3 *(2.2)*	0.3 *(2.2)*	0.3 *(2.2)*	0.3 *(2.2)*
	PDC *(Percent of 2009 LANL Generation Rate)*	N/A	N/A	0.3 *(2.2)*	0.3 *(2.2)*	0.3 *(2.2)*
	PF-4 and MFFF *(Percent of 2009 LANL Generation Rate)*	N/A	1.4 *(10)*	1.4 *(10)*	1.4 *(10)*	1.4 *(10)*
	PF-4, HC/HBL, and MFFF *(Percent of 2009 LANL Generation Rate)*	N/A	1.4 *(10)*	1.4 *(10)*	1.4 *(10)*	1.4 *(10)*
Solid HW (m^3/yr)	PDCF *(Percent of 2009 LANL Generation Rate)*	negligible	negligible	negligible	negligible	negligible
	PDC *(Percent of 2009 LANL Generation Rate)*	N/A	N/A	negligible	negligible	negligible
	PF-4 and MFFF *(Percent of 2009 LANL Generation Rate)*	N/A	0.2 *(<0.1)*	0.2 *(<0.1)*	0.2 *(<0.1)*	0.2 *(<0.1)*
	PF-4, HC/HBL, and MFFF *(Percent of 2009 LANL Generation Rate)*	N/A	0.2 *(<0.1)*	0.2 *(<0.1)*	0.2 *(<0.1)*	0.2 *(<0.1)*
Solid Non-HW (m^3/yr)	PDCF *(Percent of 2009 LANL Generation Rate)*	negligible	negligible	negligible	negligible	negligible
	PDCF *(Percent of 2009 LANL Generation Rate)*	N/A	N/A	negligible	negligible	negligible
	PF-4 and MFFF *(Percent of 2009 LANL Generation Rate)*	N/A	negligible	negligible	negligible	negligible
	PF-4, HC/HBL, and MFFF *(Percent of 2009 LANL Generation Rate)*	N/A	negligible	negligible	negligible	negligible
Liquid LLW (liters/yr)	PDCF *(Percent of LANL Capacity)*	570 *(<0.1)*	570 *(<0.1)*	570 *(<0.1)*	570 *(<0.1)*	570 *(<0.1)*
	PDC *(Percent of LANL Capacity)*	N/A	N/A	570 *(<0.1)*	570 *(<0.1)*	570 *(<0.1)*
	PF-4 and MFFF *(Percent of LANL Capacity)*	N/A	3,200 *(0.1)*	3,200 *(0.1)*	3,200 *(0.1)*	3,200 *(0.1)*
	PF-4, HC/HBL, and MFFF *(Percent of LANL Capacity)*	N/A	3,200 *(0.1)*	3,200 *(0.1)*	3,200 *(0.1)*	3,200 *(0.1)*
Liquid Non-HW (liters/yr)	PDCF *(Percent of LANL Capacity)*	negligible	negligible	negligible	negligible	negligible
	PDC *(Percent of LANL Capacity)*	N/A	N/A	negligible	negligible	negligible
	PF-4 and MFFF *(Percent of LANL Capacity)*	N/A	negligible	negligible	negligible	negligible
	PF-4, HC/HBL, and MFFF *(Percent of LANL Capacity)*	N/A	negligible	negligible	negligible	negligible

DWPF = Defense Waste Processing Facility; HC/HBL = H-Canyon/HB-Line; HW = hazardous waste; LANL = Los Alamos National Laboratory; LLW = low-level radioactive waste; MFFF = Mixed Oxide Fuel Fabrication Facility; MLLW = mixed low-level radioactive waste; m^3 = cubic meters; MOX = mixed oxide; N/A = not applicable; PDC = Pit Disassembly and Conversion Project; PDCF = Pit Disassembly and Conversion Facility; PF-4 = Plutonium Facility; TRU = transuranic; WIPP = Waste Isolation Pilot Plant; yr = year.

[a] Waste generated under each pit disassembly and conversion option would be the same across all action alternatives, except that the PDC Option for pit disassembly and conversion does not occur under the Immobilization to DWPF Alternative.

Waste Type	Pit Disassembly and Conversion Option [a]	Alternative: No Action	Alternative: Immobilization to DWPF	Alternative: MOX Fuel	Alternative: HC/HBL to DWPF	Alternative: WIPP [b]

[b] The values are presented for this alternative assuming 7.1 metric tons (7.8 tons) of pit plutonium are prepared at SRS for potential WIPP disposal. If, under the PF-4 and MFFF or PF-4, HC/HBL, and MFFF Option, some or all of this pit plutonium was instead prepared at LANL for potential WIPP disposal, the TRU waste volume generated at SRS would be reduced while the TRU waste volume generated at LANL would increase. The total TRU waste volume as summed over both sites would remain approximately the same.

Note: Values are rounded to two significant figures. To convert cubic meters to cubic yards, multiply by 1.308.

Source: Appendix F, Section F.4; Appendix G, Section G.4; Appendix H, Sections H.1.4 and H.2.

Table 4–20 Total Operations Waste Generation at the Savannah River Site

Waste Type	Pit Disassembly and Conversion Option	Alternative				
		No Action	Immobilization to DWPF	MOX Fuel	HC/HBL to DWPF	WIPP [a]
TRU Waste (m^3)	PDCF	5,900	12,000	11,000	7,000	25,000
	PDC	N/A	N/A	11,000	7,000	25,000
	PF-4 and MFFF	N/A	10,000	9,800	5,400	24,000
	PF-4, HC/HBL, and MFFF	N/A	11,000	10,000	5,700	24,000
Solid LLW (m^3)	PDCF	16,000	22,000	22,000	20,000	19,000
	PDC	N/A	N/A	22,000	20,000	19,000
	PF-4 and MFFF	N/A	12,000	12,000	11,000	9,700
	PF-4, HC/HBL, and MFFF	N/A	14,000	14,000	13,000	12,000
Solid MLLW (m^3)	PDCF	negligible	800	negligible	negligible	negligible
	PDC	N/A	N/A	negligible	negligible	negligible
	PF-4 and MFFF	N/A	800	negligible	negligible	negligible
	PF-4, HC/HBL, and MFFF	N/A	800	negligible	negligible	negligible
Solid HW (m^3)	PDCF	10	810	8	8	6
	PDC	N/A	N/A	8	8	6
	PF-4 and MFFF	N/A	810	7	7	5
	PF-4, HC/HBL, and MFFF	N/A	810	7	7	5
Solid Non-HW (m^3)	PDCF	29,000	36,000	37,000	35,000	32,000
	PDC	N/A	N/A	38,000	36,000	32,000
	PF-4 and MFFF	N/A	16,000	17,000	15,000	13,000
	PF-4, HC/HBL, and MFFF	N/A	16,000	17,000	15,000	13,000
Liquid LLW (liters)	PDCF	94,000,000	115,000,000	130,000,000	100,000,000	95,000,000
	PDC	N/A	N/A	130,000,000	100,000,000	94,000,000
	PF-4 and MFFF	N/A	114,000,000	130,000,000	100,000,000	94,000,000
	PF-4, HC/HBL, and MFFF	N/A	114,000,000	130,000,000	100,000,000	94,000,000
Liquid Non-HW (liters)	PDCF	3,600,000,000	4,400,000,000	4,800,000,000	4,400,000,000	3,700,000,000
	PDC	N/A	N/A	4,900,000,000	4,400,000,000	3,700,000,000
	PF-4 and MFFF	N/A	4,100,000,000	4,500,000,000	4,100,000,000	3,400,000,000
	PF-4, HC/HBL, and MFFF	N/A	4,100,000,000	4,500,000,000	4,100,000,000	3,400,000,000

DWPF = Defense Waste Processing Facility; HC/HBL = H-Canyon/HB-Line; HW = hazardous waste; LLW = low-level radioactive waste; MFFF = Mixed Oxide Fuel Fabrication Facility; MLLW = mixed low-level radioactive waste; m^3 = cubic meters; MOX = mixed oxide; N/A = not applicable; PDC = Pit Disassembly and Conversion Project; PDCF = Pit Disassembly and Conversion Facility; PF-4 = Plutonium Facility; TRU = transuranic; WIPP = Waste Isolation Pilot Plant.

[a] The values are presented for this alternative assuming 7.1 metric tons (7.8 tons) of pit plutonium are prepared at SRS for potential WIPP disposal. If, under the PF-4 and MFFF or PF-4, HC/HBL, and MFFF Option, some or all of this pit plutonium was instead prepared at LANL for potential WIPP disposal, the TRU waste volume generated at SRS would be reduced while the TRU waste volume generated at LANL would increase. The total TRU waste volume as summed over both sites would remain approximately the same.

Note: Values are rounded to two significant figures. To convert cubic meters to cubic yards, multiply by 1.308.

Source: Appendix F, Section F.4; Appendix G, Section G.4; Appendix H, Sections H.1.4 and H.2.

Table 4–21 Total Operations Waste Generation at Los Alamos National Laboratory

Waste Type	*Pit Disassembly and Conversion Option*	*Alternative*				
		No Action [a]	*Immobilization to DWPF*	*MOX Fuel*	*HC/HBL to DWPF*	*WIPP* [b]
TRU Waste (m^3)	PDCF	120	120	120	120	120
	PDC	N/A	N/A	120	120	120
	PF-4 and MFFF	N/A	2,400	2,400	2,400	2,400
	PF-4, HC/HBL, and MFFF	N/A	2,400	2,400	2,400	2,400
Solid LLW (m^3)	PDCF	200	200	200	200	200
	PDC	N/A	N/A	200	200	200
	PF-4 and MFFF	N/A	4,000	4,000	4,000	4,000
	PF-4, HC/HBL, and MFFF	N/A	4,000	4,000	4,000	4,000
Solid MLLW (m^3)	PDCF	2	2	2	2	2
	PDC	N/A	N/A	2	2	2
	PF-4 and MFFF	N/A	31	31	31	31
	PF-4, HC/HBL, and MFFF	N/A	31	31	31	31
Solid HW (m^3)	PDCF	negligible	negligible	negligible	negligible	negligible
	PDC	N/A	N/A	negligible	negligible	negligible
	PF-4 and MFFF	N/A	4	4	4	4
	PF-4, HC/HBL, and MFFF	N/A	4	4	4	4
Solid Non-HW (m^3)	PDCF	negligible	negligible	negligible	negligible	negligible
	PDC	N/A	N/A	negligible	negligible	negligible
	PF-4 and MFFF	N/A	negligible	negligible	negligible	negligible
	PF-4, HC/HBL, and MFFF	N/A	negligible	negligible	negligible	negligible
Liquid LLW (liters)	PDCF	4,000	4,000	4,000	4,000	4,000
	PDC	N/A	N/A	4,000	4,000	4,000
	PF-4 and MFFF	N/A	70,000	70,000	70,000	70,000
	PF-4, HC/HBL, and MFFF	N/A	70,000	70,000	70,000	70,000
Liquid Non-HW (liters)	PDCF	negligible	negligible	negligible	negligible	negligible
	PDC	N/A	N/A	negligible	negligible	negligible
	PF-4 and MFFF	N/A	negligible	negligible	negligible	negligible
	PF-4, HC/HBL, and MFFF	N/A	negligible	negligible	negligible	negligible

DWPF = Defense Waste Processing Facility; HC/HBL = H-Canyon/HB-Line; HW = hazardous waste; LLW = low-level radioactive waste; MFFF = Mixed Oxide Fuel Fabrication Facility; MLLW = mixed low-level radioactive waste; m^3 = cubic meters; MOX = mixed oxide; N/A = not applicable; PDC = Pit Disassembly and Conversion Project; PDCF = Pit Disassembly and Conversion Facility; PF-4 = Plutonium Facility; TRU = transuranic; WIPP = Waste Isolation Pilot Plant.

[a] No Action includes conversion of 2 metric tons (2.2 tons) of plutonium at PF-4.

[b] The values are presented for this alternative assuming 7.1 metric tons (7.8 tons) of pit plutonium are prepared at SRS for potential WIPP disposal. If, under the PF-4 and MFFF or PF-4, HC/HBL, and MFFF Option, some or all of this pit plutonium was instead prepared at LANL for potential WIPP disposal, the TRU waste volume generated at SRS would be reduced while the TRU waste volume generated at LANL would increase. The TRU waste volume as summed over both sites would remain approximately the same.

Note: Values are rounded to two significant figures. To convert cubic meters to cubic yards, multiply by 1.308.

Source: Appendix F, Section F.4; Appendix G, Section G.4; Appendix H, Sections H.1.4 and H.2.

4.1.4.1 No Action Alternative

Construction at SRS—Under the No Action Alternative, it is not expected that TRU waste, solid or liquid LLW, or solid MLLW would be generated during construction of PDCF. If generated, however, these wastes would be managed in accordance with site practices and applicable Federal and state regulations. Solid hazardous and nonhazardous waste and liquid nonhazardous waste would be generated in small quantities.

The estimated peak annual generation of 6 cubic meters (7.8 cubic yards) of solid hazardous waste would represent approximately 1.9 percent of SRS existing storage capacity. This waste is not expected to have significant impacts on the SRS hazardous waste management system because this waste stream could be transported to offsite treatment, storage, and disposal facilities, as needed, so that onsite storage would not be exceeded. Hazardous waste would be packaged in containers approved by the U.S. Department of Transportation (DOT) and shipped off site to permitted recycling or treatment, storage, and disposal facilities.

Nonhazardous solid waste generated from construction would be recycled or packaged in conformance with standard industrial practice and shipped to the Three Rivers Regional Landfill or the Construction and Demolition Debris Landfill, both on site. Nonhazardous solid wastes generated from construction activities would be minimal and would have negligible impacts on waste management facilities.

Although it is likely that most liquid sanitary waste would be managed using portable toilets, it is conservatively assumed that all nonhazardous liquid wastes generated during construction would be managed at the Central Sanitary Wastewater Treatment Facility (CSWTF). Generation of nonhazardous liquid waste during construction activities would be minimal and would have negligible impacts on waste management facilities.

Construction at LANL—Under the No Action Alternative, no construction waste would be generated at LANL.

Operations at SRS—Under the No Action Alternative, operation of PDCF, MFFF and WSB is considered. Support operations, such as plutonium storage and surveillance at the K-Area Complex and TRU waste staging at E-Area, were also considered but would generate negligible amounts of waste when compared to other operations. Waste types that would be generated at SRS include TRU waste, solid LLW, solid hazardous waste, solid nonhazardous waste, liquid LLW, and liquid nonhazardous waste.

TRU waste generated at MFFF would consist of cladding, filters, convenience cans, and other miscellaneous wastes (NRC 2005a:4-33). WSB would receive high-activity/mixed high-activity waste and concentrated liquids generated by PDCF and MFFF operations for treatment. The WSB-generated TRU waste and mixed TRU waste would result from processing and solidifying the high-activity/mixed high-activity waste and concentrated liquids and would include job control waste (WSRC 2008a). TRU waste would be transferred to E-Area for staging and subsequently transported to WIPP. A peak of approximately 640 cubic meters (840 cubic yards) of TRU waste would be generated annually under the No Action Alternative, representing approximately 4.9 percent of the SRS TRU waste storage capacity. Considering the operational timeframes for these facilities, it is estimated that up to 5,900 cubic meters (7,700 cubic yards) of CH-TRU waste could be generated at SRS, representing approximately 24 percent of the unsubscribed WIPP CH-TRU waste disposal capacity.

A peak of approximately 1,800 cubic meters (2,400 cubic yards) of solid LLW per year would be generated and would represent 4.8 percent of SRS disposal capacity. This impact is considered minor because low-activity waste vaults could be used as necessary to augment SRS capabilities for management of LLW. A peak of approximately 9,800,000 liters (2,600,000 gallons) of liquid LLW per year would be generated and would be sent to the F/H-Area Effluent Treatment Project. This quantity would represent 1.7 percent of the permitted treatment capacity.

It was conservatively assumed that all nonhazardous liquid wastes generated during operation of the surplus plutonium facilities would be managed at CSWTF. A peak of approximately 380 million liters

(100 million gallons) per year would be generated and would represent 25 percent of the capacity of this treatment facility, with the majority being generated by MFFF operations and piped directly to CSWTF. Based on Chapter 3, Section 3.1.9, CSWTF currently operates at about 65 percent of capacity; therefore, wastewater from MFFF operations would not exceed the maximum capacity of this facility, although there may be very little capacity remaining to support other activities.

Minimal quantities of solid hazardous and nonhazardous waste would be generated and would have negligible impacts on waste management capacities at SRS.

Operations at LANL—Under the No Action Alternative, 2 metric tons (2.2 tons) of plutonium in pits would be converted to plutonium oxide. Operation of PF-4 at LANL is expected to generate a peak of approximately 18 cubic meters (24 cubic yards) of CH-TRU waste per year. Approximately 30 cubic meters (39 cubic yards) of solid LLW would be generated, as well as minimal quantities of liquid LLW; these waste quantities are expected to have negligible impacts on waste management capacities.

4.1.4.2 Immobilization to DWPF Alternative

Construction at SRS—Construction of the K-Area immobilization capability is considered as well as facilities that would be required under each pit disassembly and conversion option, as described in Appendix F. Modification of DWPF is also considered; however, any required modifications would be minimal and negligible amounts of waste would be generated. Liquid LLW would not be generated during construction under the Immobilization to DWPF Alternative.

TRU waste generation is expected under the PF-4, H-Canyon/HB-Line, and MFFF Option. Approximately 12 cubic meters (16 cubic yards) peak annual and 23 cubic meters (30 cubic yards) total CH-TRU waste would be generated. These amounts would have negligible impacts on storage capacity and represent a negligible amount of the unsubscribed WIPP disposal capacity.

Under the pit disassembly and conversion options, peak annual generation of solid LLW would range from 420 cubic meters (550 cubic yards) to 440 cubic meters (580 cubic yards), representing 1.1 to 1.2 percent of the SRS capacity. This impact is considered minor because low-activity waste vaults could be used as necessary to augment SRS capabilities for management of LLW.

Peak annual generation of solid MLLW would be 17 cubic meters (22 cubic yards) for all pit disassembly and conversion options, representing 5.7 percent of SRS storage capacity. Peak annual generation of solid hazardous waste would range from 17 cubic meters (22 cubic yards) to 23 cubic meters (30 cubic yards), representing 5.7 to 7.6 percent of SRS storage capacity. MLLW and hazardous waste would be shipped off site for treatment and disposal as necessary to meet storage space needs; therefore, there would not be any significant impacts from waste storage facilities.

Nonhazardous solid waste generated from construction would be recycled or packaged in conformance with standard industrial practice and shipped to the Three Rivers Regional Landfill or the Construction and Demolition Debris Landfill, both on site. Nonhazardous solid wastes generated from construction activities would be minimal and would have negligible impacts on waste management facilities.

Although it is likely that most liquid sanitary waste would be managed using portable toilets, it is conservatively assumed that all nonhazardous liquid wastes generated during construction would be managed at CSWTF. Generation of nonhazardous liquid waste during construction activities would be minimal and would have negligible impacts on waste management facilities.

Construction at LANL—Construction activities would only occur at LANL under the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option. Waste generation would include CH-TRU waste, solid LLW, and solid MLLW. Minimal amounts of CH-TRU waste and solid LLW would be generated annually and would have negligible impacts on waste management capacities. Solid MLLW, although also generated in minimal quantities, would increase by 52 percent over rates generated at LANL during 2009.

Operations at SRS—Under the Immobilization to DWPF Alternative, operations of the K-Area immobilization capability, DWPF, MFFF, WSB, and various pit disassembly and conversion facilities, depending on the option implemented, are considered. Support operations, such as plutonium storage and surveillance at the K-Area Complex, and TRU waste staging at E-Area, were also considered but their operation would generate negligible amounts of waste when compared to other operations.

Approximately 790 can-in-canisters from the K-Area immobilization capability would be processed at DWPF. Due to displaced HLW, this would result in generation of approximately 95 additional canisters of vitrified HLW (WSRC 2008a). GWSBs currently have the capacity to store up to 4,590 canisters and S-Area storage capacity could be expanded to 10,000 canisters (DOE 1994; SRNS 2012a; SRR 2013); therefore, there would be no significant impacts from the generation and storage of HLW canisters under this alternative.

Peak annual generation of CH-TRU waste would range from 930 cubic meters (1,200 cubic yards) to 1,100 cubic meters (1,400 cubic yards) per year, representing 7.0 to 8.3 percent of SRS storage capacity. The K-Area immobilization capability would generate solid TRU waste primarily consisting of empty inner plutonium storage cans, pin cans, fuel pins, convenience cans, failed bagless transfer cans, weld stubs not classified as LLW, lead-lined gloves, HEPA filters, and contaminated equipment. Considering the operational timeframes for the facilities associated with the PDCF Option under the Immobilization to DWPF Alternative, it is estimated that up to 12,000 cubic meters (16,000 cubic yards) of CH-TRU waste could be generated at SRS, representing approximately 47 percent of the unsubscribed WIPP disposal capacity.

Peak annual generation of solid LLW waste would range from 1,100 cubic meters (1,400 cubic yards) to 2,000 cubic meters (2,600 cubic yards) per year, representing 2.9 to 5.5 percent of SRS disposal capacity. This impact is considered minor because low-activity waste vaults could be used as necessary to augment SRS capabilities for management of LLW.

Peak annual generation of solid MLLW would be 80 cubic meters (105 cubic yards), representing 27 percent of SRS storage capacity. Peak annual generation of solid hazardous waste would be approximately 80 cubic meters (105 cubic yards), representing 27 percent of SRS storage capacity. MLLW and hazardous waste would be generated at the K-Area immobilization capability and DWPF. Examples of MLLW and hazardous waste include lead-lined gloves, decontamination chemicals, fluorescent light bulbs, batteries, and other miscellaneous items (WSRC 2008a). Small quantities of hazardous waste would also be generated at the other plutonium facilities addressed under this alternative. This waste would include liquids such as spent cleaning solutions, oils, hydraulic fluids, antifreeze solutions, paints and chemicals, and rags or wipes contaminated with these materials (WSRC 2008a). MLLW and hazardous waste would be shipped off site for treatment and disposal as necessary to meet storage space needs; therefore, there would be no significant impacts on waste storage facilities.

Peak annual generation of solid nonhazardous waste would be minimal with associated negligible impacts.

A peak of approximately 9,700,000 to 9,800,000 liters (2,560,000 to 2,590,000 gallons) of liquid LLW waste per year would be generated and would be sent to the F/H-Area Effluent Treatment Project under all pit disassembly and conversion options. This quantity would represent 1.6 to 1.7 percent of the permitted treatment capacity.

It was conservatively assumed that all nonhazardous liquid wastes generated during the operation of surplus plutonium facilities would be managed at CSWTF. A peak of approximately 350 to 380 million liters (92 to 100 million gallons) per year would be generated under all pit disassembly and conversion options and would represent 23 to 25 percent of the capacity of this treatment facility, with the majority being generated by MFFF operations and piped directly to CSWTF. Based on information in Chapter 3, Section 3.1.9, CSWTF currently operates at about 65 percent of capacity; therefore, wastewater from MFFF operations would not exceed the maximum capacity of this facility, although there may be very little capacity remaining to support other activities.

Operations at LANL—Operation of PF-4 at LANL is considered. Operation of PF-4 is expected to generate CH-TRU waste, solid LLW, and liquid LLW. Similar to the No Action Alternative, under the PDCF Option, operation of PF-4 at LANL would generate a peak of approximately 18 cubic meters (24 cubic yards) of CH-TRU waste and 30 cubic meters (39 cubic yards) of solid LLW per year, representing 0.5 and 0.8 percent of the LANL capacity, respectively. However, under the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option, operation of PF-4 at LANL would generate approximately 170 cubic meters (220 cubic yards) of CH-TRU waste, 290 cubic meters (380 cubic yards) of solid LLW, and 1.4 cubic meters (1.8 cubic yards) of MLLW per year, representing 5.0, 7.7, and 10 percent of LANL capacity, respectively. Minimal quantities of liquid LLW would be generated.

4.1.4.3 MOX Fuel Alternative

Construction at SRS—Under the MOX Fuel Alternative, construction waste would be limited to that associated with construction and/or modification of facilities for pit disassembly and conversion activities, as described in Appendix F. Modifications to the K-Area Complex and H-Canyon/HB-Line are also considered under one pit disassembly and conversion option; however, any required modifications would be minimal and negligible amounts of waste would be generated.

TRU waste generation under the PF-4, H-Canyon/HB-Line, and MFFF Option would be approximately 17 cubic meters (22 cubic yards) peak annual and 33 cubic meters (43 cubic yards) total CH-TRU waste, representing negligible impacts on storage capacity and a negligible amount of the unsubscribed WIPP CH-TRU waste disposal capacity. Under all other pit disassembly and conversion options, approximately 5 cubic meters (6.5 cubic yards) peak annual and 10 cubic meters (13 cubic yards) total CH-TRU waste would be generated, also representing negligible impacts on SRS storage capacity and unsubscribed WIPP CH-TRU waste disposal capacity. Additionally, minimal amounts of solid LLW would be generated under this option; however, no other waste types would be generated.

Peak annual waste generation under the PDCF Option would only result from construction of PDCF; and therefore, would be similar to those construction impacts discussed under the No Action Alternative in Section 4.1.4.1.

Under the PDC Option, solid LLW, solid MLLW, solid hazardous waste, and solid nonhazardous waste would be generated. The peak annual generation rate of solid LLW would be 1,300 cubic meters (1,700 cubic yards), representing 3.5 percent of SRS disposal capacity. This impact is considered minor because low-activity waste vaults could be used as necessary to augment SRS capabilities for management of LLW. Peak annual generation of solid MLLW would be 19 cubic meters (25 cubic yards), representing 6.4 percent of SRS storage capacity. Peak annual generation of solid hazardous waste would be 820 cubic meters (1,100 cubic yards), representing about 280 percent of SRS storage capacity. MLLW and hazardous waste would be shipped off site for treatment and disposal as necessary to meet storage space needs; therefore, there would not be any significant impacts on waste storage facilities. Offsite shipments of hazardous waste would need to be expedited to avoid exceeding the SRS storage capacity. Peak annual generation of solid nonhazardous waste would be 860 cubic meters (1,100 cubic yards) per year.

Minimal construction waste generation would be associated with the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option.

Construction at LANL—Construction activities would only occur at LANL under the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option. Waste generation would include CH-TRU waste, solid LLW, and solid MLLW. Minimal amounts of CH-TRU waste and solid LLW would be generated annually and would have negligible impacts on waste management capacities. Solid MLLW, although also generated in minimal quantities, would increase by 52 percent over rates generated at LANL during 2009.

Operations at SRS—Under the MOX Fuel Alternative, operation of H-Canyon/HB-Line, DWPF, MFFF, WBS, and various pit disassembly and conversion facilities are considered. Support operations, such as plutonium storage and surveillance at the K-Area Complex and TRU waste staging at E-Area, were also considered but their operation would generate negligible amounts of waste when compared to other operations. DWPF operations would not be impacted.

Peak annual generation of CH-TRU waste would range from 840 cubic meters (1,100 cubic yards) to 1,000 cubic meters (1,300 cubic yards) per year, representing 6.4 to 7.7 percent of the SRS storage capacity. Considering the operational timeframes for the facilities under the PDCF or PDC Options, it is estimated that up to 11,000 cubic meters (14,000 cubic yards) of CH-TRU waste could be generated at SRS, representing approximately 46 percent of the unsubscribed WIPP CH-TRU waste disposal capacity.

As discussed in Chapter 2, Section 2.2.4, non-pit plutonium includes unirradiated Fast Flux Test Facility (FFTF) fuel. It is assumed for the previously mentioned CH-TRU waste volume estimates and associated impacts that FFTF fuel and other non-pit plutonium would be packaged in pipe overpack containers (POCs) for potential disposal at WIPP. As noted in Appendix B, Section B.1.3, a POC is assumed to contain 150 fissile gram equivalents (FGE) of plutonium. If FFTF fuel is not repackaged into POCs and is instead transported to WIPP using the transportation packages within which it is currently stored, the number of POCs would decrease. In addition, the number of POCs would decrease if other non-pit plutonium were packaged in criticality control overpacks (CCOs), which are assumed to each contain 350 FGE. If both of these approaches were to be taken, the total CH-TRU waste volume could be reduced from approximately 11,000 cubic meters (14,000 cubic yards) to approximately 9,600 cubic meters (13,000 cubic yards). This reduced waste volume would represent about 39 percent of the unsubscribed WIPP CH-TRU waste disposal capacity.

Peak annual generation of solid LLW waste would range from 1,000 cubic meters (1,300 cubic yards) to 2,000 cubic meters (2,600 cubic yards) per year, representing 2.8 to 5.5 percent of SRS disposal capacity. This impact is considered minor because low-activity waste vaults could be used as necessary to augment SRS capabilities for management of LLW.

Negligible quantities of solid MLLW would be annually generated. Peak annual generation of solid hazardous waste would range from 0.6 cubic meters (0.8 cubic yards) to 0.7 cubic meters (0.9 cubic yards), representing less than 1 percent of SRS storage capacity.

Negligible quantities of solid nonhazardous waste would be annually generated.

A peak of approximately 9,700,000 to 9,800,000 liters (2,560,000 to 2,590,000 gallons) of liquid LLW waste per year would be generated and would be sent to the F/H-Area Effluent Treatment Project under all pit disassembly and conversion options. This quantity would represent 1.6 to 1.7 percent of the permitted treatment capacity.

It was conservatively assumed that all nonhazardous liquid wastes generated during the operation of surplus plutonium facilities would be managed at CSWTF. A peak of approximately 350 to 380 million liters (92 to 100 million gallons) per year would be generated under all pit disassembly and conversion options and would represent 23 to 25 percent of the capacity of this treatment facility, with the majority being generated by MFFF operations and piped directly to CSWTF. Based on information in Chapter 3, Section 3.1.9, CSWTF currently operates at about 65 percent of capacity; therefore, wastewater from MFFF operations would not exceed the maximum capacity of this facility, although there may be very little capacity remaining to support other activities.

Operations at LANL—Under the MOX Fuel Alternative, waste generated from operations of PF-4 and associated impacts at LANL would be similar to those in Section 4.1.4.2 under the Immobilization to DWPF Alternative.

4.1.4.4 H-Canyon/HB-Line to DWPF Alternative

Construction at SRS—Under the H-Canyon/HB-Line to DWPF Alternative, construction generated waste and associated impacts at SRS would be similar to those in Section 4.1.4.3 under the MOX Fuel Alternative, with the exception of TRU waste. Less TRU waste would be generated, also representing negligible impacts on SRS waste storage capacity.

Construction at LANL—Under the H-Canyon/HB-Line to DWPF Alternative, construction generated waste and associated impacts at LANL would be similar to those in Section 4.1.4.3 under the MOX Fuel Alternative.

Operations at SRS—Under the H-Canyon/HB-Line to DWPF Alternative, operation of H-Canyon/HB-Line, DWPF, MFFF, WSB, and various pit disassembly and conversion facilities, depending on the option implemented, are considered. Other supporting operations, such as plutonium storage and surveillance in the K-Area Complex and TRU waste staging in E-Area, were also considered but would generate negligible amounts of waste when compared to other operations.

Approximately 48 additional vitrified glass canisters would be generated at DWPF due to processing 6 metric tons (6.6 tons) of surplus plutonium at H-Canyon/HB-Line for DWPF vitrification, although these additional canisters would not significantly impact its existing operation. This assumes that there would be no credit for using gadolinium as a neutron poison at DWPF (see Appendix B, Section B.1.4.1). If gadolinium is credited, then approximately 20 canisters would be generated (SRNL 2013). GWSBs currently have the capacity to store up to 4,590 canisters and S-Area storage capacity could be expanded to 10,000 canisters (DOE 1994; SRNS 2012a; SRR 2013); therefore, there would be no significant impacts from the generation and storage of HLW canisters under this alternative.

Peak annual generation of CH-TRU waste would range from 480 cubic meters (630 cubic yards) to 650 cubic meters (850 cubic yards) per year, representing 3.6 to 4.9 percent of SRS storage capacity. Considering the operational timeframes for the facilities associated with the H-Canyon/HB-Line to DWPF Alternative under the PDC Option, it is estimated that up to 7,000 cubic meters (9,200 cubic yards) of CH-TRU waste could be generated at SRS, representing approximately 28 percent of the unsubscribed WIPP CH-TRU waste disposal capacity.

Annual generation rates of all other waste types considered from operations would be similar to those in Section 4.1.4.3 under the MOX Fuel Alternative. These include solid LLW, solid MLLW, solid hazardous waste, solid nonhazardous waste, liquid LLW, and liquid nonhazardous waste.

Operations at LANL—Under the H-Canyon/HB-Line to DWPF Alternative, waste generated from operations of PF-4 and associated impacts at LANL would be similar to those in Section 4.1.4.2 under the Immobilization to DWPF Alternative.

4.1.4.5 WIPP Alternative

Construction at SRS—Under the WIPP Alternative, construction-generated waste and associated impacts at SRS would be similar to those in Section 4.1.4.3 under the MOX Fuel Alternative.

Construction at LANL—Under the WIPP Alternative, construction-generated waste and associated impacts at LANL would be similar to those in Section 4.1.4.3 under the MOX Fuel Alternative. Development of an enhanced capability at TA-55 for preparation of surplus plutonium for potential WIPP disposal is expected to represent a minor variation on the facility modifications proposed for the enhanced pit disassembly and conversion capability at PF-4, with generation of negligible quantities of wastes. Any additional wastes generated from support facility modifications at TA-63 are expected to be nonradioactive and in negligible quantities.

Operations at SRS—Under the WIPP Alternative, operation of H-Canyon/HB-Line, MFFF, WSB, and various pit disassembly and conversion facilities is considered, depending on the option implemented. Other supporting operations such as plutonium storage and surveillance at the K-Area Complex and

CH-TRU waste staging at E-Area, were also considered but would generate negligible amounts of waste when compared to other operations.

Assuming 7.1 metric tons (7.8 tons) of pit plutonium and 6 metric tons (6.6 tons) of non-pit plutonium were prepared at H-Canyon/HB-Line for potential disposal at WIPP, peak annual generation of CH-TRU waste would range from 1,200 cubic meters (1,600 cubic yards) to 1,400 cubic meters (1,800 cubic yards) per year, representing 9.5 to 11 percent of the SRS storage capacity. Given this assumption and considering the operational timeframes for the facilities associated with the WIPP Alternative, it is estimated that up to 25,000 cubic meters (33,000 cubic yards) of CH-TRU waste could be generated at SRS, representing (for SRS alone) approximately 103 percent of the unsubscribed WIPP CH-TRU waste disposal capacity (also see below).

As discussed in Chapter 2, non-pit plutonium includes unirradiated FFTF fuel. It is assumed for the previously mentioned TRU waste volume estimates and associated impacts that FFTF fuel and pit and other non-pit plutonium would be packaged in POCs for potential disposal at WIPP. As noted in Appendix B, Section B.1.3, a POC is assumed to contain 150 FGE of plutonium. If FFTF fuel is not repackaged into POCs and is instead transported to WIPP using the transportation packages within which it is currently stored, the number of POCs would decrease. In addition, the number of POCs would decrease if pit and other non-pit plutonium were packaged in CCOs, which are assumed to each contain 350 FGE. If both of these approaches were to be taken, the total CH-TRU waste volume could be reduced from approximately 25,000 cubic meters (33,000 cubic yards) to approximately 15,000 cubic meters (20,000 cubic yards). This reduced waste volume would represent (for SRS alone) about 60 percent of the unsubscribed WIPP CH-TRU waste disposal capacity.

Under the PF-4 and MFFF and PF-4, H-Canyon/HB-Line, and MFFF Options, some or all of the 7.1 metric tons (7.8 tons) of pit plutonium could be prepared at LANL for potential WIPP disposal rather than at SRS. In this event, the volume of CH-TRU waste generated at SRS would decrease while the volume of CH-TRU waste generated at LANL would increase. The total CH-TRU waste volume as summed over SRS and LANL, however, would remain approximately the same.

Peak annual generation of solid LLW waste would range from 880 cubic meters (1,200 cubic yards) to 1,800 cubic meters (2,400 cubic yards) per year, representing 2.4 to 5.0 percent of the SRS disposal capacity. This impact is considered minor because low-activity waste vaults could be used as necessary to augment SRS capabilities for management of LLW.

Negligible quantities of solid MLLW would be annually generated.

Peak annual generation of solid nonhazardous waste would range from 1,300 cubic meters (1,700 cubic yards) to 3,300 cubic meters (4,300 cubic yards), representing a negligible amount of the SRS disposal capacity.

Annual generation rates of solid hazardous waste, liquid LLW, and liquid nonhazardous waste considered from operations would be similar those discussed in Section 4.1.4.3 under the MOX Fuel Alternative.

Operations at LANL—If 7.1 metric tons (7.8 tons) of pit plutonium were prepared at SRS for potential WIPP disposal, the wastes generated from operation of PF-4 and associated impacts at LANL would be the same as those in Section 4.1.4.2 under the Immobilization to DWPF Alternative. To the extent, however, under the PF-4 and MFFF and PF-4, H-Canyon/HB-Line, and MFFF Options that this pit plutonium was prepared at LANL, the volume of TRU waste generated at LANL would increase while the volume of TRU waste generated at SRS would decrease. At LANL, careful planning may be needed to expedite the increased throughput of TRU waste within TA-55 and transfer to onsite waste management areas for staging for shipment to WIPP. Operational adjustments may be needed at existing TA-55 facilities or the principal support facilities to address increased TRU waste volumes requiring temporary storage, certification, and staging for shipment to WIPP. But as discussed above, the total CH-TRU waste volume as summed over SRS and LANL would remain approximately the same.

4.1.5 Transportation

For transportation, both radiological and nonradiological impacts would result from shipment of radioactive materials and waste. Only nonradiological impacts would result from shipment of nonradioactive wastes and construction materials. Radiological impacts are those associated with the effects from low levels of radiation emitted during incident-free transportation and from the accidental release of radioactive materials, and are expressed as additional LCFs. Nonradiological impacts are independent of the nature of the cargo being transported, and are expressed as traffic accident fatalities resulting only from the physical forces that accidents could impart to humans.

Appendix E contains a more detailed description of the transportation analysis and results. Increases in nonradiological pollutants from traffic emissions are discussed in Section 4.1.1, Air Quality.

Onsite shipment of radioactive materials and wastes at SRS would not affect members of the public because roads between SRS processing areas are closed to the public; therefore, shipments would only affect onsite workers. Shipment of TRU waste, LLW, and MLLW to E-Area is currently conducted as part of site operations with no discernible impacts on noninvolved workers. The transport of radioactive materials and wastes under the alternatives is not expected to significantly increase the risk to these workers. As shown in this section, the risks from incident-free transport of radioactive waste and materials off site over long distances (hundreds to thousands of kilometers) are very small; therefore, the risks from transporting radioactive waste and materials on site, where distances would be less than 20 kilometers (12 miles) and sometimes less than 5 kilometers (3 miles), would be even smaller. For NNSA Secure Transportation Asset (STA) shipments, onsite roads would be closed during transport, further limiting the risk of noninvolved worker exposure. All involved workers (i.e., drivers and escorts) would be monitored and the maximum annual dose to a transportation worker would be administratively limited to 2 rem (10 CFR Part 835). The potential for a trained radiation worker to develop a fatal latent cancer from the maximum annual exposure is 0.0012 LCFs; therefore, an individual transportation worker is not expected to develop a lifetime latent fatal cancer from exposure during these activities. Impacts associated with accidents during onsite transport of radioactive materials and wastes would be less than the impacts assessed for the bounding accident analyses for the plutonium facilities (see Section 4.1.2.2), and less than the impacts for offsite transports because of the much shorter distance traveled on site and because of onsite security measures and lower vehicle speeds. Because of these reasons, impacts from onsite transport of radioactive materials and wastes are not analyzed further in this *SPD Supplemental EIS*.

Methodology and Assumptions

Transportation packages containing radioactive materials emit low levels of radiation; the amount of transportation radiation depends on the kind and amount of transported materials. DOT regulations require that transportation packages containing radioactive materials have sufficient radiation shielding to limit the radiation dose rate to 10 millirem per hour at a distance of 2 meters (6.6 feet) from the transporter. For incident-free transportation, the potential human health impacts of the radiation field surrounding the transportation packages were estimated for transportation workers and the general population along the route (termed off-traffic or off-link), as well as for people sharing the route (termed in-traffic or on-link), at rest areas, and at other stops along the route. The RADTRAN 6 [Radioactive Material Transportation Risk Assessment] computer code (SNL 2009) was used to estimate the impacts on transportation workers and population along the route, as well as the impacts on an MEI (e.g., a person stuck in traffic, a gas station attendant, an inspector).

Transportation accidents involving radioactive materials present both nonradiological and radiological risks to workers and the public. Nonradiological impacts of transportation accidents include traffic accident fatalities. Radioactive material would be released during transportation accidents only when the transport package carrying the material is subjected to forces that exceed its design standard. Only a severe fire and/or a powerful collision, both events of extremely low probability, could lead to a transportation package of the type used to transport highly radioactive material being damaged to the extent that there could be a significant release of radioactive material to the environment.

The radiological impact of a specific accident is expressed in terms of probabilistic risk (i.e., dose-risk), which is defined as the accident probability (i.e., accident frequency) multiplied by the accident consequences (i.e., dose). The overall radiological risk is obtained by summing the individual radiological risks from all reasonably conceivable accidents. The analysis of accident risks takes into account a spectrum of accident severities ranging from high-probability accidents of low severity (e.g., a fender bender) to hypothetical high-severity accidents having low probabilities of occurrence.

In addition to calculating the radiological risks that would result from all reasonably conceivable accidents during transportation of radioactive materials and wastes, this *SPD Supplemental EIS* assesses the highest consequences of a maximum reasonably foreseeable accident having a radioactive release frequency greater than 1×10^{-7} (1 chance in 10 million) per year in an urban or suburban population area along the route. This latter analysis used the RISKIND [Risks and Consequences of Radioactive Material Transport] computer code, Version 2.0, to estimate doses to individuals and populations (Yuan et al. 1995). The results of this analysis are presented in Appendix E, Section E.8.

Incident-free radiological health impacts are expressed in terms of additional LCFs. Radiological health impacts from accidents are also expressed as additional LCFs, and nonradiological accident risk as additional immediate (traffic) fatalities. LCFs associated with radiological exposure were estimated by multiplying the occupational (worker) and public dose by a dose conversion factor of 0.0006 LCFs per rem or person-rem of exposure (DOE 2003a). The health impacts associated with shipment of special nuclear material and unirradiated MOX fuel were calculated assuming that all transportation packages would be transported by escorted commercial truck or NNSA STA.

In determining transportation risks, per-shipment risk factors were calculated for incident-free and accident conditions using the RADTRAN 6 code (SNL 2009) in conjunction with the Transportation Routing Analysis Geographic Information System (TRAGIS) code (Johnson and Michelhaugh 2003), which was used to identify transportation routes in accordance with DOT regulations and other parameters. The TRAGIS program currently provides population density estimates along the routes based on the 2000 U.S. Census for determining population radiological risk factors. For incident-free operations, the affected population includes individuals living within 800 meters (0.5 miles) of each side of the road or rail line. For accident conditions, the affected population includes individuals living within 80 kilometers (50 miles) of the accident, and the MEI was assumed to be a receptor located 100 meters (330 feet) directly downwind from the accident. Additional details on the analytical approach and on modeling and parameter selections are provided in Appendix E. The estimated population for which dose is calculated was increased by comparing 2010 and 2000 census data and assuming the rate of population growth in this time period continues through the year 2020.

Accident and fatality rates for commercial truck transports are used for determining traffic accident fatalities (Saricks and Tompkins 1999). Statistics specific to STA shipments, which would be used for shipment of special nuclear material, are also used for escorted commercial truck shipments (see Appendix E, Section E.7.2). The methodology for obtaining and using accident and fatality rates is provided in Appendix E, Section E.7.2, Accident Rates.

For each alternative, transportation impacts were evaluated for the transport of the following (as applicable to each alternative):

- pits and assorted materials from Pantex near Amarillo, Texas, to SRS and LANL
- plutonium materials from LANL to SRS
- TRU waste from SRS and LANL to WIPP

- unirradiated MOX fuel from SRS to the Browns Ferry Nuclear Plant near Athens, Alabama; the Sequoyah Nuclear Plant near Soddy-Daisy, Tennessee; and one or more generic commercial nuclear power reactors assumed for analysis purposes to be located in the northwestern United States
- highly enriched uranium from SRS and LANL to the Y–12 National Security Complex at the Oak Ridge Reservation in Tennessee
- pieces and parts of pits from SRS to LANL
- LLW and MLLW from SRS and LANL to offsite Federal or commercial disposal facilities
- depleted uranium hexafluoride from the Portsmouth Gaseous Diffusion Plant at Piketon, Ohio, to AREVA at Richland, Washington
- depleted uranium oxide and depleted uranyl nitrate hexahydrate from AREVA at Richland, Washington, to SRS
- hazardous waste from SRS and LANL to an offsite treatment, storage, and disposal facility, which, for analysis purposes, would be located in Waynoka, Oklahoma (nonradiological impacts only)[11]

Route characteristics are determined for shipments to assess incident-free and transportation accident impacts related to radioactive material and waste shipments. The number of shipments associated with the transport of plutonium metal pits, highly enriched uranium, and pieces and parts of pits are determined by proportionally scaling the number of shipments analyzed in the *SPD EIS* based on the amount of material being transported for this *SPD Supplemental EIS*. The numbers of shipments associated with the transport of MOX fuel, depleted uranium, and wastes are determined using up-to-date information (as compared to the *SPD EIS*) regarding the types of transport packaging to be used and forecasted generation rates. The composition of transportation packages for different radioactive materials is estimated using unclassified information that provides a conservative estimate that would be reflective of the material or waste being transported. All shipments were assumed to be conducted by truck. Transport of plutonium materials and other classified materials was assumed to be conducted by STA (see Appendix E, Section E.2.4, for more information regarding STA vehicle requirements). Truck routes between specific origination and destination sites are analyzed, as shown in Appendix E, Figures E–2 and E–3. Tables E–6 through E–10 in Appendix E summarize the assumed destinations and estimated number of truck shipments for each type of radioactive waste or nuclear material.

Summary of Impacts

Table 4–22 summarizes transportation impacts under each alternative for shipments of radioactive materials and waste, not including shipments of unirradiated MOX fuel. The accident impacts presented in this table are those that could result from all reasonably conceivable impacts during transport of radioactive materials and waste. The impacts associated with transport of unirradiated MOX fuel to commercial nuclear power reactors are shown in **Table 4–23**. These impacts are also presented in Appendix E, Section E.8, and Appendix I, Sections I.1.2.5 and I.2.2.5, and are not expected to be substantially different from the impacts of shipping LEU fuel from the fuel supplier to the reactor sites. **Table 4–24** shows the impacts from transporting construction materials and hazardous wastes related to construction and operations (summarizing the information in Tables E–13 and E–14). The results in Tables 4–22 through 4–24 are discussed further in Sections 4.1.5.1 through 4.1.5.5. Route-specific impacts are presented in Tables E–6 through E–10.

[11] *Of the offsite treatment, storage, and disposal facilities used for management of SRS hazardous waste, this site would represent one of the longer waste transportation distances.*

Table 4–22 Risks of Transporting Radioactive Materials and Waste Under Each Alternative [a, b]

Pit Disassembly and Conversion Option	Number of Shipments	One-way Kilometers Traveled (million)	Incident-Free: Crew Dose (person-rem)	Incident-Free: Crew Risk [c]	Incident-Free: Population Dose (person-rem)	Incident-Free: Population Risk [c]	Accident: Radiological Risk [c]	Accident: Non-radiological Risk [c]
No Action Alternative								
PDCF	3,300	8.8	230	0.1	150	0.09	0.00007	0.4
Immobilization to DWPF Alternative								
PDCF	4,300	11	300	0.2	200	0.1	0.00007	0.5
PDC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PF-4 and MFFF [d]	4,900	10	250	0.2	160	0.1	0.00009	0.5
PF-4, HC/HBL, and MFFF [e]	4,800	10	260	0.2	170	0.1	0.00008	0.5
MOX Fuel Alternative								
PDCF	4,400	11	320	0.2	210	0.1	0.00009	0.6
PDCF with packaging option [f]	4,200	11	290	0.2	190	0.1	0.00009	0.5
PDC	4,500	12	320	0.2	210	0.1	0.00009	0.6
PDC with packaging option [f]	4,200	11	290	0.2	200	0.1	0.00009	0.5
PF-4 and MFFF [d]	5,000	10	270	0.2	170	0.1	0.0001	0.5
PF-4 and MFFF with packaging option [d, f]	4,800	9.8	240	0.1	160	0.1	0.0001	0.5
PF-4, HC/HBL, and MFFF [e]	4,900	11	280	0.2	180	0.1	0.0001	0.5
PF-4, HC/HBL, and MFFF with packaging option [e, f]	4,600	9.9	250	0.1	160	0.1	0.0001	0.5
H-Canyon/HB-Line to DWPF Alternative								
PDCF	3,800	10	260	0.2	180	0.1	0.00008	0.5
PDC	3,900	10	260	0.2	180	0.1	0.00008	0.5
PF-4 and MFFF [d]	4,500	9.0	210	0.1	140	0.09	0.0001	0.4
PF-4, HC/HBL, and MFFF [e]	4,300	9.1	220	0.1	150	0.09	0.0001	0.4
WIPP Alternative								
PDCF	6,400	16	500	0.3	300	0.2	0.00007	0.9
PDCF with packaging option [f]	4,700	12	340	0.2	220	0.1	0.00007	0.6
PDC	6,400	16	500	0.3	300	0.2	0.00007	0.9
PDC with packaging option [f]	4,700	12	340	0.2	220	0.1	0.00007	0.6
PF-4 and MFFF [d]	7,000	15	460	0.3	260	0.2	0.00009	0.8
PF-4 and MFFF with packaging option [d, f]	5,300	11	290	0.2	180	0.1	0.00009	0.6
PF-4, HC/HBL, and MFFF [e]	6,900	15	460	0.3	270	0.2	0.00008	0.8
PF-4, HC/HBL, and MFFF with packaging option [e, f]	5,200	11	300	0.2	190	0.1	0.00008	0.6

DWPF = Defense Waste Processing Facility; HC/HBL= H-Canyon/HB-Line; MFFF = Mixed Oxide Fuel Fabrication Facility; MOX = mixed oxide; N/A = not applicable; PDC = Pit Disassembly and Conversion Project; PDCF = Pit Disassembly and Conversion Facility; PF-4 = Plutonium Facility; WIPP = Waste Isolation Pilot Plant.

[a] The total impacts for each alternative include transportation due to construction and operations activities.

[b] Impacts in this table do not include impacts from transporting unirradiated MOX fuel to commercial nuclear power reactors. See Table 4–23 for these impacts.

[c] Risk is expressed in terms of LCFs, assuming a factor of 0.0006 LCFs per person-rem (DOE 2003a), except for nonradiological risk, where it refers to the number of traffic accident fatalities. Accident radiological dose-risk can be calculated by dividing the indicated risk values by 0.0006 (DOE 2003a). Radiological risk is representative of one-way travel, whereas nonradiological risk is representative of two-way travel.

[d] Under this option, pits would be disassembled at PF-4 at LANL. Pits disassembled at LANL would be converted to an oxide at LANL or at SRS using metal oxidation furnaces installed in MFFF.

[e] Under this option, pits would be disassembled at PF-4 at LANL or at the K-Area Complex at SRS. Pits disassembled at LANL would be converted to an oxide at PF-4 at LANL or at SRS using H-Canyon/HB-Line or metal oxidation furnaces installed in MFFF. Pits disassembled at the K-Area Complex would be converted to an oxide at H-Canyon/HB-Line at SRS.

[f] Under the packaging option, pit (WIPP Alternative only) and non-pit (MOX Fuel and WIPP Alternatives) plutonium would be packaged in CCOs rather than POCs for shipment to WIPP for disposal as CH-TRU waste, reducing the number of shipments, and Hanford Unirradiated Fuel Packages (HUFPs) would be used to transport unirradiated FFTF fuel to WIPP for disposal as CH-TRU waste, rather than repackaging the fuel in POCs.

Note: To convert kilometers to miles, multiply by 0.62137; metric tons to tons, multiply by 1.1023.

Table 4–23 Risks of Transporting Unirradiated Mixed Oxide Fuel Under Each Alternative

Unirradiated MOX Fuel Transport Option	Number of Shipments	One-way Kilometers Traveled (million)	Incident-Free				Accident	
			Crew		Population			
			Dose (person-rem)	Risk [a]	Dose (person-rem)	Risk [a]	Radiological Risk [c]	Non-radiological Risk [a]
No Action Alternative								
To TVA reactors	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
To generic reactors	3,400	15	150	0.09	280	0.2	0.000002	0.3
Immobilization to DWPF Alternative								
To TVA reactors	2,100	1.5	15	0.009	24	0.01	0.0000004	0.03
To generic reactors	3,400	15	150	0.09	280	0.2	0.000002	0.3
MOX Fuel Alternative								
To TVA reactors	2,900	2.0	20	0.01	32	0.02	0.0000005	0.04
To generic reactors	4,500	20	190	0.1	370	0.2	0.000002	0.4
H-Canyon/HB-Line to DWPF Alternative								
To TVA reactors	2,600	1.8	18	0.01	29	0.02	0.0000004	0.03
To generic reactors	4,100	18	180	0.1	340	0.2	0.000002	0.4
WIPP Alternative								
To TVA reactors	2,100	1.5	15	0.009	24	0.01	0.0000004	0.03
To generic reactors	3,400	15	150	0.09	280	0.2	0.000002	0.3

DWPF = Defense Waste Processing Facility; MOX = mixed oxide; N/A = not applicable; TVA = Tennessee Valley Authority; WIPP = Waste Isolation Pilot Plant.

[a] Risk is expressed in terms of LCFs, assuming a factor of 0.0006 LCFs per person-rem (DOE 2003a), except for nonradiological risk, where it refers to the number of traffic accident fatalities. Accident radiological dose-risk can be calculated by dividing the indicated risk values by 0.0006 (DOE 2003a). Radiological risk is representative of one-way travel, whereas nonradiological risk is representative of two-way travel.

Note: To convert kilometers to miles, multiply by 0.62137; metric tons to tons, multiply by 1.1023.

Table 4–24 Estimated Impacts from Hazardous Waste and Construction Material Transport

Pit Disassembly and Conversion Option	Number of Shipments	Total Distance Traveled (two-way kilometers)	Number of Accidents	Traffic Fatality Risk
No Action Alternative				
PDCF	42,000	4,300,000	3.3	0.2
Immobilization to DWPF Alternative				
PDCF	43,000	4,600,000	3.5	0.2
PDC	N/A	N/A	N/A	N/A
PF-4 and MFFF [a]	1,300	370,000	0.23	0.01
PF-4, HC/HBL, and MFFF [b]	1,300	390,000	0.25	0.01
MOX Fuel Alternative				
PDCF	42,000	4,300,000	3.3	0.2
PDC	43,000	6,100,000	4.3	0.2
PF-4 and MFFF [a]	4	16,000	0.009	0.0004
PF-4, HC/HBL, and MFFF [b]	5	20,000	0.012	0.0005
H-Canyon/HB-Line to DWPF Alternative				
PDCF	42,000	4,300,000	3.3	0.2
PDC	43,000	6,100,000	4.3	0.2
PF-4 and MFFF [a]	4	16,000	0.009	0.0004
PF-4, HC/HBL, and MFFF [b]	5	20,000	0.012	0.0005

Pit Disassembly and Conversion Option	*Number of Shipments*	*Total Distance Traveled (two-way kilometers)*	*Number of Accidents*	*Traffic Fatality Risk*
WIPP Alternative				
PDCF	42,000	4,300,000	3.3	0.2
PDC	43,000	6,100,000	4.3	0.2
PF-4 and MFFF [a]	4	16,000	0.009	0.0004
PF-4, HC/HBL, and MFFF [b]	4	16,000	0.009	0.0004

DWPF = Defense Waste Processing Facility; HC/HBL = H-Canyon/HB-Line; MFFF = Mixed Oxide Fuel Fabrication Facility; N/A = not applicable; PDC = Pit Disassembly and Conversion Project; PDCF = Pit Disassembly and Conversion Facility; PF-4 = Plutonium Facility; MOX = mixed oxide; WIPP = Waste Isolation Pilot Plant.

[a] Under this option, pits would be disassembled at PF-4 at LANL. Pits disassembled at PF-4 would be converted to an oxide at PF-4 or at SRS using metal oxidation furnaces installed in MFFF.

[b] Under this option, pits could be disassembled at PF-4 at LANL or at the K-Area Complex at SRS. Pits disassembled at LANL would be converted to an oxide at PF-4 at LANL or at SRS using H-Canyon/HB-Line or metal oxidation furnaces installed in MFFF. Pits disassembled at the K-Area Complex would be converted to an oxide at H-Canyon/HB-Line at SRS.

Note: To convert kilometers to miles, multiply by 0.62137; metric tons to tons, multiply by 1.1023.

Transportation impacts are shown in Table 4–22 for: (1) an option whereby blended non-pit plutonium under the MOX Fuel and WIPP Alternatives and blended pit plutonium under the WIPP Alternative are transported in POCs; and (2) a packaging option whereby blended pit and non-pit plutonium (other than unirradiated FFTF fuel) is transported in CCOs rather than POCs, and unirradiated FFTF fuel is transported in Hanford Unirradiated Fuel Packages (HUFPs) rather than being first disassembled and repackaged. FFTF fuel is currently stored at SRS in HUFPs.

For all alternatives, transportation impacts were determined assuming that unirradiated MOX fuel would be transported using NNSA STA vehicles to TVA and generic commercial nuclear power plant sites, for which each shipment would consist of 2 MOX fuel assemblies transported in a Type B package. DOE is, however, considering shipment of up to 5 Type B packages per shipment containing pressurized-water reactor fuel assemblies or 7 Type B packages per shipment containing boiling-water reactor fuel assemblies, assuming use of escorted commercial trucks under NNSA's Secure Transportation Asset Program. If this MOX fuel shipment program is implemented, it is expected that radiological impacts on transport crew members would increase by a small amount, as addressed in detail in Appendix I, Sections I.1.2.5 and I.2.2.5, while incident-free radiological impacts on the population along the transport routes would decrease. Under either scenario, no LCFs would be expected among the transport crew and general population. The radiological risks to the population from all projected accidents would decrease if escorted commercial trucks were used because fewer shipments would be required, as would nonradiological traffic fatality risks. Possible impacts from a maximum reasonably foreseeable accident involving shipment of unirradiated MOX fuel would be unchanged.

4.1.5.1 No Action Alternative

Under this alternative, there would be about 3,300 truck shipments of radioactive materials and waste and 3,400 truck shipments of unirradiated MOX fuel to generic commercial nuclear power reactors.

Impacts of Incident-Free Transportation

Under this alternative, the impacts of transporting radioactive materials and wastes would be less than those under the action alternatives because the 13.1 metric tons (14.4 tons) of surplus plutonium would remain in storage.

Crew – Transport of radioactive materials, waste, and unirradiated MOX fuel likely would not result in any LCFs among crew members.

Public – The cumulative dose to the general population likely would not result in any LCFs from transport of radioactive materials and waste, or from transport of unirradiated MOX fuel to generic commercial nuclear power reactors.

Impacts of Transportation Accidents

As described previously, two sets of analyses were performed for the evaluation of radiological transportation accident impacts: impacts of maximum reasonably foreseeable accidents (accidents having radioactive release probabilities greater than 1×10^{-7} [1 chance in 10 million] per year), and impacts of all conceivable accidents (total transportation accidents).

For maximum reasonably foreseeable transportation accidents probabilities were calculated for all route segments (i.e., rural, suburban, and urban), and maximum consequences were determined for those route shipments having a likelihood-of-release frequency exceeding 1 in 10 million per year. For radioactive materials and waste, the maximum reasonably foreseeable transportation accident having the highest consequence would involve truck transport of depleted uranium hexafluoride from the Portsmouth Gaseous Diffusion Plant at Piketon, Ohio, to AREVA at Richland, Washington, in 48G containers (see Appendix E, Table E–12). These shipments would occur over about 21 years.

The maximum reasonably foreseeable probability of a truck accident involving this material would be up to 2.1×10^{-7} per year in a suburban area, or about 1 chance in 4.8 million each year. The consequences of the truck transport accident in terms of population dose would be about 750 person-rem, resulting in no additional LCFs among the exposed population.

For unirradiated MOX fuel shipped to generic commercial nuclear power reactors, the maximum reasonably foreseeable probability of a truck accident involving this material would be up to 3.3×10^{-6} per year in a suburban area, or about 1 chance in 300,000 each year. The consequences of the truck transport accident in terms of population dose would be about 4.0 person-rem. If such an accident were to occur, the projected exposure likely would not result in an LCF (0.002) among the exposed population.

Estimates of total transportation accident dose-risks for all projected accidents involving all materials and waste shipments, regardless of material or waste type, and unirradiated MOX fuel associated with the pit disassembly and conversion options likely would not result in any LCFs. Transport of radioactive materials and wastes and unirradiated MOX fuel could result in a nonradiological fatality due to a traffic accident.

Impacts of Construction Materials and Hazardous Waste Transport

Impacts from transporting construction materials to SRS and hazardous waste to an offsite disposal or recycle facility were also evaluated. No traffic fatalities are expected due to these activities.

4.1.5.2 Immobilization to DWPF Alternative

Under this alternative, there would be up to about 4,900 truck shipments of radioactive materials and waste (not including shipments of unirradiated MOX fuel). This is an increase over the total number of shipments under the No Action Alternative due to an increase in the amount of plutonium material to be transported to SRS for processing, and the resulting transport of additional products and wastes. For transport of unirradiated MOX fuel, there would be about 2,100 shipments to TVA reactors, or about 3,400 shipments to generic commercial nuclear power reactors.

Impacts of Incident-Free Transportation

Under this alternative, the impacts of transporting radioactive materials and wastes would be slightly greater than those under the No Action Alternative.

Crew – Transport of radioactive materials and waste and unirradiated MOX fuel likely would not result in any LCFs among crew members.

Public – The cumulative dose to the general population likely would not result in LCFs from transport of radioactive materials and waste associated with any of the pit disassembly and conversion options, or from transport of unirradiated MOX fuel to TVA reactors or to generic commercial nuclear power reactors.

Impacts of Transportation Accidents

For radioactive materials and waste shipped under any of the pit disassembly and conversion options, or unirradiated MOX fuel shipped to TVA reactors or generic commercial nuclear power reactors, the maximum reasonably foreseeable offsite truck transportation accident having the highest consequence would involve the transport of plutonium oxide powder from LANL to SRS. The maximum reasonably foreseeable probability of a truck accident involving this material would be up to 2.0×10^{-7} per year in a suburban area, or 1 chance in 5 million each year. The consequences of the truck transport accident in terms of population dose would be about 6,300 person-rem, resulting in up to 4 LCFs (3.8) among the exposed population.

Estimates of total transportation accident dose-risks for all projected accidents involving all materials and waste shipments, regardless of material and waste type, and unirradiated MOX fuel associated with the pit disassembly and conversion options, likely would not result in any LCFs. Transport activities under this alternative could result in a nonradiological fatality due to a traffic accident.

Impacts of Construction Materials and Hazardous Waste Transport

The impacts of transporting construction materials to SRS and hazardous waste to an offsite disposal or recycle facility were also evaluated. No traffic fatalities are expected due to these activities.

4.1.5.3 MOX Fuel Alternative

Under this alternative, there would be up to about 5,000 truck shipments of radioactive materials and waste. For transport of unirradiated MOX fuel, there would be about 2,900 shipments to TVA reactors, or about 4,500 shipments to generic commercial nuclear power reactors.

Impacts of Incident-Free Transportation

Under this alternative, the radiation doses and resulting risks to crew members and to the public would be about the same as those under the Immobilization to DWPF Alternative (Section 4.1.5.2).

Crew – Transport of radioactive materials and waste and unirradiated MOX fuel likely would not result in any LCFs among crew members.

Transporting unirradiated FFTF fuel in HUFPs and transporting other surplus non-pit plutonium using CCOs to WIPP would not substantially change overall incident-free transportation risks to the crew for the alternative.

Public – The cumulative dose to the general population would not result in any LCFs from transport of radioactive materials and waste associated with the pit disassembly and conversion options, or from transport of unirradiated MOX fuel to TVA reactors or to generic commercial nuclear power reactors.

Transporting unirradiated FFTF fuel in HUFPs and transporting other surplus non-pit plutonium using CCOs to WIPP would not substantially change overall incident-free transportation risks to the public for the alternative.

Impacts of Transportation Accidents

For radioactive materials and waste shipped under any of the pit disassembly and conversion options, or unirradiated MOX fuel shipped to TVA reactors or generic commercial nuclear power reactors, the maximum reasonably foreseeable offsite truck transportation accident having the highest consequence would be the same as that under the Immobilization to DWPF Alternative (Section 4.1.5.2).

Estimates of total transportation accident dose-risks for all projected accidents involving all materials and waste shipments, regardless of material or waste type, and unirradiated MOX fuel associated with the pit disassembly and conversion options would not result in any LCFs. Transport activities under this alternative could result in a nonradiological fatality due to a traffic accident. As indicated in Table 4–22, the overall accident risks for the alternative would not substantially change if FFTF fuel was transported in HUFPs and other surplus non-pit plutonium was transported in CCOs.

Impacts of Construction Materials and Hazardous Waste Transport

The impacts of transporting construction materials to SRS and hazardous waste to an offsite disposal or recycle facility were also evaluated. No traffic fatalities are expected due to these activities.

4.1.5.4 H-Canyon/HB-Line to DWPF Alternative

Under this alternative, there would be up to about 4,500 truck shipments of radioactive materials and waste. For transport of unirradiated MOX fuel, there would be about 2,600 shipments to TVA reactors, or about 4,100 shipments to generic commercial nuclear power reactors.

Impacts of Incident-Free Transportation

Under this alternative, the radiation doses and resulting risks to crew members and to the public would be comparable to those under the Immobilization to DWPF Alternative (Section 4.1.5.2) and MOX Fuel Alternative (Section 4.1.5.3).

Crew – Transport of radioactive materials and waste and unirradiated MOX fuel likely would not result in any LCFs among crew members.

Public – The cumulative dose to the general population likely would not result in any LCFs from transport of radioactive materials and waste associated with the pit disassembly and conversion options, or from transport of unirradiated MOX fuel to TVA reactors or to generic commercial nuclear power reactors.

Impacts of Transportation Accidents

For radioactive materials and waste shipped under any of the pit disassembly and conversion options, or unirradiated MOX fuel shipped to TVA reactors or generic commercial nuclear power reactors, the maximum reasonably foreseeable offsite truck transportation accident having the highest consequence would be the same as that under the Immobilization to DWPF Alternative (Section 4.1.5.2).

Estimates of the total transportation accident dose-risks for all projected accidents involving all materials and waste shipments, regardless of material or waste type, and unirradiated MOX fuel associated with the pit disassembly and conversion options, likely would not result in any LCFs. Transport activities under this alternative could result in a nonradiological fatality due to a traffic accident.

Impacts of Construction Materials and Hazardous Waste Transport

The impacts of transporting construction materials to SRS and hazardous waste to an offsite disposal or recycle facility were also evaluated. No traffic fatalities are expected due to these activities.

4.1.5.5 WIPP Alternative

Under this alternative, there would be up to about 7,000 truck shipments of radioactive materials and waste (not including shipments of unirradiated MOX fuel). This represents about a 60 percent increase over the H-Canyon/HB-Line to DWPF Alternative, primarily due to the shipment of 13.1 metric tons (14.4 tons) of surplus plutonium to WIPP for disposal as CH-TRU waste. For transport of unirradiated MOX fuel, there would be about 2,100 shipments to TVA reactors, and about 3,400 shipments to generic commercial nuclear power reactors.

Impacts of Incident-Free Transportation

Under this alternative, the radiation doses to crew members and the public would be higher than those under the Immobilization to DWPF, MOX Fuel, and H-Canyon/HB-Line to DWPF Alternatives (Sections 4.1.5.2, 4.1.5.3, and 4.1.5.4, respectively), but the relative risks would be about the same.

Crew – Transport of radioactive materials and waste and unirradiated MOX fuel likely would not result in any LCFs among crew members.

Transporting unirradiated FFTF fuel in HUFPs and transporting surplus pit and other non-pit plutonium using CCOs to WIPP would not substantially change overall incident-free transportation risks to the crew for the alternative.

Public – The cumulative dose to the general population would likely not result in LCFs from transport of radioactive materials and waste associated with the pit disassembly and conversion options, or from transport of unirradiated MOX fuel to generic commercial nuclear power reactors.

Transporting unirradiated FFTF fuel in HUFPs and transporting surplus pit and other non-pit plutonium using CCOs to WIPP would not substantially change overall incident-free transportation risks to the public for the alternative.

Impacts of Transportation Accidents

For radioactive materials and waste shipped under any of the pit disassembly and conversion options, or unirradiated MOX fuel shipped to TVA reactors or generic commercial nuclear power reactors, the maximum reasonably foreseeable offsite truck transportation accident having the highest consequence would be the same as that under the Immobilization to DWPF Alternative (Section 4.1.5.2).

Estimates of the total transportation accident dose-risks for all projected accidents involving all materials and waste shipments, regardless of materials or waste type, and unirradiated MOX fuel associated with the pit disassembly and conversion options, likely would not result in LCFs. Transport activities under this alternative could result in a nonradiological traffic fatality due to a traffic accident, with this risk being larger than that for the other alternatives because of the larger number of shipments. The overall accident risks for the alternative would not substantially change if FFTF fuel was transported in HUFPs and surplus pit and other non-pit plutonium was transported in CCOs.

Impacts of Construction Materials and Hazardous Waste Transport

The impacts of transporting construction materials to SRS and hazardous waste to an offsite disposal or recycle facility were also evaluated. No traffic fatalities are expected due to these activities.

Impacts of Transporting Pit Plutonium in POCs and CCOs from LANL to WIPP

The analysis in this section reflects the assumption that 7.1 metric tons (7.8 tons) of surplus pit plutonium would be prepared at SRS for potential WIPP disposal. Under the PF-4 and MFFF Option and the PF-4, H-Canyon, and MFFF Option, however, some or all of this pit plutonium could be prepared at LANL for potential WIPP disposal, and then shipped directly to WIPP, instead of being transported to SRS for processing with subsequent shipment to WIPP. In this event, there would be fewer shipments of pit plutonium from LANL to SRS, and fewer shipments of CH-TRU waste from SRS to WIPP, but additional shipments of CH-TRU waste from LANL to WIPP. The incident-free and accident impacts associated with shipments from SRS to WIPP would envelope similar shipments from LANL to WIPP because of the longer distances traveled and the larger total population along the route from SRS to WIPP as compared to the distances traveled and the total population along the route from LANL to WIPP. Furthermore, there would be fewer incident-free and accident risks associated with shipment of disassembled pit plutonium from LANL to SRS, because the total number of these shipments would be smaller. Therefore, the overall transportation impacts under the WIPP Alternative would be lower to the extent that preparation of pit plutonium for potential WIPP disposal occurred at LANL rather than SRS.

4.1.6 Environmental Justice

Estimates of entire populations and minority and low-income subsets of populations in the vicinity of SRS and LANL have been projected to the year 2020 (see Chapter 3, Sections 3.1.11 and 3.2.11). Consistent with the human health analysis, impacts were analyzed on the potentially affected populations within 50 miles (80 kilometers) of the facilities at SRS and LANL that could be engaged in surplus plutonium activities. In addition, impacts were analyzed on populations in close proximity to the facilities (radial distances of 5, 10, and 20 miles [8, 16, and 32 kilometers]). However, no populations reside within 5 miles (8 kilometers) of the proposed facilities at SRS.

As described in Section 4.1.2.1 and Appendix I, the use of a 40 percent MOX fuel core in commercial nuclear power reactors is not expected to substantially change the environmental impacts that currently occur at commercial nuclear power reactors due to the use of a 100 percent LEU fuel core. Therefore, there would be no disproportionately high and adverse impacts on minority and low-income populations in the vicinities of the commercial nuclear power reactors addressed in this *SPD Supplemental EIS*.

4.1.6.1 No Action Alternative

Construction—As discussed in Section 4.1.2.1.1, there would be no radiological risk to the public from construction activities at SRS and there would be no additional construction at LANL. Construction of PDCF at F-Area would occur in generally uncontaminated areas, resulting in no construction-related radiological impacts on the general population. Therefore, there would be no disproportionately high and adverse impacts on minority or low-income populations due to construction activities under the No Action Alternative.

Operations—As discussed in Sections 4.1.2.1.1 and 4.1.5.1, routine operations under the No Action Alternative would pose no significant health risks to the public. **Table 4–25** shows the annual impacts on the total and subset populations within 10, 20, and 50 miles (16, 32, and 80 kilometers) of the proposed surplus plutonium facilities at SRS under the No Action Alternative. Within the 10-mile (16-kilometer) radius, the only minority subgroup with an average individual dose higher than the corresponding nonminority individual is an individual of the Hispanic population. This individual would receive an annual dose that is about 0.0002 millirem higher than that of the average nonminority individual. However, this difference represents a negligible increased risk to the exposed individual of developing a latent fatal cancer of 1×10^{-10}, or 1 chance in 10 billion, annually. Within the 20-mile (32-kilometer) radius, the average individual of each subpopulation would receive the same annual dose and the doses are very small. Within the 50-mile (80-kilometer) radius, the average Black or African-American individual would each receive an annual dose that is about 0.00001 millirem higher than that of the average nonminority individual. However, this difference is so small it represents no appreciable change in the risk to the exposed individual of developing a latent fatal cancer.

Table 4–25 Comparison of Annual Doses to an Average Individual of the Total Minority, Hispanic, Black or African-American, and Low-Income Populations Near the Savannah River Site in 2020 Under the No Action Alternative (millirem)

Population Group	*Within 10 Miles*	*Within 20 Miles*	*Within 50 Miles*
Average individual	0.0029	0.0013	0.00062
Nonminority individual	0.0029	0.0013	0.00062
Minority individual	0.0029	0.0013	0.00062
Hispanic individual [a]	0.0031	0.0013	0.00060
Black or African-American individual [b]	0.0029	0.0013	0.00063
Non-low-income individual	0.0029	0.0013	0.00061
Low-income individual	0.0029	0.0013	0.00064

[a] The Hispanic population includes all Hispanic persons regardless of race.
[b] Includes persons who also indicated Hispanic or Latino origin.
Note: To convert miles to kilometers, multiply by 1.6093.

Doses to persons living below the poverty level are also presented in Table 4–25. The average annual dose to an individual, whether below or above the poverty level, would be the same for persons living within 10 and 20 miles (16 and 32 kilometers) of SRS. The average low-income individual living within 50 miles (80 kilometers) of SRS would receive an annual dose that is about 0.00003 millirem higher than that of the average non-low-income individual. However, this difference is so small it represents no appreciable change in the risk to the exposed individual of developing a latent fatal cancer.

Therefore, operations under the No Action Alternative would not result in disproportionately high and adverse impacts on minority or low-income populations residing near SRS.

Table 4–26 shows the annual impacts on the total and subset populations within 5, 10, 20, and 50 miles (8, 16, 32, and 80 kilometers) of PF-4 at LANL under the No Action Alternative. Within the 5-mile (8-kilometer) radius, an average minority individual, an average Hispanic individual, and an average Native American individual would each receive a dose about 0.0001 millirem higher than that to the average nonminority individual. However, this difference represents a negligible increased risk to the exposed individual of developing a latent fatal cancer (6×10^{-11}, or about 1 chance in 17 billion, annually). Within the 10-mile (16-kilometer) radius, an average Hispanic individual would receive a dose that is about 0.00003 millirem higher than that of the average nonminority individual. However, this difference represents a negligible increased risk to the exposed individual of developing a latent fatal cancer (2×10^{-11}, or 1 chance in 50 billion, annually). Within the 20- and 50-mile (32- and 80-kilometer) radii, the average dose to the nonminority individual would exceed the average dose to an individual of each subpopulation.

Table 4–26 Comparison of Annual Doses to an Average Individual of the Total Minority, Hispanic, Native American, and Low-Income Populations Near Los Alamos National Laboratory in 2020 Under the No Action Alternative (millirem)

Population Group	*Within 5 miles*	*Within 10 Miles*	*Within 20 Miles*	*Within 50 Miles*
Average individual	0.00093	0.00068	0.00028	0.000057
Nonminority individual	0.00090	0.00068	0.00045	0.000068
Minority individual	0.0010	0.00068	0.00018	0.000048
Hispanic individual [a]	0.0010	0.00071	0.00015	0.000044
Native American individual [b]	0.0010	0.00036	0.00013	0.000041
Non-low-income individual	0.00093	0.00069	0.00030	0.000059
Low-income individual	0.0010	0.00060	0.00012	0.000042

[a] The Hispanic population includes all Hispanic persons regardless of race.
[b] Includes persons who also indicated Hispanic or Latino origin.
Note: To convert miles to kilometers, multiply by 1.6093.

To explore potential radiological impacts associated with LANL operations under the No Action Alternative on Native Americans living near LANL, impacts were assessed for hypothetical individuals residing at the Pueblo de San Ildefonso and Santa Clara Pueblo boundaries where the greatest impacts would be expected. Other than location, these individuals have the same exposure characteristics, including food consumption, as the LANL MEI. The results of this analysis show that the probability of these individuals developing an LCF from radionuclide releases during normal operations would essentially be zero. The maximum annual dose for a person at the Pueblo de San Ildefonso boundary would be 0.0053 millirem; the risk of an LCF from this dose is 3×10^{-9} (about 1 chance in 330 million). The maximum annual dose for a person at the Santa Clara boundary would be 0.00055 millirem; the risk of an LCF from this dose is 3×10^{-10} (about 1 chance in 3.3 billion). These doses can be compared to the MEI dose of about 0.0097 millirem per year and the average dose from natural background radiation in the vicinity of LANL of 469 millirem per year. Potential radiological impacts to a receptor at either pueblo boundary location would be smaller than those to the MEI because of the distances and directions from PF-4 and meteorological conditions (e.g., dominant wind direction).

In addition, Section 4.5.3.8.2 summarizes an analysis performed in the 2008 *LANL SWEIS* (DOE 2008f) addressing the impacts to individuals in the vicinity of LANL that may experience special exposure pathways that could cause larger exposures to environmental contaminants. The analysis concluded that persons living near LANL who adopt traditional living habits would receive a higher dose than the rest of the populations living in the same area, but the risks associated with the exposures from LANL would be small. Consequently, the analysis concluded that there would be no disproportionately high and adverse cumulative human health and environmental effects on such individuals.

Doses to persons living below the poverty level are also presented in Table 4–26. Within the 5-mile (8-kilometer) radius, the average low-income individual would receive a dose that is about

0.00007 millirem higher than that to the average non-low-income individual. However, this difference represents a negligible increased risk to the exposed individual of developing a latent fatal cancer of 4×10^{-11}, or 1 chance in approximately 25 billion, annually. Within the 10-, 20-, and 50-mile (16-, 32-, and 80-kilometer) radii, the dose to the average non-low-income individual would exceed that to the average low-income individual.

Therefore, operations under the No Action Alternative would not result in disproportionately high and adverse impacts on minority or low-income populations residing near LANL.

4.1.6.2 Immobilization to DWPF Alternative

Construction—As discussed in Section 4.1.2.1.2, impacts from construction of PDCF at F-Area would be the same as those under the No Action Alternative (Section 4.1.2.1.1). No additional radiological risks to the general population are expected from modifications to the K-Area Complex, H-Canyon/HB-Line, and MFFF at SRS, and PF-4 at LANL. In addition, no additional radiological risk to the general population from construction of the K-Area immobilization capability is expected and no radiological releases are expected to result from modification of DWPF. Therefore, there would be no disproportionately high and adverse impacts on minority or low-income populations due to construction activities under the Immobilization to DWPF Alternative.

Operations—As discussed in Sections 4.1.2.1.2 and 4.1.5.2, routine operations under the Immobilization to DWPF Alternative would pose no significant health risks to the public.

Table 4–27 shows the annual impacts on the total and subset populations within 10, 20, and 50 miles (16, 32, and 80 kilometers) of the facilities at SRS under the Immobilization to DWPF Alternative. The impacts under this alternative for the area surrounding SRS are greatest under the PF-4, H-Canyon/HB-Line, and MFFF Option for pit disassembly and conversion. Therefore, the impacts at SRS presented in this section are representative of the PF-4, H-Canyon/HB-Line, and MFFF Option.

Table 4–27 Comparison of Annual Doses to an Average Individual of the Total Minority, Hispanic, Black or African-American, and Low-Income Populations Near the Savannah River Site in 2020 Under the Immobilization to DWPF Alternative (millirem)

Population Group	*Within 10 Miles*	*Within 20 Miles*	*Within 50 Miles*
Average individual	0.0036	0.0017	0.00082
Nonminority individual	0.0037	0.0017	0.00082
Minority individual	0.0037	0.0017	0.00083
Hispanic individual [a]	0.0039	0.0017	0.00080
Black or African-American individual [b]	0.0036	0.0017	0.00083
Non-low-income individual	0.0037	0.0017	0.00082
Low-income individual	0.0037	0.0017	0.00085

DWPF = Defense Waste Processing Facility.
[a] The Hispanic population includes all Hispanic persons regardless of race.
[b] Includes persons who also indicated Hispanic or Latino origin.
Note: To convert miles to kilometers, multiply by 1.6093.

Within the 10-mile (16-kilometer) radius, the annual dose to an average individual of the Hispanic population would be about 0.0002 millirem higher than that of the average nonminority individual. However, this difference represents a negligible increased risk to the exposed individual of developing a latent fatal cancer (1×10^{-10}, or about 1 chance in 10 billion, annually).

Within the 20-mile (32-kilometer) radius, the annual dose to an average individual of each population would receive the same very small annual dose.

Within the 50-mile (80-kilometer) radius, an average individual of the minority and Black or African-American populations would each receive an annual dose that is about 0.00001 millirem higher than that to the average nonminority individual. However, this difference is so small that it represents no appreciable change in the risk to the exposed individual of developing a latent fatal cancer.

Doses to persons living below the poverty level are also presented in Table 4–27. The average annual dose to an individual, whether below or above the poverty level, would be the same for persons living within 10 and 20 miles (16 and 32 kilometers) of SRS. Within the 50-mile (80-kilometer) radius, an average low-income individual would receive an annual dose that is about 0.00003 millirem higher than that to the average non-low-income individual. However, this difference represents a negligible increased risk to the exposed individual of developing a latent fatal cancer (2×10^{-11}, or about 1 chance in 50 billion, annually).

Therefore, operations under the Immobilization to DWPF Alternative would not result in disproportionately high and adverse impacts on minority or low-income populations residing near SRS.

Table 4–28 shows the annual impacts on the total and subset populations within 5, 10, 20, and 50 miles (8, 16, 32, and 80 kilometers) of PF-4 at LANL under the Immobilization to DWPF Alternative. The impacts at LANL would be the greatest under the two options where 35 metric tons (38.6 tons) of surplus plutonium are processed through PF-4. Therefore, the impacts at LANL presented in this section are representative of these options.

Table 4–28 Comparison of Annual Doses to an Average Individual of the Total Minority, Hispanic, Native American, and Low-Income Populations Near Los Alamos National Laboratory in 2020 Under the Immobilization to DWPF Alternative (millirem)

Population Group	*Within 5 miles*	*Within 10 Miles*	*Within 20 Miles*	*Within 50 Miles*
Average individual	0.0077	0.0057	0.0023	0.00047
Nonminority individual	0.0075	0.0057	0.0038	0.00057
Minority individual	0.0083	0.0057	0.0015	0.00040
Hispanic individual [a]	0.0085	0.0059	0.0012	0.00037
Native American individual [b]	0.0081	0.0030	0.0011	0.00034
Non-low-income individual	0.0077	0.0057	0.0025	0.00049
Low-income individual	0.0082	0.0050	0.0010	0.00035

DWPF = Defense Waste Processing Facility.

[a] The Hispanic population includes all Hispanic persons regardless of race.

[b] Includes persons who also indicated Hispanic or Latino origin.

Note: To convert miles to kilometers, multiply by 1.6093.

For distances beyond 10 miles (16 kilometers), the average nonminority individual would receive a slightly higher annual dose from the proposed surplus plutonium disposition activities than a minority individual. An average individual of the minority, Hispanic, and Native American populations within 5 miles (8 kilometers) of LANL would receive a slightly higher annual dose from these activities. Similarly, an average individual of the Hispanic populations within 10 miles (16 kilometers) of LANL would receive a slightly higher dose than that of an average nonminority individual. The greatest difference in annual doses would be to an average individual of the Hispanic population within 5 miles (8 kilometers) who would receive an annual dose that is about 0.001 millirem higher than that for the average nonminority individual. However, this difference represents a negligible increased risk to the exposed individual of developing a latent fatal cancer (6×10^{-10}, or about 1 chance in 1.7 billion, annually).

To explore potential radiological impacts associated with LANL operations under the Immobilization to DWPF Alternative on Native Americans living near LANL, impacts were evaluated for hypothetical individuals residing at the Pueblo de San Ildefonso and Santa Clara Pueblo boundaries where the greatest impacts would be expected. Other than location, these individuals have the same exposure characteristics, including food consumption, as the LANL MEI. The results of this analysis show that the probability of these individuals developing an LCF from radionuclide releases during normal operations of pit disassembly and conversion at PF-4 would be essentially zero. The maximum annual dose for a person at the Pueblo de San Ildefonso boundary would be 0.044 millirem; the risk of an LCF from this dose is 3×10^{-8} (about 1 chance in 33 million). The maximum annual dose for a person at the Santa Clara boundary would be 0.0046 millirem; the risk of an LCF from this dose is 3×10^{-9} (about 1 chance in 330 million). These doses can be compared to the MEI dose of about 0.081 millirem per year and the average dose from natural background radiation in the vicinity of LANL of 469 millirem per year. Potential radiological impacts to a receptor at either pueblo boundary location would be smaller than those to the MEI because of the distances and directions from PF-4 and meteorological conditions (e.g., dominant wind direction). Thus, there would be no disproportionately high and adverse impacts on these individuals. Additionally, as under the No Action Alternative, there would be no disproportionately high and adverse cumulative environmental and health effects on individuals experiencing special exposure pathways near LANL (see Section 4.5.3.8.2).

Doses to persons living below the poverty level are also presented in Table 4–28. The average annual dose to a non-low-income individual would be higher than that of a low-income individual living within 10, 20, and 50 miles (16, 32, and 80 kilometers) of LANL. The average low-income individual living within 5 miles (8 kilometers) of LANL would receive an annual dose that is about 0.0005 millirem higher than that to the average non-low-income individual. However, this difference is so small it represents no appreciable change in the risk to the exposed individual of developing a latent fatal cancer.

Therefore, operations under the Immobilization to DWPF Alternative would not result in disproportionately high and adverse impacts on minority or low-income populations residing near LANL.

4.1.6.3 MOX Fuel Alternative

Construction—Section 4.1.2.1.3 discusses radiological impacts on the public as a result of construction under the MOX Fuel Alternative. The impacts would be essentially the same as those under the No Action (Section 4.1.2.1.1) and Immobilization to DWPF (Section 4.1.2.1.2) Alternatives. In addition, there would be no additional radiological risk to the general population from construction of PDC if this pit disassembly and conversion option were selected.

Operations—As discussed in Sections 4.1.2.1.3 and 4.1.5.3, routine operations under the MOX Fuel Alternative would pose no significant health risks to the public. **Table 4–29** shows the annual impacts on the total and subset populations within 10, 20, and 50 miles (16, 32, and 80 kilometers) of the facilities at SRS under the MOX Fuel Alternative. The impacts under this alternative for the area surrounding SRS are greatest under the PF-4, H-Canyon/HB-Line, and MFFF Option for pit disassembly and conversion. Therefore, the impacts at SRS presented in this section are representative of the PF-4, H-Canyon/HB-Line, and MFFF Option.

Table 4–29 Comparison of Annual Doses to an Average Individual of the Total Minority, Hispanic, Black or African-American, and Low-Income Populations Near the Savannah River Site in 2020 Under the MOX Fuel Alternative (millirem)

Population Group	*Within 10 Miles*	*Within 20 Miles*	*Within 50 Miles*
Average individual	0.0048	0.0023	0.0011
Nonminority individual	0.0048	0.0023	0.0011
Minority individual	0.0048	0.0023	0.0011
Hispanic individual [a]	0.0051	0.0023	0.0011
Black or African-American individual [b]	0.0048	0.0023	0.0011
Non-low-income individual	0.0048	0.0023	0.0011
Low-income individual	0.0049	0.0023	0.0012

MOX = mixed oxide.
[a] The Hispanic population includes all Hispanic persons regardless of race.
[b] Includes persons who also indicated Hispanic or Latino origin.
Note: To convert miles to kilometers, multiply by 1.6093.

For all distances, the average nonminority individual and minority individual residing near SRS would receive nearly the same annual dose and the doses are very small. The minority subgroup with the largest difference when compared to an average nonminority individual is a Hispanic individual living within 10 miles (16 kilometers) of SRS. This individual would receive an annual dose that is about 0.0003 millirem higher than that to the average nonminority individual. However, this difference represents a negligible increased risk to the exposed individual of developing a latent fatal cancer (2×10^{-10}, or about 1 chance in about 5 billion, annually).

Doses to persons living below the poverty level are also presented in Table 4–29. The average annual dose to an individual, whether below or above the poverty level, would be the same for persons living within 20 miles (32 kilometers) of SRS. The average low-income individual living within 10 and 50 miles (16 and 80 kilometers) of SRS would receive an annual dose which is about 0.0001 millirem higher than that to the average non-low-income individual. However, this difference is so small it represents no appreciable change in the risk to the exposed individual of developing a latent fatal cancer.

Therefore, operations under the MOX Fuel Alternative would not result in disproportionately high and adverse impacts on minority or low-income populations residing near SRS.

The doses to individuals in the LANL vicinity under the MOX Fuel Alternative, including hypothetical individuals at the boundaries of the Pueblo de San Ildefonso and the Santa Clara Pueblo, would be the same as those in Section 4.1.6.2 under the Immobilization to DWPF Alternative. Thus, there would be no disproportionately high and adverse impacts on these individuals. Additionally, as under the No Action Alternative, there would be no disproportionately high and adverse cumulative environmental and health effects on individuals experiencing special exposure pathways near LANL (see Section 4.5.3.8.2).

4.1.6.4 H-Canyon/HB-Line to DWPF Alternative

Construction—Section 4.1.2.1.4 discusses radiological impacts on the public as a result of construction under the H-Canyon/HB-Line to DWPF Alternative. The impacts are essentially the same as those under the MOX Fuel Alternative (Section 4.1.2.1.3).

Operations—As discussed in Sections 4.1.2.1.4 and 4.1.5.4, routine operations under the H-Canyon/HB-Line to DWPF Alternative would pose no significant health risks to the public. **Table 4–30** shows the annual impacts on the total and subset populations within 10, 20, and 50 miles (16, 32, and 80 kilometers) of the facilities at SRS under the H-Canyon/HB-Line to DWPF Alternative. The impacts under this alternative for the area surrounding SRS are greatest under the PF-4, H-Canyon/HB-Line, and MFFF Option for pit disassembly and conversion. Therefore, the impacts at SRS presented in this section are representative of the PF-4, H-Canyon/HB-Line, and MFFF Option.

Table 4–30 Comparison of Annual Doses to an Average Individual of the Total Minority, Hispanic, Black or African-American, and Low-Income Populations Near the Savannah River Site in 2020 Under the H-Canyon/HB-Line to DWPF Alternative (millirem)

Population Group	*Within 10 Miles*	*Within 20 Miles*	*Within 50 Miles*
Average individual	0.0037	0.0017	0.00083
Nonminority individual	0.0037	0.0017	0.00083
Minority individual	0.0037	0.0017	0.00084
Hispanic individual [a]	0.0039	0.0017	0.00080
Black or African-American individual [b]	0.0037	0.0018	0.00084
Non-low-income individual	0.0037	0.0017	0.00082
Low-income individual	0.0037	0.0017	0.00086

DWPF = Defense Waste Processing Facility.
[a] The Hispanic population includes all Hispanic persons regardless of race.
[b] Includes persons who also indicated Hispanic or Latino origin.
Note: To convert miles to kilometers, multiply by 1.6093.

The annual dose to an average nonminority individual from surplus plutonium disposition activities at SRS would be nearly identical to the annual dose received by an average individual of all population subgroups at every radial distance, and would not result in any appreciable increase in risk of a fatal cancer from these doses for any individual.

Within the 10-mile (16-kilometer) radius, the dose to the average Hispanic individual would receive a dose that is about 0.0002 millirem higher than that to the average nonminority individual. However this difference is so small it represents a negligible increased risk to the exposed individual of developing a latent fatal cancer of about 1×10^{-10}, or about 1 chance in 10 billion.

Within the 20-mile (32-kilometer) radius, an average Black or African-American individual would receive a dose that is about 0.0001 millirem higher than that to the average nonminority individual. However this difference is so small it represents a negligible increased risk to the exposed individual of developing a latent fatal cancer of about 6×10^{-11}, or about 1 chance in 17 billion, annually.

Within the 50-mile (80-kilometer) radius, the dose to the average minority individual and the average Black or African-American individual would each receive a dose that is about 0.00001 millirem higher than that to the average nonminority individual. However this difference is so small it represents no appreciable change in the risk to the exposed individual of developing a latent fatal cancer.

Within the 10- and 20-mile (16- and 32-kilometer) radii, the dose to the average individual of the low-income population and the average individual of the non-low-income population would be the same, and the doses are very small.

Within the 50-mile (80-kilometer) radius, an average low-income individual would receive a dose that is about 0.00004 millirem higher than that to the average non-low-income individual. However, this difference is so small that it represents no appreciable change in the risk to the exposed individual of developing a latent fatal cancer.

The doses to individuals in the LANL vicinity under the H-Canyon/HB-Line to DWPF Alternative, including hypothetical individuals at the boundaries of the Pueblo de San Ildefonso and the Santa Clara Pueblo, would be the same as those in Section 4.1.6.2 under the Immobilization to DWPF Alternative. Thus, there would be no disproportionately high and adverse impacts on these individuals. Additionally, as under the No Action Alternative, there would be no disproportionately high and adverse cumulative environmental and health effects on individuals experiencing special exposure pathways near LANL (see Section 4.5.3.8.2).

4.1.6.5 WIPP Alternative

Construction—Section 4.1.2.1.5 discusses radiological impacts on the public as a result of construction under the WIPP Alternative. The impacts are the same as those under the MOX Fuel Alternative (Section 4.1.2.1.3).

Operations—As discussed in Section 4.1.2.1.5 and 4.1.5.5, routine operations under the WIPP Alternative would pose no significant health risks to the public. **Table 4–31** shows the annual impacts on the total and subset populations within 10, 20, and 50 miles (16, 32, and 80 kilometers) of the facilities at SRS under the WIPP Alternative. The impacts under this alternative for the area surrounding SRS are greatest under the PF-4, H-Canyon/HB-Line, and MFFF Option. Therefore, the impacts at SRS presented in this section are representative of the PF-4, H-Canyon/HB-Line, and MFFF Option.

The annual doses to individuals from surplus plutonium disposition activities at SRS under the WIPP Alternative would be nearly identical to those in Section 4.1.6.3 under the MOX Fuel Alternative, and would not result in any appreciable increase in risk of a fatal cancer from these doses for any individual regardless of whether they are a member of a minority or low-income population. Therefore, operations under the WIPP Alternative would not result in disproportionately high and adverse impacts on minority and low-income populations residing near SRS.

Table 4–31 Comparison of Annual Doses to an Average Individual of the Total Minority, Hispanic, Black or African-American, and Low-Income Populations Near the Savannah River Site in 2020 Under the WIPP Alternative (millirem)

Population Group	Within 10 Miles	Within 20 Miles	Within 50 Miles
Average individual	0.0048	0.0023	0.0011
Nonminority individual	0.0048	0.0023	0.0011
Minority individual	0.0048	0.0023	0.0011
Hispanic individual [a]	0.0051	0.0023	0.0011
Black or African-American individual [b]	0.0048	0.0023	0.0011
Non-low-income individual	0.0048	0.0023	0.0011
Low-income individual	0.0048	0.0023	0.0012

WIPP = Waste Isolation Pilot Plant
[a] The Hispanic population includes all Hispanic persons regardless of race.
[b] Includes persons who also indicated Hispanic or Latino origin.
Note: To convert miles to kilometers, multiply by 1.6093.

The annual doses to individuals in the LANL vicinity under the WIPP Alternative, including hypothetical individuals at the boundaries of the Pueblo de San Ildefonso and the Santa Clara Pueblo, would be the same as those in Section 4.1.6.2 under the Immobilization to DWPF Alternative. Thus, there would be no disproportionately high and adverse impacts on these individuals. This is expected to still be the case if pit plutonium was prepared at LANL rather than SRS for potential WIPP disposal. Although detailed information about the design and operation of an enhanced WIPP preparation capability is not available, preparation of pit plutonium at LANL for potential WIPP disposal is expected to represent a minor variation on operations at PF-4 involving pit disassembly and conversion. Additionally, as under the No Action Alternative, there would be no disproportionately high and adverse cumulative environmental and health effects on individuals experiencing special exposure pathways near LANL (see Section 4.5.3.8.2).

4.1.7 Other Resource Areas

This section analyzes impacts at SRS and LANL under the *SPD Supplemental EIS* alternatives for land resources, geology and soils, water resources, noise, ecological resources, cultural resources, and infrastructure.

As described in Appendix I, the use of a 40 percent MOX fuel core in domestic commercial nuclear power reactors would not require any construction other than minor modifications within existing structures. The use of a 40 percent MOX fuel core is not expected to require nor impact geologic and soil materials. There would be no change in impacts on land resources, water resources, noise, ecological resources, cultural resources, and infrastructure that currently occur due to the use of a 100 percent LEU fuel core. Therefore, impacts on these resource areas from use of MOX fuel at commercial nuclear power reactors are not discussed further in this section.

4.1.7.1 Land Resources

This section describes impacts that *SPD Supplemental EIS* alternatives would have on land resources, including land use and visual resources. As described in Appendix H, no new construction is expected at the principal SRS plutonium support facilities. At LANL, modifications to provide an enhanced capability to prepare surplus plutonium for potential WIPP disposal (applicable under the WIPP Alternative) would likely occur within the footprint of existing facilities in TA-55 and planned plutonium support facilities in TA-63. Therefore, impacts on land use and visual resources from plutonium support activities at SRS and LANL are not discussed further in this section.

4.1.7.1.1 Land Use

Impacts on the land are generally related to construction with little or no impacts associated with operations. Therefore, this section only describes the impacts associated with construction of PDCF at

F-Area, PDC at K-Area, and the K-Area immobilization capability at SRS, and the impacts associated with modifications to the existing PF-4 at LANL under two pit disassembly and conversion options. **Table 4–32** summarizes the land disturbed under the alternatives and options.

Table 4–32 Land Disturbed Under the *SPD Supplemental EIS* Alternatives for Each Pit Disassembly and Conversion Option

Pit Disassembly and Conversion Option	***Alternative***				
	No Action	***Immobilization to DWPF***	***MOX Fuel***	***H-Canyon/ HB-Line to DWPF***	***WIPP***
PDCF	At SRS, 50 acres of previously disturbed land in F-Area to construct PDCF	At SRS, 50 acres of previously disturbed land in F-Area to construct PDCF, and 2 acres of previously disturbed land in K-Area to construct the immobilization capability.	Same as No Action	Same as No Action [a]	Same as No Action
PDC	N/A	N/A	At SRS, 25 acres of previously disturbed land, and 5 acres of newly disturbed land, in K-Area to construct PDC. [b]	Same as MOX Fuel [a]	Same as MOX Fuel
PF-4 and MFFF	N/A	At SRS, 2 acres of previously disturbed land in K-Area to construct the immobilization capability. At LANL, less than 2 acres at TA-55 at LANL for modification of PF-4.[c]	At SRS, no additional land disturbance. At LANL, less than 2 acres at TA-55 at LANL for modification of PF-4.[c]	Same as MOX Fuel [a]	Same as MOX Fuel
PF-4, HC/HBL, and MFFF	N/A	At SRS, 2 acres of previously disturbed land in K-Area to construct the immobilization capability. At LANL, less than 2 acres at TA-55 at LANL for modification of PF-4.[c]	At SRS, no additional land disturbance. At LANL, less than 2 acres at TA-55 at LANL for modification of PF-4.	Same as MOX Fuel [a]	Same as MOX Fuel

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; N/A = not applicable; PDC = Pit Disassembly and Conversion Project; PDCF = Pit Disassembly and Conversion Facility; PF-4 = Plutonium Facility; SRS = Savannah River Site; TA = Technical Area; WIPP = Waste Isolation Pilot Plant.

[a] A transfer bypass line may be installed around a diversion box at the H-Area tank farm on land that is already disturbed.

[b] It is expected that a sanitary tie-in connecting K-Area to a lift station at C-Area would be constructed on previously disturbed land (Reddick 2010).

[c] A site for a construction trailer and construction parking has not been selected, but preference would be given to previously disturbed land.

Note: To convert acres to hectares, multiply by 0.40469.

Source: LANL 2013a; SRNL 2013; SRNS 2012a; WSRC 2008a.

4.1.7.1.1.1 No Action Alternative

PDCF would be located within F-Area at SRS in the same general area as that analyzed in the *SPD EIS* (DOE 1999b). The area required to construct this facility, which has been cleared in expectation of construction, would be about 50 acres (20 hectares), including a laydown area. Once completed, PDCF would encompass less than 23 acres (9.3 hectares). Because the use of land for construction of PDCF would be consistent with the current heavy industrial nature of F-Area and would be consistent with the goals of the Industrial Core (see Chapter 3, Section 3.1.1.1), there would be minimal impacts on existing land use.

4.1.7.1.1.2 Immobilization to DWPF Alternative

PDCF Option. Similar to the No Action Alternative, PDCF would be constructed at SRS with impacts as described in Section 4.1.7.1.1.1. Also under this alternative, a number of new structures would be constructed within the built-up portion of K-Area at SRS to support a new plutonium immobilization capability. These structures, which would occupy approximately 2 acres (0.8 hectares), include a chiller building, cooling towers, office space, a sand filter, a fan house, and an exhaust stack. Because construction would take place within the built-up portion of K-Area, there would be no change in land use.

PF-4 and MFFF Option. At SRS and as noted under the PDCF Option, 2 acres (0.8 hectares) of previously disturbed land at K-Area would be required to support immobilization with no impacts on land use. At LANL, pit disassembly and conversion would take place within PF-4. Modifications to PF-4 would take place within the existing structure; however, less than 2 acres (0.8 hectares) would be needed for a temporary trailer and construction parking. Although a site has not been identified for these facilities, preference would be given to previously disturbed land. The project would go through the LANL Permit Requirements Identification process, and compliance requirements would be identified and implemented.

PF-4, H-Canyon/HB-Line, and MFFF Option. At SRS and LANL, land use impacts would be the same as those under the PF-4 and MFFF Option.

4.1.7.1.1.3 MOX Fuel Alternative

PDCF Option. At SRS and similar to the No Action Alternative, PDCF would be constructed within F-Area with impacts as described in Section 4.1.7.1.1.1.

PDC Option. At SRS, construction of PDC would take place within K-Area. In total, construction would require about 30 acres (12 hectares) of land of which 25 acres (10 hectares) are presently disturbed by existing facilities or are cleared. The remaining 5 acres (2 hectares) are wooded. This area could be cleared for a warehouse and/or parking. The total project footprint following construction would be about 18 acres (7.3 hectares) (SRNS 2012a). The impacts of clearing 210 acres (85 hectares) in and around K-Area, including the 5 acres (2 hectares) proposed under this option, were addressed in the *Environmental Assessment for the Safeguards and Security Upgrades for Storage of Plutonium Materials at the Savannah River Site* (DOE 2005d). That assessment resulted in a Finding of No Significant Impact (DOE 2005e). An additional activity planned under this option is construction of a 2-mile (3.2-kilometer) sanitary tie-in connecting K-Area to a lift station at C-Area. Although the exact route is undetermined at this time, it would likely use existing easements; thus, it is not expected to alter current land use. This would be verified prior to construction through the SRS site use process (Reddick 2010).

PF-4 and MFFF Option. At LANL, pit disassembly and conversion would take place within PF-4. As noted in Section 4.1.7.1.1.2, 2 acres (0.8 hectares) would be needed at LANL for a temporary trailer and construction parking under this option. While a site has not been identified, preference would be given to previously disturbed land. The project would go through the LANL Permit Requirements Identification process, and compliance requirements would be identified and implemented.

PF-4, H-Canyon/HB-Line, and MFFF Option. At LANL, impacts associated with modification of PF-4 to support pit disassembly and conversion would be the same as those described in this section for the PF-4 and MFFF Option.

4.1.7.1.1.4 H-Canyon/HB-Line to DWPF Alternative

PDCF Option. At SRS and similar to the No Action Alternative, PDCF would be constructed within F-Area with impacts as described in Section 4.1.7.1.1.1.

A transfer bypass line may be installed around a diversion box at the H-Area tank farm on land that is already disturbed and used for industrial purposes. This action would have no impacts on land use within H-Area.

PDC Option. At SRS, impacts on land use from construction of PDC and a planned sanitary tie-in connecting K-Area to a lift station at C-Area, would be the same as those addressed in Section 4.1.7.1.1.3 for the PDC Option under the MOX Fuel Alternative. Also, if a transfer bypass line were installed at the H-Area tank farm, there would be no impacts on land use.

PF-4 and MFFF Option. At SRS and as addressed under the PDCF Option in this section, construction of a transfer bypass line (if needed) at H-Area would have no impacts on land use. At LANL, impacts associated with modification of PF-4 to enhance LANL's pit disassembly and conversion capability would be the same as those for the PF-4 and MFFF Option under the MOX Fuel Alternative (Section 4.1.7.1.1.3).

PF-4, H-Canyon/HB-Line, and MFFF Option. At SRS and as addressed under the PDCF Option in this section, construction of a transfer bypass line (if needed) at H-Area would have no impacts on land use. At LANL, impacts associated with modification of PF-4 to enhance LANL's pit disassembly and conversion capability would be the same as those for the PF-4 and MFFF Option under the MOX Fuel Alternative (Section 4.1.7.1.1.3).

4.1.7.1.1.5 WIPP Alternative

PDCF Option. At SRS, PDCF would be constructed with impacts as described in Section 4.1.7.1.1.1 under the No Action Alternative.

PDC Option. At SRS, impacts on land use from construction of PDC and a planned sanitary tie-in connecting K-Area to a lift station at C-Area, would be the same as those in Section 4.1.7.1.1.3 for the PDC Option under the MOX Fuel Alternative.

PF-4 and MFFF Option. At LANL, impacts associated with modification of PF-4 to enhance LANL's pit disassembly and conversion capability would be the same as those in Section 4.1.7.1.1.3 for the PF-4 and MFFF Option under the MOX Fuel Alternative.

PF-4, H-Canyon/HB-Line, and MFFF Option. At LANL, impacts associated with modification of PF-4 to enhance LANL's pit disassembly and conversion capability would be the same as those in Section 4.1.7.1.1.3 for the PF-4, H-Canyon/HB-Line, and MFFF Option under the MOX Fuel Alternative.

4.1.7.1.2 Visual Resources

Impacts on visual resources at SRS and LANL are addressed in this section. Impacts are related to construction of new facilities or modifications to existing facilities that may affect visual resources. Therefore, this section only describes impacts associated with possible construction of PDCF at F-Area, PDC at K-Area, and the K-Area immobilization capability at SRS, and impacts associated with modifications to PF-4 at LANL that would occur under the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option. Modification activities occurring inside existing buildings (e.g., minor modifications to H-Canyon/HB-Line to support preparation of surplus plutonium for potential WIPP disposal under the WIPP Alternative) are expected to have little impact on visual resources and, therefore, are not discussed.

4.1.7.1.2.1 No Action Alternative

At SRS, PDCF would be built within F-Area with construction occurring within a cleared area immediately adjacent to existing industrial facilities. Thus, the appearance of new facilities would be consistent with the industrialized character of the area. Therefore, the Visual Resource Management (VRM) Class IV designation applicable to F-Area would not change.

4.1.7.1.2.2 Immobilization to DWPF Alternative

PDCF Option. At SRS and similar to the No Action Alternative, PDCF would be constructed within F-Area with impacts as described in Section 4.1.7.1.2.1. Also under this alternative, a number of new structures requiring 2 acres (0.8 hectares) would be constructed within the built-up portion of K-Area to support a new plutonium immobilization capability. Because the appearance of these new facilities would be consistent with the industrialized character of the area, there would be no change to the visual environment. Therefore, the VRM Class IV designation applicable to K-Area would not change.

PF-4 and MFFF Option. At SRS and as noted in this section under the PDCF Option, 2 acres (0.8 hectares) of previously disturbed land at K-Area would be required to support immobilization with no impacts on the visual environment. At LANL, modifications to PF-4 to provide an enhanced pit disassembly and conversion capability would take place within the existing structure; however, less than 2 acres (0.8 hectares) would be needed for a temporary trailer and construction parking. Although a site has not been identified for these facilities, preference would be given to previously disturbed land. The project would go through the LANL Permit Requirements Identification process, and compliance requirements would be identified and implemented. Thus, although visual impacts cannot be determined at this time, the visual environment would be considered during the site permitting process. At SRS and LANL, because the appearance of these new and modified structures would be consistent with the industrialized character of the areas where they would be or are located, there would be no change to the visual environment at either site.

PF-4, H-Canyon/HB-Line, and MFFF Option. At SRS and as noted in this section under the PDCF Option, 2 acres (0.8 hectares) of previously disturbed land at K-Area would be required to support immobilization with no impacts on the visual environment. At LANL, visual impacts associated with modification of PF-4 would be the same as those described in this section under the PF-4 and MFFF Option.

4.1.7.1.2.3 MOX Fuel Alternative

PDCF Option. At SRS, PDCF would be constructed within F-Area with visual impacts as described in Section 4.1.7.1.2.1 under the No Action Alternative.

PDC Option. At SRS and as noted in Section 4.1.7.1.1.3 under the PDC Option, with the exception of a warehouse and/or parking lot, construction would take place within the developed portion of K-Area. Because development would be compatible with the industrial appearance of K-Area, there would be no change to its Class IV VRM designation. The warehouse and/or parking lot would remove 5 acres (2 hectares) of woodland located on the east side of the complex; however, this acreage is part of the 210 acres (85 hectares) of woodland to be removed as part of the safeguards and security measures to be implemented at K-Area. The removal of this acreage was evaluated in the *Environmental Assessment for the Safeguards and Security Upgrades for Storage of Plutonium Materials at the Savannah River Site* (DOE 2005d) for which a Finding of No Significant Impact was issued (DOE 2005e). An additional activity planned under this option is construction of a 2-mile (3.2-kilometer) sanitary tie-in connecting K-Area to a lift station at C-Area. Although the exact route is undetermined at this time, it would likely use existing easements; thus, it is not expected to impact visual resources at SRS. This would be verified prior to construction through the SRS site use process (Reddick 2010).

PF-4 and MFFF Option. At LANL, visual impacts from modification of PF-4 would be the same as described for the PF-4 and MFFF Option under the Immobilization to DWPF Alternative (Section 4.1.7.1.2.2).

PF-4, H-Canyon/HB-Line, and MFFF Option. At LANL, visual impacts associated with modification of PF-4 would be the same as described for the PF-4, H-Canyon/HB-Line, and MFFF Option under the Immobilization to DWPF Alternative (Section 4.1.7.1.2.2).

4.1.7.1.2.4 H-Canyon/HB-Line to DWPF Alternative

PDCF Option. At SRS and similar to the No Action Alternative, PDCF would be constructed within F-Area with visual impacts as described in Section 4.1.7.1.2.1. Construction of a transfer bypass line around a diversion box at the H-Area tank farm (if required) would not impact visual resources since this action would take place on land that is already disturbed.

PDC Option. At SRS, impacts on visual resources from construction of PDC at K-Area and a planned sanitary tie-in connecting K-Area to a lift station at C-Area would be the same as those addressed in Section 4.1.7.1.2.3 under the MOX Fuel Alternative. Additionally, construction of a transfer bypass line (if needed) around a diversion box in the H-Area tank farm would not impact visual resources.

PF-4 and MFFF Option. At SRS, construction of a transfer bypass line (if needed) around a diversion box in the H-Area tank farm would not impact visual resources. At LANL, visual impacts associated with modification of PF-4 would be the same as described for the PF-4 and MFFF Option under the Immobilization to DWPF Alternative (Section 4.1.7.1.2.2).

PF-4, H-Canyon/HB-Line, and MFFF Option. At SRS, construction of a transfer bypass line (if needed) around a diversion box in the H-Area tank farm would not impact visual resources. At LANL, visual impacts associated with modification of PF-4 would be the same as described for the PF-4, H-Canyon/HB-Line, and MFFF Option under the Immobilization to DWPF Alternative (Section 4.1.7.1.2.2).

4.1.7.1.2.5 WIPP Alternative

PDCF Option. At SRS and similar to the No Action Alternative, PDCF would be constructed with impacts as described in Section 4.1.7.1.2.1 under the No Action Alternative.

PDC Option. At SRS, impacts on visual resources from construction of PDC, and a planned sanitary tie-in connecting K-Area to a lift station at C-Area, would be the same as those for the PDC Option in Section 4.1.7.1.2.3 under the MOX Fuel Alternative.

PF-4 and MFFF Option. At LANL, visual impacts associated with modification of PF-4 would be the same as those for the PF-4 and MFFF Option in Section 4.1.7.1.2.2 under the Immobilization to DWPF Alternative.

PF-4, H-Canyon/HB-Line, and MFFF Option. At LANL, visual impacts associated with modification of PF-4 would be the same as those for the PF-4, H-Canyon/HB-Line, and MFFF Option in Section 4.1.7.1.2.2 under the Immobilization to DWPF Alternative.

4.1.7.2 Geology and Soils

Impacts on geology and soils can occur from disturbance of geologic and soil materials during land clearing, grading, and excavation activities, and the use of geologic and soils materials during facility construction and operations. Disturbance of geologic and soil materials includes excavating rock and soil, soil mixing, soil compaction, and covering building foundations, parking lots, roadways, and fill materials. Geologic and soil materials used as fill during building and road construction include crushed stone, sand, gravel, and soil.

Construction of PDCF at F-Area, PDC at K-Area, and the K-Area immobilization capability at SRS, and modification of PF-4 at LANL, have the potential to affect geology and soils by disturbance of the land surface and by the use of geologic and soil materials. As described in Section 4.1.7.1.1, these facilities would disturb approximately 50 acres (20 hectares), 30 acres (12 hectares), 2 acres (0.8 hectares), and 2 acres (0.8 hectares), respectively. Enhancement of the LANL capability in TA-55 to prepare plutonium for potential WIPP disposal is expected to occur with the footprint of existing facilities with no additional land disturbance or use of geologic and soil materials.

Table 4–33 summarizes the geologic and soil materials used during construction for the alternatives and pit disassembly and conversion options evaluated in this *SPD Supplemental EIS*. As described in Appendix H, no new construction is expected, and little or no geologic and soils materials would be needed, for any of the principal plutonium support facilities located at SRS. At LANL, there would be no new construction at the principal support facilities except that under the WIPP Alternative, there could be modifications within the footprint of planned facilities in TA-63. It is expected that no geologic and soils materials would be needed for these modifications. Therefore, impacts on geology and soils from these activities are not discussed further in this section.

Land disturbance would not occur at the other facilities addressed in this *SPD Supplemental EIS*.

Table 4–33 Comparison of Geologic and Soil Materials Used During Construction

Geologic and Soil Materials	Pit Disassembly and Conversion Option	Alternative				
		No Action	Immobilization to DWPF	MOX Fuel	HC/HBL to DWPF	WIPP
Crushed stone, sand, and gravel (tons)	PDCF [a]	190,000 (SRS)	190,000 (SRS)	190,000 (SRS)	190,000 (SRS)	190,000 (SRS)
	PDC [a]	N/A	N/A	530,000 (SRS)	530,000 (SRS)	530,000 (SRS)
	PF-4 and MFFF	N/A	1,200 (SRS) minimal (LANL)	minimal (SRS) minimal (LANL)	minimal (SRS) minimal (LANL)	minimal (SRS) minimal (LANL)
	PF-4, HC/HBL, and MFFF	N/A	1,200 (SRS) minimal (LANL)	minimal (SRS) minimal (LANL)	minimal (SRS) minimal (LANL)	minimal (SRS) minimal (LANL)
Soil (cubic yards)	PDCF [a]	130,000 (SRS)	140,000 (SRS)	130,000 (SRS)	130,000 (SRS)	130,000 (SRS)
	PDC [a]	N/A	N/A	13,000 (SRS)	13,000 (SRS)	13,000 (SRS)
	PF-4 and MFFF	N/A	9,500 (SRS) minimal (LANL)	minimal (SRS) minimal (LANL)	minimal (SRS) minimal (LANL)	minimal (SRS) minimal (LANL)
	PF-4, HC/HBL, and MFFF	N/A	9,500 (SRS) minimal (LANL)	minimal (SRS) minimal (LANL)	minimal (SRS) minimal (LANL)	minimal (SRS) minimal (LANL)

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; N/A = not applicable; PDC = Pit Disassembly and Conversion Project; PDCF = Pit Disassembly and Conversion Facility; PF-4 = Plutonium Facility; SRS = Savannah River Site; WIPP = Waste Isolation Pilot Plant.

[a] Under the PDCF and PDC Options, no construction or facility modifications would be needed to enable pit disassembly and conversion of 2 metric tons (2.2 tons) of plutonium at PF-4, with no need for geologic and soils materials at LANL.

Note: Values are rounded to two significant figures. To convert tons to metric tons, multiply by 0.90718; cubic yards to cubic meters, multiply by 0.76456.

Source: Appendix F, Section F.7.2; Appendix G, Section G.7.2.

4.1.7.2.1 No Action Alternative

Construction—As described in Section 4.1.7.1.1.1, construction of PDCF at F-Area at SRS would disturb a total of 50 acres (20 hectares) of previously disturbed land. During construction, best management practices (BMPs), such as silt fences, straw bales, geotextile fabrics, and revegetation, would be used to control erosion. The South Carolina Department of Health and Environmental Control (SCDHEC) requires a Stormwater Pollution Prevention Plan (SWPPP) under the South Carolina National Pollutant Discharge Elimination System (NPDES) General Permit for stormwater discharges from construction activities (Permit Number SCR100000) (NRC 2005a:4-24, 5-2). Because this area has already been disturbed, a limited area of soils would be disturbed at any one time, and BMPs would be used to limit soil erosion, minimal impacts on geology and soils are expected.

Table 4–33 presents the geologic and soil materials used during construction of facilities under the No Action Alternative. Sources of construction materials would include crushed stone, sand, and gravel supplied by regional commercial operations; soils from SRS borrow pits; and soils stockpiled during construction site excavation. The total quantities of these materials would represent small percentages of regionally plentiful resources (USGS 2011a:12.1, 2011b:43.2), and are unlikely to adversely impact SRS geology and soil resources.

Operations—Continued storage of surplus plutonium at the K-Area Complex and operation of surplus plutonium facilities would involve no ground disturbance and little or no use of local geologic and soils materials and, therefore, would have no impacts on SRS and LANL geology and soils.

4.1.7.2.2 Immobilization to DWPF Alternative

Construction—As described in Section 4.1.7.1.1.2, construction would disturb a total of 2 to 52 acres (0.8 to 21 hectares) at SRS and less than 2 acres (0.8 hectares) at LANL. As described for the No Action Alternative (Section 4.1.7.2.1), the use of SWPPPs and construction site BMPs would likely result in minimal impacts on SRS and LANL geology and soils.

Table 4–33 presents the geologic materials used during construction of facilities under this alternative. As described for the No Action Alternative, the use of these materials is unlikely to have adverse impacts on SRS and LANL geology and soils.

Operations—Operation of facilities under this alternative would involve no ground-disturbing activities and little or no use of local geologic and soils materials and, therefore, would result in minimal impacts on SRS and LANL geology and soils.

4.1.7.2.3 MOX Fuel Alternative

Construction—As described in Section 4.1.7.1.1.3, construction would disturb up to 50 acres (20 hectares) at SRS and less than 2 acres (0.8 hectares) at LANL. As described for the No Action Alternative, the use of SWPPPs and construction site BMPs would likely result in minimal impacts on SRS and LANL geology and soils.

Table 4–33 presents the geologic materials used during construction of facilities under this alternative. As described for the No Action Alternative, the use of these materials is unlikely to have adverse impacts on SRS and LANL geology and soils.

Operations—Operation of facilities under this alternative would involve no ground-disturbing activities and little or no use of local geologic and soils materials and, therefore, would result in minimal impacts on SRS and LANL geology and soils.

4.1.7.2.4 H-Canyon/HB-Line to DWPF Alternative

The areas of land disturbed and the amounts of geologic and soil materials used would be the same as those under the MOX Fuel Alternative (Section 4.1.7.2.3). Therefore, impacts on geology and soils would be the same.

4.1.7.2.5 WIPP Alternative

The areas of land disturbed and the amounts of geologic and soil materials used would be the same as those under the MOX Fuel Alternative (Section 4.1.7.2.3). Therefore, impacts on geology and soils would be the same.

4.1.7.3 Water Resources

Environmental impacts on water resources under each alternative are herein compared. Environmental impacts would be considered significant if they resulted in:

- Degradation or impairment of water resource quantity or quality (introduction of chemical materials or sediments into the water column) that violates Federal and/or state regulations, quality standards, or existing permits or SWPPPs
- Changes to affected area surface and/or subsurface drainage features that alter waterway courses, system recharge, or drainage patterns, and/or exceed the capacity of existing stormwater management systems
- Increases in water supply consumption that may compromise the capacity and/or availability of the water system to meet intended or future needs

No new construction is expected for the principal plutonium support facilities at SRS (see Appendix H), with no greater than minimal impacts on water resources. At LANL, there would be no new construction at the principal support facilities except that under the WIPP Alternative, there could be some modifications within the footprint of planned facilities in TA-63. It is expected that there would be minimal impacts on water resources from these modifications. Hence, impacts from construction or modification of SRS and LANL principal support facilities are not further addressed in this section.

4.1.7.3.1 Surface Water

Surface water resources of concern include rivers, smaller streams, impoundments (lakes, ponds, sloughs, etc.), and springs associated with SRS and/or LANL. Surface water features are discussed in Chapter 3, Sections 3.1.3.1 and 3.2.3.1.

4.1.7.3.1.1 No Action Alternative

Construction—At SRS, construction of PDCF at F-Area may have impacts on surface waters from the discharge of stormwater runoff and sediments; however, compliance with the existing South Carolina NPDES General Permit (SCR100000) to develop and implement an SWPPP for PDCF construction would limit the extent and duration of impacts. The SWPPP would identify site-specific BMPs designed to minimize impacts from runoff, soil erosion, sedimentation, and construction-related accidental chemical spills and nonhazardous effluent releases (see Appendix F, Section F.7.3.1.1). There would be no direct release of contaminated effluent during PDCF construction. No long-term changes to stream channel morphology, aquatic habitats, or flow regimes are expected, and the availability of surface water for downstream users would not be limited (WSRC 2008a).

Operations—At SRS, operational nonhazardous wastewater and stormwater runoff from PDCF, MFFF, and plutonium support facilities would be discharged at permitted outfalls and concentrations of regulated pollutants would be at safe levels below NPDES permitted limits (WGI 2005b:129-149; WSRC 2008a); thus, it is expected that potential impacts on surface water quality would be minimal. Surface water sources would not be used to supply water for facility operations; therefore, no decrease in surface water levels or flows is expected. At LANL, nonhazardous wastewater and stormwater runoff from PF-4 and plutonium support facilities would be discharged at permitted outfalls in accordance with NPDES permitted limits (DOE 2008f), with minimal impacts on surface water quality. Surface water sources would not be used to supply water for facility operations.

4.1.7.3.1.2 Immobilization to DWPF Alternative

Construction—

PDCF Option. PDCF construction requirements and resultant impacts on surface water resources would be the same as those under the No Action Alternative (Section 4.1.7.3.1.1). Construction within K-Area to support plutonium immobilization would disturb approximately 2 acres (0.8 hectares) of land. The effects of construction activities on surface water are expected to be minor and short-term. An SWPPP would be developed prior to construction to guide the installation and maintenance of BMPs to minimize the amount of sediment in runoff to surface waters. The management and discharge of construction site runoff would be in compliance with existing stormwater permits (WSRC 2008a). Minor modifications of existing structures at DWPF at S-Area to support vitrification of plutonium would have no impacts on surface waters; no additional HLW canister storage capacity would be required.

PF-4 and MFFF Option. At SRS, impacts from construction of the K-Area immobilization capability would be the same as those under the PDCF Option, as would impacts from modification of DWPF. Modification of capabilities at MFFF to support plutonium conversion would be internal to the structure (SRNS 2012a), with no potential for erosion or sediment loss that could impact surface waters.

At LANL, modifications to the existing PF-4 in TA-55 would disturb approximately 2 acres (0.8 hectares) of land; this disturbance is expected to have only minor short-term impacts and no long-term impacts on surface water resources. Prior to construction, the LANL Permit Requirements Identification process would be initiated to review and update permit requirements and subject matter experts would be consulted to ensure that appropriate soil erosion, sediment, and runoff control measures are installed and maintained during site construction to prevent and mitigate the potential for surface water impacts (LANL 2013a). There would be no direct release of contaminated effluent during construction.

PF-4, H-Canyon/HB-Line, and MFFF Option. At SRS, impacts from construction of the K-Area immobilization capability would be the same as those under the PDCF Option, as would impacts from modification of DWPF. Impacts from modification of capabilities at MFFF to support plutonium conversion would be the same as those under the PF-4 and MFFF Option. Modifications to the K-Area Complex and H-Canyon/HB-Line to support an enhanced pit disassembly and conversion capability would occur within existing structures with no potential for erosion or sediment loss that could impact surface waters. At LANL, impacts would be the same as those discussed in this section under the PF-4 and MFFF Option.

Operations—Under all pit disassembly and conversion options, the potential for surface water impacts would be minimal from operation of PDCF, H-Canyon/HB-Line, the K-Area immobilization capability and pit disassembly capability, MFFF, DWPF, GWSBs, or plutonium support facilities at SRS, and from operation of PF-4 and plutonium support facilities at LANL. Wastewater and stormwater runoff would be managed and discharged in compliance with existing regulations and facility permits that require pollutant concentrations to be limited to safe levels. No decreases in SRS or LANL surface water flows are expected.

4.1.7.3.1.3 MOX Fuel Alternative

Construction—

PDCF Option. At SRS, PDCF construction requirements and resultant impacts on surface water resources would be the same as those under the No Action Alternative (Section 4.1.7.3.1.1). Modifications to H-Canyon/HB-Line to support preparation of some non-pit plutonium for potential WIPP disposal would occur within the existing structure, with no impacts on surface water resources.

PDC Option. At SRS, construction of PDC at K-Area would disturb approximately 30 acres (12 hectares) and may result in minor, short-term impacts on surface water quality. As required for PDCF construction, an SWPPP would be developed and implemented to prevent and mitigate potential surface water impacts. To meet SCDHEC requirements, the site would be divided into four drainage areas having four stormwater retention basins and outfalls (SRNS 2012a). There would be no direct release of contaminated effluent during construction. No long-term changes to stream channel morphology, aquatic habitats, or flow regimes are expected, and the availability of surface water for downstream users would not be limited (WSRC 2008a). Control measures to minimize erosion and sediment loss would be implemented during construction of a planned sanitary tie-in connecting K-Area to a lift station at C-Area, with minimal impacts on surface water resources.

PF-4 and MFFF Option. At SRS, modifications to MFFF to install metal oxidation furnaces would occur within the structure with no additional impacts on surface water resources. At LANL, impacts on surface water resources would be minimal as discussed for the PF-4 and MFFF Option under the Immobilization to DWPF Alternative (Section 4.1.7.3.1.2).

PF-4, H-Canyon/HB-Line, and MFFF Option. At SRS, modification of capabilities at MFFF to support plutonium conversion would be internal to the structure (SRNS 2012a), with no potential for erosion or sediment loss that could impact surface waters. Modifications to the K-Area Complex and H-Canyon/HB-Line to support an enhanced pit disassembly and conversion capability would occur within existing structures with no potential for erosion or sediment loss that could impact surface waters. At LANL, impacts on surface water resources would be minimal as discussed for the PF-4 and MFFF Option under the Immobilization to DWPF Alternative (Section 4.1.7.3.1.2).

Operations—Under all pit disassembly and conversion options, the potential for surface water impacts would be minimal from operation of PDCF, PDC, H-Canyon/HB-Line, MFFF, DWPF, GWSBs, or plutonium support facilities at SRS, and from operation of PF-4 and plutonium support facilities at LANL. Wastewater and stormwater runoff would be managed and discharged in compliance with existing regulations and facility permits that require pollutant concentrations to be limited to safe levels. No decreases in SRS or LANL surface water flows are expected.

4.1.7.3.1.4 H-Canyon/HB-Line to DWPF Alternative

Construction—

PDCF Option. At SRS, PDCF construction requirements and resultant impacts on surface water resources would be the same as those under the No Action Alternative (Section 4.1.7.3.1.1). Modifications to H-Canyon/HB-Line to support preparation of non-pit plutonium for dissolution with subsequent vitrification at DWPF would occur within the existing structure, with no impacts on surface water resources. In the event a buried transfer line is required at the H-Area tank farm, construction BMPs would be used, resulting in minimal potential for surface water impacts (SRNL 2013).

PDC Option. At SRS, impacts from construction of PDC and installation of a planned sanitary tie-in connecting K-Area to a lift station at C-Area would be the same as those discussed for this option under the MOX Fuel Alternative (Section 4.1.7.3.1.3). Modifications to H-Canyon/HB-Line to support preparation of non-pit plutonium for dissolution with subsequent vitrification at DWPF would occur within the existing structure, with no impacts on surface water resources. Impacts from the possible addition of a buried transfer line at the H-Area tank farm would be the same as those under the PDCF Option.

PF-4 and MFFF Option. At SRS, modifications to H-Canyon/HB-Line to support preparation of non-pit plutonium for dissolution with subsequent vitrification at DWPF would occur within the existing structure, with no impacts on surface water resources. Impacts from the possible addition of a buried transfer line at the H-Area tank farm would be the same as those under the PDCF Option. Modifications to MFFF to install metal oxidation furnaces would occur within the structure, with no additional impacts on surface water resources. At LANL, impacts on surface water resources would be minimal as discussed for the PF-4 and MFFF Option under the Immobilization to DWPF Alternative (Section 4.1.7.3.1.2).

PF-4, H-Canyon/HB-Line, and MFFF Option. At SRS, modification of capabilities at MFFF to support plutonium conversion would be internal to the structure (SRNS 2012a), with no potential for erosion or sediment loss that could impact surface waters. Impacts from the possible addition of a buried transfer line at the H-Area tank farm would be the same as those under the PDCF Option. Modifications to the K-Area Complex and H-Canyon/HB-Line to support an enhanced pit disassembly and conversion capability, or to support dissolution of non-pit plutonium with subsequent vitrification at DWPF, would occur within existing structures with no potential for erosion or sediment loss that could impact surface waters. Impacts from the possible addition of a buried transfer line at the H-Area tank farm would be the same as those under the PDCF Option. At LANL, impacts on surface water resources would be minimal as discussed for the PF-4 and MFFF Option under the Immobilization to DWPF Alternative (Section 4.1.7.3.1.2).

*Operations—*Potential surface water impacts from SRS and LANL facility operations would be the same as those under the MOX Fuel Alternative (Section 4.1.7.3.1.3).

4.1.7.3.1.5 WIPP Alternative

PDCF Option – At SRS, PDCF construction requirements and resultant impacts on surface water resources would be the same as those under the No Action Alternative (Section 4.1.7.3.1.1). Modifications to H-Canyon/HB-Line to support preparation of surplus plutonium for potential disposal at WIPP would occur within the existing structure, with no impacts on surface water resources.

PDC Option – At SRS, impacts from construction of PDC at K-Area and installation of a planned sanitary tie-in connecting K-Area to a lift station at C-Area would be the same as those discussed for this option under the MOX Fuel Alternative (Section 4.1.7.3.1.3). Modifications to H-Canyon/HB-Line to support preparation of surplus plutonium for potential disposal at WIPP would occur within the existing structure, with no impacts on surface water resources.

PF-4 and MFFF Option. At SRS, modifications to H-Canyon/HB-Line to support preparation of surplus plutonium for potential disposal at WIPP would occur within the existing structure, with no impacts on surface water resources. Modifications to MFFF to install metal oxidation furnaces would also occur within the structure with no additional impacts on surface water resources. At LANL, impacts on surface water resources from modifications to PF-4 to enhance LANL's pit disassembly and conversion capability would be minimal as discussed for the PF-4 and MFFF Option under the Immobilization to DWPF Alternative (Section 4.1.7.3.1.2). Modifications to provide an enhanced capability to prepare surplus plutonium for potential WIPP disposal would likely occur within the footprint of existing TA-55 facilities, with no impacts on surface waters.

PF-4, H-Canyon/HB-Line, and MFFF Option. At SRS, modification of capabilities at MFFF to support plutonium conversion would be internal to the structure, with no potential for erosion or sediment loss that could impact surface waters. Modifications to the K-Area Complex and H-Canyon/HB-Line to support an enhanced pit disassembly and conversion capability, or to prepare surplus plutonium for potential disposal at WIPP, would occur within existing structures with no potential for erosion or sediment loss that could impact surface waters. At LANL, impacts on surface water resources from modifications to PF-4 to enhance LANL's pit disassembly and conversion capability would be minimal as discussed for the PF-4 and MFFF Option under the Immobilization to DWPF Alternative (Section 4.1.7.3.1.2). Modifications to provide an enhanced capability to prepare surplus plutonium for potential WIPP disposal would likely occur within the footprint of existing TA-55 facilities, with no impacts on surface waters.

*Operations—*Potential surface water impacts from SRS facility operations would be the same as those under the MOX Fuel Alternative (Section 4.1.7.3.1.3). Potential surface water impacts from LANL facility operations would be the same as those under the Immobilization to DWPF Alternative (Section 4.1.7.3.1.2) whether or not pit plutonium was prepared at LANL for potential WIPP disposal. This is because preparation for potential WIPP disposal would likely occur in existing TA-55 facilities and subsequent characterization and staging for shipment would be within the footprint of existing and planned facilities in TA-54 and TA-63. There would be no direct discharge of industrial effluent from these facilities and sanitary wastewater would be directed to an appropriate treatment facility for disposal. No surface water sources would be used to supply water for operations.

4.1.7.3.2 Groundwater

This section analyzes impacts on groundwater resources resulting from facility construction and/or modification and operations under each alternative. Groundwater features of concern include near-surface groundwater associated with water tables and aquifers (see Chapter 3, Sections 3.1.3.2 and 3.2.3.2). Water supply describes the utility systems used to access water resources and distribute potable and nonpotable water to support site processes and personnel.

SRS water supply sources for domestic, sanitary, and process water include groundwater and river water; groundwater is the source of potable water for SRS (NRC 2005a:3-11). The LANL water supply is drawn from the regional aquifer (LANL 2005:2-103).

4.1.7.3.2.1 No Action Alternative

*Construction—*Construction of PDCF would require less than 1 percent of SRS's available water capacity (see Section 4.1.7.7.1) with no long-term impacts expected on the SRS water supply. Potential impacts on groundwater quality would be minimized by implementation of an SWPPP for facility construction as described in Section 4.1.7.3.1.1. Short of direct connectivity to groundwater afforded by well heads, karst features, springs, or other recharge features, pollution of groundwater would most likely occur from the infiltration and permeation of contaminated stormwater runoff and chemical materials from accidental spills into and through the soil and into the underlying groundwater. The management of surface water runoff and prevention of accidental spills and effluent releases addressed by SWPPPs would not only minimize potential impacts on surface waters but also reduce the potential for contaminating near-surface water tables or aquifers.

Operation—Operations under this alternative would require about 2 percent of the available water capacity at SRS and less than 1 percent of the available water capacity at LANL (see Section 4.1.7.7.1). No long-term impacts are expected on the available capacity at either SRS or LANL. No impacts on groundwater quality are expected from facility operations, because no direct discharge of liquid effluents to groundwater during facility operation is expected. In addition, because all regulated industrial wastewater and stormwater runoff would be discharged at safe levels well below NPDES permitted limits, impacts on groundwater would be minimized for the same reasons as those discussed above for facility construction (DOE 2008f; WGI 2005b:129-149; WSRC 2008a).

4.1.7.3.2.2 Immobilization to DWPF Alternative

Construction—At SRS, construction activities would require less than 1 percent of SRS's available water capacity under any of the pit disassembly and conversion options (see Section 4.1.7.7.2). Construction would have no long-term impacts on SRS available capacity. Because no liquid effluents would be directly discharged to groundwater during construction (WSRC 2008a), no impacts on groundwater quality are expected.

At LANL, there would be no long-term impacts on LANL water supply available capacity or adverse effects on groundwater quality. Modifications to PF-4 under two pit disassembly conversion options would require less than 1 percent of LANL's available water capacity. Implementation of the Permit Requirements Identification process as described in Section 4.1.7.3.1.2 would minimize potential impacts on surface water quality; this is because pollution of groundwater would most likely occur from the infiltration and permeation of contaminated stormwater runoff and chemical materials from accidental spills into and through the soil and into the underlying groundwater. The management of surface water runoff and prevention of accidental spills and effluent releases would not only minimize potential impacts on surface waters but also reduce the potential for contaminating near-surface water tables or aquifers. In addition, the extent of alluvium and intermediate perched groundwater and hundreds of feet of underlying dry bedrock would restrict the volumetric recharge contribution to the regional aquifer (DOE 2011g:3-35; LANL 2011d:5-4).

Operations—Operations are expected to require about 2 percent of SRS's available water capacity and up to 2 percent of LANL's available water capacity (see Section 4.1.7.7.2). As under the No Action Alternative (Section 4.1.7.3.2.1), no impacts on groundwater quality are expected from operations because there would be no direct discharge of liquid effluents to groundwater at either site and all regulated industrial wastewater and stormwater runoff would be discharged at safe levels well below NPDES permitted limits. Thus, no long-term impacts on SRS or LANL available capacity and quality are expected.

4.1.7.3.2.3 MOX Fuel Alternative

Construction—At SRS, construction activities would require less than 1 percent of SRS's available water capacity under any of the pit disassembly and conversion options (see Section 4.1.7.7.3), with no long-term impacts on SRS available capacity. Because no liquid effluents would be directly discharged to groundwater during construction (WSRC 2008a) no impacts on groundwater quality are expected.

At LANL, water use for optional modification of PF-4 would be the same as that under the Immobilization to DWPF Alternative (Section 4.1.7.3.2.2), with no long-term impacts on LANL water supply available capacity or adverse effects on groundwater quality.

Operations—Operations are expected to require up to 2 percent of SRS's available water capacity and up to 2 percent of LANL's available water capacity (see Section 4.1.7.7.3). As under the Immobilization to DWPF Alternative (Section 4.1.7.3.2.2), no long-term impacts on SRS or LANL available capacity or groundwater quality are expected.

4.1.7.3.2.4 H-Canyon/HB-Line to DWPF Alternative

Construction—The water needed for plutonium facility construction at SRS and LANL is the same as that for the MOX Fuel Alternative (see Sections 4.1.7.3.2.3 and 4.1.7.7.3), with no long-term impacts expected on available capacity or groundwater quality.

Operations—The water needed for plutonium facility operations at SRS and LANL is the same as that for the MOX Fuel Alternative (see Sections 4.1.7.3.2.3 and 4.1.7.7.3), with no long-term impacts expected on available capacity or groundwater quality.

4.1.7.3.2.5 WIPP Alternative

Construction—At SRS, the water needed for plutonium facility construction is the same as that for the MOX Fuel Alternative (see Sections 4.1.7.3.2.3 and 4.1.7.7.3), with no long-term impacts expected on available capacity or groundwater quality. At LANL, the water needed to enhance LANL's capability for pit disassembly and conversion would be the same as that for the Immobilization to DWPF Alternative (see Sections 4.1.7.3.2.2 and 4.1.7.7.2). Modifications to TA-55 facilities or principal support facilities in TA-63 to enhance preparation of pit plutonium for potential WIPP disposal could require additional construction personnel with a correspondingly small increase in construction water use; however, there would be no long-term impacts on available LANL capacity or groundwater quality.

Operations—The water needed for plutonium facility operations at SRS is the same as that for the MOX Fuel Alternative (see Sections 4.1.7.3.2.3 and 4.1.7.7.3), with no long-term impacts expected on available capacity or groundwater quality. The water needed for plutonium facility operations at LANL is substantially the same as that for the MOX Fuel Alternative (see Sections 4.1.7.3.2.3 and 4.1.7.7.3), with no long-term impacts expected on available capacity or groundwater quality. To the extent under the PF-4 and MFFF and PF-4, H-Canyon/HB-Line, and MFFF Options that pit plutonium was prepared at LANL for potential WIPP disposal, there could be increased annual requirements for water at TA-55 and LANL's principal support facilities commensurate with possible employment of additional workers. This additional groundwater use, however, is expected to be within LANL's existing capacity for water use (see Section 7.1.7.7.5).

4.1.7.4 Noise

Activities under the alternatives would result in noise from vehicles, construction equipment, and facility operations. The change in noise levels was considered for construction and operation of the plutonium facilities.

4.1.7.4.1 No Action Alternative

Construction—Construction noise associated with this alternative would be similar to that described in the *SPD EIS* for construction of PDCF (DOE 1999b). Noise sources during construction of PDCF at SRS would include bulldozers, graders, dump trucks, and other vehicles. Impacts from onsite noise sources would be small, and construction traffic noise impacts would be unlikely to result in increased public annoyance (DOE 1999b:4-52). Any change in traffic noise associated with construction would occur on site and along offsite local and regional transportation routes.

Operations—At SRS, noise sources during operation of MFFF, PDCF, and WSB could include diesel generators, cooling systems, vents, motors, material-handling equipment, and trucks and employee vehicles. Given the distances to site boundaries (about 5.4 miles [8.7 kilometers] from F-Area, for example), noise from facility operations is not expected to result in public annoyance. Non-traffic noise sources are far enough away from offsite areas that the contribution to offsite noise levels would be small. Noise from traffic associated with the operation of facilities is expected to increase by less than 1 decibel as a result of the increase in staffing under this alternative. Some noise sources could have onsite noise impacts, such as the disturbance of wildlife. However, noise would be unlikely to affect federally listed threatened or endangered species or their critical habitats. Some change in the noise levels to which noninvolved workers are exposed could occur. At LANL, there would be no change in current planned operations at PF-4, and thus no change in noise impacts. At SRS and LANL, appropriate noise control measures would be implemented under DOE Order 440.1B, *Worker Protection Program for DOE (Including the National Nuclear Security Administration) Federal Employees*, to protect worker hearing.

4.1.7.4.2 Immobilization to DWPF Alternative

Construction—At SRS, construction noise impacts under this alternative would be similar to those under the No Action Alternative (Section 4.1.7.4.1). At LANL, noise impacts from optional modifications to PF-4 at LANL would be minor (LANL 2013a).

Operations—At SRS, noise impacts due to operation of facilities would be similar to those under the No Action Alternative. At LANL, additional activities under two pit disassembly and conversion options would take place within the existing PF-4, and there would be little to no change in noise from equipment such as diesel generators; the only change in noise impacts is expected to result from additional trucks and employee vehicles. These impacts are expected to be minor. As under the No Action Alternative (Section 4.1.7.4.1), at SRS and LANL, appropriate noise control measures would be implemented under DOE Order 440.1B to protect worker hearing.

4.1.7.4.3 MOX Fuel Alternative

Construction—Construction noise impacts under this alternative would be similar to those under the Immobilization to DWPF Alternative (Section 4.1.7.4.2).

Operations—Operations noise impacts under this alternative would be similar to those under the Immobilization to DWPF Alternative (Section 4.1.7.4.2).

4.1.7.4.4 H-Canyon/HB-Line to DWPF Alternative

Construction—Construction noise impacts under this alternative would be similar to those under the Immobilization to DWPF Alternative (Section 4.1.7.4.2).

Operations—Operations noise impacts under this alternative would be similar to those under the Immobilization to DWPF Alternative (Section 4.1.7.4.2).

4.1.7.4.5 WIPP Alternative

Construction—Construction noise impacts under this alternative would be similar to those under the Immobilization to DWPF Alternative (Section 4.1.7.4.2). At LANL, modifications to provide an enhanced capability to prepare surplus plutonium for potential WIPP disposal would likely occur within the footprint of existing or planned facilities in TA-55 and TA-63, with no additional noise impacts.

Operations—Operations noise impacts under this alternative would be similar to those under the Immobilization to DWPF Alternative (Section 4.1.7.4.2). At LANL, minimal additional noise impacts would be expected at TA-54, TA-55, and TA-63 associated with preparation, characterizing, and staging pit plutonium for potential WIPP disposal.

4.1.7.5 Ecological Resources

This section addresses potential impacts on ecological resources, including terrestrial and aquatic resources, wetlands, and threatened and endangered species. Impacts on ecological resources are generally related to land disturbance activities that could occur during construction; little or no impacts would occur during operations. Ecological resources would not be further affected because additional land would not be disturbed during facility operations, and any artificial lighting and noise-producing activities would occur in areas that are already in industrial use. Therefore, this section only describes the impacts from construction of PDCF at F-Area, PDC at K-Area, and the K-Area immobilization capability at SRS, and impacts from modifications to PF-4 at LANL under the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option. As summarized in Table 4–32, only construction or modification of these facilities would involve land-disturbing activities.

At SRS, construction of PDCF at F-Area, PDC at K-Area, and the K-Area immobilization capability have the potential to affect ecological resources by disturbance of the land surface. As described in Section 4.1.7.1.1, these facilities would disturb approximately 50 acres (20 hectares), 30 acres (12 hectares), and 2 acres (0.8 hectares), respectively. Land disturbance would not occur at the other pit disassembly and conversion and plutonium disposition facilities addressed in this *SPD Supplemental EIS*. All construction would be conducted consistent with the *Natural Resources Management Plan for the Savannah River Site* (DOE 2005b).

At LANL, modification of PF-4 at LANL under the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option would disturb less than 2 acres (0.8 hectares) of land. During facility modification, the project would go through the LANL Permit Requirements Identification process, and compliance requirements would be identified and implemented to ensure that no natural resources would be impacted. Threatened and endangered species would be protected in accordance with the LANL *Threatened and Endangered Species Habitat Management Plan* (LANL 2011a).

As described in Appendix H, no new construction is expected at the principal plutonium support facilities at SRS or LANL, and no impacts on ecological resources are expected during their operation. Therefore, impacts on ecological resources from construction and operation of the principal plutonium support facilities at SRS and LANL are not discussed further in this section.

4.1.7.5.1 No Action Alternative

Construction—As described in Section 4.1.7.1.1.1, PDCF would be constructed, disturbing about 50 acres (20 hectares) of land at F-Area. This area has already been cleared. Thus, construction of PDCF would not cause additional impacts on terrestrial resources. No aquatic resources or wetlands exist within the disturbed area required for the construction and operation of PDCF (WSRC 2008a). An SWPPP would be implemented during construction to minimize the amount of soil erosion and sedimentation that could be transported from the construction area. Control measures would include sediment fences and minimizing the amount of time that bare soil would be exposed. Therefore, any impacts on aquatic resources (including streams, lakes, or ponds) or wetlands would be minimized. During construction, BMPs such as silt fences, straw bales, geotextile fabrics, and revegetation would be used to control erosion, thus further limiting and mitigating any potential impacts on ecological resources. Construction of PDCF would take place on already disturbed land where no threatened or endangered species are known to forage, breed, nest, or occur. Because no threatened or endangered species occur within or nearby the area surrounding the proposed construction site, they would not be affected by noise from construction activities. Therefore, no impacts on threatened or endangered species are expected (WSRC 2008a; NRC 2005a:4-105). There would be no new construction at H-, K-, or S-Areas that would affect ecological resources.

Operations—Continued storage of surplus plutonium at the K-Area Complex and operation of surplus plutonium facilities would involve no ground disturbance and therefore, would have no impacts on ecological resources at SRS and LANL.

4.1.7.5.2 Immobilization to DWPF Alternative

Construction—As described in Section 4.1.7.1.1.2, construction would disturb a total of 2 to 52 acres (0.8 to 21 hectares) at SRS and less than 2 acres (0.8 hectares) at LANL. All of the land needed for construction at SRS has already been disturbed, and the preference at LANL would be to avoid previously undisturbed land. In addition, the use of SWPPPs and construction site BMPs as described for the No Action Alternative (Section 4.1.7.5.1), and implementation of other procedures and plans such as those discussed in the opening paragraphs of this section, would likely result in minimal impacts on SRS and LANL ecological resources.

Operations—Operation of facilities under this alternative would involve no ground-disturbing activities and, therefore, would result in minimal impacts on ecological resources at SRS and LANL.

4.1.7.5.3 MOX Fuel Alternative

Construction—As described in Section 4.1.7.1.1.3, construction would disturb up to 50 acres (20 hectares) at SRS and less than 2 acres (0.8 hectares) at LANL. The majority of land needed for construction to support SRS and LANL has already been disturbed. Construction of PDC at K-Area at SRS would require the clearing of 5 acres (2 hectares) of wooded land. In addition, the use of SWPPPs and construction site BMPs as described for the No Action Alternative (Section 4.1.7.5.1), and implementation of other procedures and plans, such as those discussed in the opening paragraphs of this section, would likely result in minimal impacts on SRS and LANL ecological resources.

Operations—Operation of facilities under this alternative would involve no ground-disturbing activities and, therefore, would result in minimal impacts on ecological resources at SRS and LANL.

4.1.7.5.4 H-Canyon/HB-Line to DWPF Alternative

The areas of land disturbed under this alternative would be the same as those under the MOX Fuel Alternative (Section 4.1.7.5.3). Therefore, impacts on ecological resources at SRS and LANL would be the same.

4.1.7.5.5 WIPP Alternative

The areas of land disturbed under this alternative would be the same as those under the MOX Fuel Alternative (Section 4.1.7.5.3). Therefore, impacts on ecological resources at SRS and LANL would be the same. This is expected to still be the case should enhanced capability be developed at LANL to prepare surplus plutonium for potential WIPP disposal. This is because modifications to provide an enhanced capability to prepare pit plutonium for potential WIPP disposal would likely occur within the footprint of existing or planned LANL facilities in TA-55 and TA-63, with no impacts on ecological resources.

4.1.7.6 Cultural Resources

The analysis of impacts on cultural resources, including prehistoric, historic, American Indian, and paleontological, addresses potential impacts at SRS and LANL primarily from land disturbance activities associated with construction. The potential for the alternatives to impact cultural resources was assessed by comparing the locations of known cultural resources to the areas of potential effect from the alternatives.

New construction is associated with PDCF at F-Area, PDC at K-Area, and the immobilization capability in K-Area at SRS, and pit disassembly and conversion activities in PF-4 in TA-55 at LANL. As described in Appendix H, no new construction is expected at the principal SRS plutonium support facilities, while new construction at the principal LANL support facilities is only expected to occur under the WIPP Alternative. Therefore, impacts on cultural resources from plutonium support activities are only discussed for LANL in Section 4.1.7.6.5.

4.1.7.6.1 No Action Alternative

Construction—PDCF would be constructed on 50 acres (20 hectares) within F-Area at SRS. Before construction of MFFF began, this entire area was surveyed for cultural resources and 15 prehistoric sites were identified as described in Appendix F, Section F.7.6.1. Data recovery of these sites was completed, as well as appropriate monitoring, which ensures that DOE, through the Savannah River Archaeological Research Program (SRARP), exceeded the recommendations in the data recovery plans (NRC 2005a:App. B) and met the terms of the Memorandum of Agreement (SRARP 1989:App. C) regarding mitigation of impacts on archaeological sites within the surplus plutonium disposition facilities project area (King 2010).

In addition, 75 acres (30 hectares) in F-Area were surveyed during 2008 and 2009 for the purpose of constructing a laydown yard for the proposed PDCF. This fieldwork located four of five previously recorded sites and identified a new site, as well as five artifacts. Because the artifacts have no research potential there would be no adverse impact; however, two sites are potentially eligible for nomination to the National Register of Historic Places (NRHP) so it is recommended that they be avoided. SRARP personnel are expecting an amended site use permit to facilitate this recommendation (SRARP 2009:10-12).

There would be no new construction in H-, K-, or S-Areas at SRS, or at PF-4 in TA-55 at LANL. Therefore, no impacts on cultural resources are expected at SRS or LANL.

Operations—Continued storage of surplus plutonium at the K-Area Complex, and operation of surplus plutonium disposition facilities, would involve no land disturbance; therefore, no impacts on cultural resources are expected at SRS or LANL.

4.1.7.6.2 Immobilization to DWPF Alternative

Construction—Under this alternative, a number of new structures would be constructed within the industrial portion of K-Area to support a new immobilization capability. During construction, these facilities could occupy approximately 2 acres (0.8 hectares) of land associated with the immobilization capability. Because construction would take place within the built-up portion of K-Area and previous archeological reviews did not reveal any identified sites where land disturbance would occur, impacts on cultural resources are unlikely. There are several NRHP-eligible structures in K-Area, so proposed changes to the historic fabric of these buildings and structure, or to any intact historically significant equipment, would be studied, discussed with the South Carolina State Historic Preservation Office (SHPO), and avoided, mitigated, or minimized (DOE 2005a:16). There would be no impacts on cultural resources in S-Area at SRS because minor modifications would take place within an existing facility (DWPF) that is not an NRHP-eligible property (SRR 2013).

At SRS, PDCF construction under the PDCF Option would occur on 50 acres (20 hectares) within F-Area with impacts on cultural resources as described for the No Action Alternative (Section 4.1.7.6.1). Modifications to the K-Area Complex and H-Canyon/HB-Line would occur under the PF-4, H-Canyon/HB-Line, and MFFF Option. Modifications to the K-Area Complex could involve replacement of non-historic equipment, which would have negligible impacts on cultural resources, while modifications to H-Canyon/HB-Line would be more extensive. The H-Canyon building, including HB-Line, and any other attached auxiliaries have been identified as NRHP-eligible individually, and collectively, within the context of the Cold War Historic District. The H-Canyon building and its auxiliary facilities are considered highly significant given that these structures were primary to SRS's mission and housed one of the site's nuclear production processes (DOE 2005a:39, 58, 61, 66). Photographic mitigation and oral histories have been initiated, and when completed, will be distributed to the South Carolina SHPO to determine what, if any, further action is required to preserve the historical integrity of these facilities (DOE 2008c:4). The proposed facility modifications would be accessed in accordance with the *Cold War Historic Preservation Program* (Sauerborn 2011). Modifications to MFFF under the PF-4 and MFFF Option would be internal to a new facility, with no impacts on cultural resources.

At LANL, modification of PF-4 under the PF-4 and MFFF Option and the PF-4, H-Canyon/HB-Line, and MFFF Option would disturb less than 2 acres (0.8 hectares) of land in TA-55 for a temporary trailer and construction parking. Although a site has not been identified for these facilities, preference would be given to previously disturbed land. The project would go through the LANL Permit Requirements Identification process, and compliance requirements would be identified and implemented, taking into account the potential for impacts on cultural resources; in particular, there are two archeological sites within TA-55 that have been identified as eligible or potentially eligible for listing on the NRHP (DOE 2011g:3-44). Modifications to PF-4 would also conform to requirements presented in *A Plan for the Management of the Cultural Heritage at Los Alamos National Laboratory, New Mexico* (LANL 2006c).

Operations—Operation of facilities under this alternative would involve no land disturbance; therefore, no impacts on cultural resources are expected at SRS or LANL.

4.1.7.6.3 MOX Fuel Alternative

Construction—At SRS, PDCF construction under the PDCF Option would occur on 50 acres (20 hectares) within F-Area with impacts on cultural resources as described for the No Action Alternative (Section 4.1.7.6.1). Construction of PDC under the PDC Option would take place within K-Area, disturbing about 30 acres (12 hectares). The majority of this land is disturbed with the exception of approximately 5 acres (2 hectares) that are currently wooded. Because previous archeological reviews did not reveal any identified sites where land disturbance would occur, impacts on cultural resources are unlikely. Although six archeological sites have been identified in the vicinity of the project boundary, none would be disturbed (DOE 2005d:13-14; SRARP 2006:10; Blunt 2010). There are several NRHP-eligible structures in K-Area, however, so proposed changes to the historic fabric of buildings and structures, or to any intact historically significant equipment, would be studied, discussed with the South Carolina SHPO, and avoided, mitigated, or minimized (DOE 2005a:16).

An additional activity planned under the PDC Option is construction of a 2-mile (3.2-kilometer) sanitary tie-in connecting K-Area to a lift station in C-Area. Although the exact route is undetermined at this time, it would likely use existing easements; thus, it is not expected to impact cultural resources. This would be verified prior to construction through the SRS site use process and, if necessary, cultural resource surveys would be conducted (Reddick 2010; SRARP 1989:App. C).

Impacts on cultural resources as a result of modifications to MFFF under the PF-4 and MFFF Option and H-Canyon/HB-Line and the K-Area Complex under the PF-4, H-Canyon/HB-Line, and MFFF Option would be the same as those under the Immobilization to DWPF Alternative (Section 4.1.7.6.2).

At LANL, impacts on cultural resources as a result of modifications to PF-4 under the PF-4, H-Canyon/HB-Line, and MFFF Option would be the same as those under the Immobilization to DWPF Alternative (Section 4.1.7.6.2).

Operations—Operation of facilities under this alternative would involve no land disturbance; therefore, no impacts on cultural resources are expected at SRS or LANL.

4.1.7.6.4 H-Canyon/HB-Line to DWPF Alternative

Facility construction and modification activities would be the same as those under the MOX Fuel Alternative in Section 4.1.7.6.3, except for the possible installation of a buried transfer line at the H-Area tank farm. This activity would occur in a previously disturbed area with no impacts expected on cultural resources. Impacts on cultural resources during construction and operations would thus be the same.

4.1.7.6.5 WIPP Alternative

Facility construction and modification activities at SRS would be the same as those under the MOX Fuel Alternative in Section 4.1.7.6.3, while at LANL, there could be modifications to existing or planned LANL facilities in TA-55 and TA-63 to enable preparation, characterization, and staging pit plutonium for potential WIPP disposal. No additional impacts on cultural resources would be expected at SRS during construction and operations, and only minimal additional impacts, if any, at LANL. At LANL, modifications in TA-55 would likely principally occur within PF-4 with impacts as described in Section 4.1.7.6.2, and modifications to the planned TRU Waste Facility in TA-63 would be within the facility boundary.

4.1.7.7 Infrastructure

Impacts on infrastructure requirements at SRS and LANL could occur principally as a result of construction of PDCF at F-Area, PDC at K-Area, and the K-Area immobilization capability at SRS, and modification of PF-4 at LANL. Ongoing construction of the MFFF and WSB is not considered in this *SPD Supplemental EIS* because impacts from this construction have been previously assessed. There would be no new construction at the principal SRS and LANL plutonium support facilities.

Table 4–34 summarizes the peak annual infrastructure requirements at SRS and LANL related to construction for the alternatives and pit disassembly and conversion options evaluated in this *SPD Supplemental EIS*.

Table 4–34 Comparison of Peak Annual Infrastructure Requirements During Construction [a, b]

Resource	*Pit Disassembly and Conversion Option*	*Alternative*				
		No Action	*Immobilization to DWPF*	*MOX Fuel*	*HC/HBL to DWPF*	*WIPP*
Electricity (megawatt-hours)	PDCF	15,000 (SRS)	24,000 (SRS)	15,000 (SRS)	15,000 (SRS)	15,000 (SRS)
	PDC	N/A	N/A	16,000 (SRS)	16,000 (SRS)	16,000 (SRS)
	PF-4 and MFFF [c]	N/A	9,000 (SRS) 80 (LANL)	minimal (SRS) 80 (LANL)	minimal (SRS) 80 (LANL)	minimal (SRS) 80 (LANL)
	PF-4, HC/HBL, and MFFF [d]	N/A	9,000 (SRS) 80 (LANL)	minimal (SRS) 80 (LANL)	minimal (SRS) 80 (LANL)	minimal (SRS) 80 (LANL)
Water (gallons)	PDCF	2,600,000 (SRS)	2,600,000 (SRS)	2,600,000 (SRS)	2,600,000 (SRS)	2,600,000 (SRS)
	PDC	N/A	N/A	1,100,000 (SRS)	1,100,000 (SRS)	1,100,000 (SRS)
	PF-4 and MFFF [c]	N/A	2,000 (SRS) 340,000 (LANL)	minimal (SRS) 340,000 (LANL)	minimal (SRS) 340,000 (LANL)	minimal (SRS) 340,000 (LANL)
	PF-4, HC/HBL, and MFFF [d]	N/A	2,000 (SRS) 340,000 (LANL)	minimal (SRS) 340,000 (LANL)	minimal (SRS) 340,000 (LANL)	minimal (SRS) 340,000 (LANL)
Fuel oil (gallons)	PDCF	390,000 (SRS)	400,000 (SRS)	390,000 (SRS)	390,000 (SRS)	390,000 (SRS)
	PDC	N/A	N/A	300,000 (SRS)	300,000 (SRS)	300,000 (SRS)
	PF-4 and MFFF [c]	N/A	5,000 (SRS) 2,800 (LANL)	minimal (SRS) 2,800 (LANL)	minimal (SRS) 2,800 (LANL)	minimal (SRS) 2,800 (LANL)
	PF-4, HC/HBL, and MFFF [d]	N/A	5,000 (SRS) 2,800 (LANL)	minimal (SRS) 2,800 (LANL)	minimal (SRS) 2,800 (LANL)	minimal (SRS) 2,800 (LANL)

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; N/A = not applicable; PDC = Pit Disassembly and Conversion Project; PDCF = Pit Disassembly and Conversion Facility; PF-4 = Plutonium Facility; SRS = Savannah River Site; WIPP = Waste Isolation Pilot Plant.

[a] As described in Appendix F, modification of H-Canyon/HB-Line and the addition of metal oxidation furnaces to MFFF at SRS would result in the requirement for little or no electricity, water, or fuel oil, with minimal impacts on infrastructure at these sites. There would be no additional resource use at LANL for minor upgrades to PF-4 under the No Action Alternative and the PDCF and PDC Options under the action alternatives.

[b] As described in Appendix H, no new construction would be needed at any of the principal plutonium support facilities at SRS, with no impacts on infrastructure.

[c] Under this option, pits would be disassembled at PF-4 at LANL. Pits disassembled at LANL would be converted to plutonium oxide at LANL or at SRS using H-Canyon/HB-Line or metal oxidation furnaces installed in MFFF.

[d] Under this option, pits could be disassembled at PF-4 at LANL or at the K-Area Complex at SRS. Pits disassembled at PF-4 would be converted to plutonium oxide at LANL or SRS. Pits disassembled at the K-Area Complex would be converted to plutonium oxide at H-Canyon/HB-Line.

Note: Values are rounded to two significant figures. To convert gallons to liters, multiply by 3.7854.

Source: Appendix F, Section F.7.7; Appendix G, Section G.7.7.

Impacts also could occur because of changes in operational requirements at SRS and LANL. **Table 4–35** summarizes the peak annual infrastructure requirements at SRS and LANL related to operations.

Table 4–35 Comparison of Peak Annual Infrastructure Requirements During Operations

Resource	Pit Disassembly and Conversion Option	Alternative				
		No Action	Immobilization to DWPF	MOX Fuel	HC/HBL to DWPF	WIPP
Electricity (megawatt-hours)	PDCF	270,000 (SRS) 960 (LANL)	310,000 (SRS) 960 (LANL)	270,000 (SRS) 960 (LANL)	270,000 (SRS) 960 (LANL)	270,000 (SRS) 960 (LANL)
	PDC	N/A	N/A	220,000 (SRS) 960 (LANL)	220,000 (SRS) 960 (LANL)	220,000 (SRS) 960 (LANL)
	PF-4 and MFFF	N/A	220,000 (SRS) 1,900 (LANL)	170,000 (SRS) 1,900 (LANL)	170,000 (SRS) 1,900 (LANL)	170,000 (SRS) 1,900 (LANL)
	PF-4, HC/HBL, and MFFF	N/A	220,000 (SRS) 1,900 (LANL)	170,000 (SRS) 1,900 (LANL)	170,000 (SRS) 1,900 (LANL)	170,000 (SRS) 1,900 (LANL)
Water (gallons)	PDCF	41,000,000 (SRS) 820,000 (LANL)	57,000,000 (SRS) 820,000 (LANL)	41,000,000 (SRS) 820,000 (LANL)	41,000,000 (SRS) 820,000 (LANL)	41,000,000 (SRS) 820,000 (LANL)
	PDC	N/A	N/A	41,000,000 (SRS) 820,000 (LANL)	41,000,000 (SRS) 820,000 (LANL)	41,000,000 (SRS) 820,000 (LANL)
	PF-4 and MFFF	N/A	41,000,000 (SRS) 2,700,000 (LANL)	25,000,000 (SRS) 2,700,000 (LANL)	25,000,000 (SRS) 2,700,000 (LANL)	25,000,000 (SRS) 2,700,000 (LANL)
	PF-4, HC/HBL, and MFFF	N/A	41,000,000 (SRS) 2,700,000 (LANL)	25,000,000 (SRS) 2,700,000 (LANL)	25,000,000 (SRS) 2,700,000 (LANL)	25,000,000 (SRS) 2,700,000 (LANL)
Fuel oil (gallons) [a]	PDCF	320,000 (SRS)	340,000 (SRS)	320,000 (SRS)	320,000 (SRS)	320,000 (SRS)
	PDC	N/A	N/A	460,000 (SRS)	460,000 (SRS)	460,000 (SRS)
	PF-4 and MFFF	N/A	300,000 (SRS)	280,000 (SRS)	280,000 (SRS)	280,000 (SRS)
	PF-4, HC/HBL, and MFFF	N/A	300,000 (SRS)	280,000 (SRS)	280,000 (SRS)	280,000 (SRS)

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; N/A = not applicable; PDC = Pit Disassembly and Conversion Project; PDCF = Pit Disassembly and Conversion Facility; PF-4 = Plutonium Facility; SRS = Savannah River Site; WIPP = Waste Isolation Pilot Plant.

[a] Values are for SRS only. Under any option, no additional fuel oil would be required at LANL to support PF-4 operations because these requirements are connected with the testing of diesel generators in TA-55 and these requirements would not change as a result of additional pit disassembly and conversion activities. This is expected to still be the case if surplus pit plutonium was prepared at LANL for potential WIPP disposal under the WIPP Alternative.

Note: Values are rounded to two significant figures. To convert gallons to liters, multiply by 0.2642.

Source: Appendix F, Section F.7.7; Appendix G, Section G.7.7; Appendix H, Sections H.1.7.3 and H.2.

4.1.7.7.1 No Action Alternative

Construction—As described in Appendix F, construction of PDCF at F-Area at SRS would require the use of additional electricity, water, and fuel oil.

As shown in Table 4–34, an annual estimated 15,000 megawatt-hours of electricity, 2.6 million gallons (9.8 million liters) of water, and 390,000 gallons (1.5 million liters) of fuel oil would be required to support construction under this alternative. These requirements would represent less than 1 percent of SRS's available electrical capacity (4.1 million megawatt-hours) and available water capacity (2.63 billion gallons [9.96 billion liters]) (see Chapter 3, Section 3.1.9). Fuel oil usage is not limited by site capacity because fuel oil is delivered to the site as needed. However, these construction requirements would represent approximately 95 percent of SRS's current annual fuel usage (about 410,000 gallons [1.6 million liters] per year).

Operations—Continued storage of surplus plutonium at the K-Area Complex, and operation of PDCF at F-Area, MFFF at F-Area, and support facilities at SRS, would require an annual estimated 270,000 megawatt-hours of electricity, 41 million gallons (160 million liters) of water, and 320,000 gallons (1.2 million liters) of fuel oil, annually, as shown in Table 4–35. These requirements represent about 7 percent of SRS's available electrical capacity and 2 percent of the site's available water capacity. Fuel oil usage would represent approximately 78 percent of SRS's current annual fuel usage.

Pit disassembly and conversion at PF-4 would annually require about 960 megawatt-hours of electricity and 820,000 gallons (3,100,000 liters) of water. These requirements would each represent less than 1 percent of LANL's current annual available capacities of 352,000 megawatt-hours and 114 million gallons (432 million liters) (Chapter 3, Section 3.2.9). This is a very conservative comparison because the electrical capacity of the entire service area is much larger (1,226,000 megawatt-hours per year), as are DOE's leased water rights (542 million gallons [2.05 billion liters]). No additional fuel oil would be required at LANL to support PF-4 operations since these requirements are connected with the testing of emergency diesel generators in TA-55 and these requirements would not change as a result of pit disassembly and conversion activities. There would be no change in resource use at the principal LANL plutonium support facilities.

4.1.7.7.2 Immobilization to DWPF Alternative

Construction—Construction of PDCF at F-Area and the K-Area immobilization capability at SRS would require the use of additional electricity, water, and fuel oil. In addition to the option of building a new PDCF, options are being considered for pit disassembly and conversion whereby existing facilities at LANL (PF-4) and SRS (the K-Area Complex, H-Canyon/HB-Line, and the addition of metal oxidation furnaces to MFFF) would be modified to support pit disassembly and conversion activities. These options are expected to result in lower construction requirements compared to those required to support construction of PDCF (see Appendix F).

As shown in Table 4–34, an estimated 9,000 to 24,000 megawatt-hours of electricity, 2,000 to 2.6 million gallons (7,600 to 9.8 million liters) of water, and 5,000 to 400,000 gallons (19,000 to 1.5 million liters) of fuel oil would be required annually to support construction under this alternative at SRS. Under any of the pit disassembly and conversion options, these requirements represent less than 1 percent of SRS's available electrical and water capacity. Fuel oil construction requirements would represent approximately 1 percent (for modifying existing facilities) to 98 percent (for building new facilities) of SRS's current annual fuel usage.

As shown in Table 4–34, minimal electricity, 340,000 gallons (1.3 million liters) of water, and 2,800 gallons (11,000 liters) of fuel oil would be required annually to support modifications at LANL under two of the pit disassembly and conversion options. These optional requirements would represent less than 1 percent of LANL's available electrical and water capacity. Fuel oil construction requirements would be minimal.

Operations—Immobilization of surplus plutonium, and operation of pit disassembly and conversion and MFFF activities, and support facilities at SRS would annually require 220,000 to 310,000 megawatt-hours of electricity, 41 million to 57 million gallons (160 million to 220 million liters) of water, and 300,000 to 340,000 gallons (1.1 million to 1.3 million liters) of fuel oil, annually, as shown in Table 4–35. These requirements represent 5 to 8 percent of SRS's available electrical capacity and about 2 percent of the site's available water capacity. Fuel oil usage would represent approximately 73 to 83 percent of SRS's current annual fuel usage.

Operation of pit disassembly and conversion activities at PF-4 at LANL would annually require 960 to 1,900 megawatt-hours of electricity, and 820,000 to 2,700,000 gallons (3.1 million to 10 million liters) of water, as shown in Table 4–35. No additional fuel oil would be required under any option. These requirements would represent 0.3 to 0.5 percent of LANL's available electrical capacity and 0.7 to 2 percent of LANL's available water capacity (conservative comparisons as discussed for the No Action Alternative [Section 4.1.7.7.1]).

4.1.7.7.3 MOX Fuel Alternative

Construction—Construction of PDCF at F-Area at SRS would require the use of additional electricity, water, and fuel oil similar to that under the No Action Alternative (Section 4.1.7.7.1). In addition to the option of building a new PDCF, options are considered for pit disassembly and conversion whereby a new PDC would be constructed in K-Area or existing facilities at LANL and SRS would be modified to support pit disassembly and conversion activities. Similar to the Immobilization to DWPF Alternative (Section 4.1.7.7.2), these options are expected to result in lower construction requirements compared to those required to support construction of PDCF at F-Area (see Appendix F).

As shown in Table 4–34, minimal to 16,000 megawatt-hours of electricity, minimal to 2.6 million gallons (9.8 million liters) of water, and minimal to 390,000 gallons (1.5 million liters) of fuel oil would be required to support construction under this alternative at SRS. Modifications to the K-Area Complex, H-Canyon/HB-Line, and MFFF to support pit disassembly and conversion activities are expected to result in minimal additional infrastructure requirements and to fall within SRS's current infrastructure requirements. Under any of the options being analyzed, these requirements represent less than 1 percent of SRS's available electrical and water capacity. Construction fuel oil requirements would represent less than 1 percent (for modifying existing facilities) to 95 percent (for building PDCF) of SRS's current annual fuel usage.

As shown in Table 4–34, the construction-related infrastructure requirements at LANL related to optional modifications at PF-4 to support proposed pit disassembly and conversion activities would be the same as those under the Immobilization to DWPF Alternative.

Operations—Operation of pit disassembly and conversion and MFFF activities, and support facilities at SRS would require 170,000 to 270,000 megawatt-hours of electricity, 25 million to 41 million gallons (95 million to 160 million liters) of water, and 280,000 to 460,000 gallons (1.1 million to 1.7 million liters) of fuel oil, annually, as shown in Table 4–35. These requirements represent 4 to 7 percent of SRS's available electrical capacity and 1 to 2 percent of the site's available water capacity. Fuel oil usage would represent approximately 68 to 110 percent of SRS's current annual fuel usage.

Pit disassembly and conversion activities in PF-4 at LANL under the MOX Fuel Alternative would require the same levels of infrastructure support as those under the Immobilization to DWPF Alternative.

4.1.7.7.4 H-Canyon/HB-Line to DWPF Alternative

Construction—Construction-related annual infrastructure requirements at SRS or LANL in support of the H-Canyon/HB-Line to DWPF Alternative would be the same as those under the MOX Fuel Alternative (see Table 4–34).

Operations—Operations-related annual infrastructure requirements at SRS or LANL in support of the H-Canyon/HB-Line to DWPF Alternative would be the same as those under the MOX Fuel Alternative (see Table 4–35).

4.1.7.7.5 WIPP Alternative

Construction—Construction-related annual infrastructure requirements at SRS or LANL in support of the WIPP Alternative would be essentially the same as those under the MOX Fuel Alternative (see Table 4–34). At LANL, modifications to TA-55 and TA-63 facilities to enhance LANL's capability for preparation of surplus plutonium for potential WIPP disposal could require additional construction employment (see Section 4.1.3.1.5), with additional water use associated with the additional personnel as well as an additional requirement for other infrastructure resources such as electricity. This additional annual infrastructure requirement is expected to be small and within LANL's existing capacity.

Operations—Operations-related annual infrastructure requirements at SRS in support of the WIPP Alternative would be substantially the same as those under the MOX Fuel Alternative (see Table 4–35). To the extent under the PF-4 and MFFF and PF-4, H-Canyon/HB-Line, and MFFF Options that pit plutonium was prepared at LANL for potential WIPP disposal, there could be an increased annual requirement for water at LANL associated with the possible employment of additional workers, plus an increased annual requirement for other infrastructure resources such as electricity. This additional annual infrastructure requirement is expected to be within LANL's existing capacity.

4.2 Incremental Impacts of Processing Additional Surplus Plutonium

In addition to the amounts of plutonium analyzed for disposition in this *SPD Supplemental EIS* and other NEPA documents, DOE may, in the future, identify additional quantities of surplus plutonium that could be processed for disposition through the facilities and capabilities analyzed herein.[12] This section describes the potential impacts of processing such quantities of surplus plutonium. Any need for further NEPA analysis related to the potential impacts of handling, transporting, or processing specific quantities of such additional plutonium would be addressed as part of, and at the time of, the planning process for its disposition.

For most resource areas, this chapter presents the maximum annual impacts from construction and operation of the plutonium facilities. The analyses in this *SPD Supplemental EIS* are based on a conservative set of assumptions and estimates under which the plutonium facilities described for each of the alternatives and options would each operate for a given number of years to process a given quantity of surplus plutonium. The maximum lifespan of operations for the plutonium disposition facilities, as considered in this *SPD Supplemental EIS*, is listed for each alternative in Appendix B, Table B–2. The actual operating period for each facility would depend on the particular mix of facilities used for plutonium processing, and their throughputs. If a future decision is made, pursuant to an appropriate disposition planning process, to address additional surplus plutonium, then some plutonium disposition facilities could be required to operate for longer periods of time than those analyzed in this *SPD Supplemental EIS*. Processing additional surplus plutonium would not change the maximum annual impacts of operations, but would extend the impacts described in this *SPD Supplemental EIS* for affected facilities further out in time. The contributions attributable to those facilities to total cumulative life-cycle impacts, such as those for total worker and population dose and LCFs, and total waste generation, would increase in proportion to the extended processing time. These impacts can be estimated from the analyses provided for facility operations by adding additional years of operation.

4.3 Incremental Impacts of Processing Plutonium at Reduced Rates or of Constructing and Operating Smaller Surplus Plutonium Disposition Facilities

As noted in Section 4.2, the plutonium facilities addressed under each of the alternatives and options for this *SPD Supplemental EIS* are each assumed to operate for a given number of years to address a given quantity of surplus plutonium. The operating periods of the plutonium facilities, however, could be extended if: (1) surplus plutonium were processed at reduced rates at the facilities, or (2) smaller facilities with reduced throughput capabilities were constructed.

For the first case, the same facility construction impacts would occur as those described in the other sections of this chapter. For a given total quantity of processed plutonium, however, annual operational impacts would be comparable to or smaller than those described in Section 4.1. For example, if the plutonium throughput for MFFF were smaller than the annual quantities assumed for the alternatives addressed in this *SPD Supplemental EIS*, then the annual operational impacts would be comparable to or smaller than those described, although MFFF would operate longer to process the same total quantity of plutonium. Facilities such as WSB that support MFFF operations would also operate longer.

Impacts on some resource areas would occur only during plutonium processing. For these resource areas, the annual impacts could be reduced if the plutonium were processed at a reduced rate, but the total impacts for processing a given quantity of surplus plutonium would not change if the processing schedule were extended. This includes impacts from hazardous and radioactive waste management, human health

[12] *For example, future sources of additional surplus plutonium could include additional future plutonium quantities recovered from foreign locations through NNSA's Global Threat Reduction Initiative or future additional quantities of plutonium from the defense stockpile declared to be excess to U.S. defense needs. 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. Although DOE no longer has a programmatic use for most of 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. The ZPPR material is not included in the scope of the present analyses for surplus plutonium.*

risk, facility accidents during plutonium processing, impacts from waste transportation, and environmental justice. For example, if the plutonium processing rate at MFFF were slowed and the processing period extended by 1 year, the total doses and LCFs for workers and the public from facility operation would remain unchanged, even though the annual doses and LCFs would decrease.

Impacts on some resource areas would occur but would be less strongly linked to plutonium processing throughput – that is, some level of impacts would occur whenever a facility is operational, although the impacts could be somewhat reduced if the rate of plutonium processing were reduced. These impacts include those on air quality for criteria pollutants, solid nonhazardous waste management, socioeconomics, facility accidents not associated with plutonium processing, transportation impacts from employee trips, and infrastructure. For example, some air quality impacts from criteria pollutant emissions associated with building heating would continue as long as a facility is operational. Likewise, impacts from nonhazardous solid waste management and impacts on infrastructure would occur to some extent as long as personnel continue to use utilities (e.g., electricity, fuel for heating, and potable water) and generate solid nonhazardous waste. Extending operations by 1 year would conservatively mean that these types of impacts would continue up to the levels described in this chapter for 1 year longer.

For the second case, in which smaller surplus plutonium facilities would be constructed having reduced plutonium throughputs, construction and annual operational impacts would both be generally reduced compared to those impacts described in Section 4.1. But because the plutonium processing throughput of the facilities would be reduced, their operating periods would be extended to process the same amount of surplus plutonium. This would apply to all plutonium facilities under consideration in this *SPD Supplemental EIS*. For example, a reduced pit disassembly and conversion capability could be implemented that would process surplus plutonium pits at a lower throughput than the full capability evaluated in this chapter.

Construction impacts would be reduced if smaller facilities were constructed. There would be less land disturbance and, therefore, less potential for impacts on air quality, land resources, geology and soils, water resources, noise, ecological resources, and cultural resources; less construction employment; less construction waste generation; fewer construction resources needed; and smaller impacts from transportation of waste and construction materials. The reduction in impacts would be generally proportional to the reduction in the amount of land disturbed, reduction in the amounts of construction materials and resources needed, and reduction in construction employment. Also, the time required for construction might be reduced, and the facilities could start operations at an earlier date.

Annual operations impacts would be reduced if smaller facilities were operated. Although the annual impacts would be reduced (e.g., less annual generation of waste or smaller radioactive air emissions), the total impacts of processing the same amount of surplus plutonium would likely be similar. For example, although the annual doses to workers would be reduced, assuming a lower plutonium throughput in a smaller facility, the total dose to the worker population for the entire campaign is likely to be similar to the total dose from processing the same quantity of plutonium at a higher throughput.

The impacts on some resource areas could depend on the revised facility design. For example, although it is expected that the design of a reduced pit disassembly and conversion capability would incorporate HEPA filtration of process exhaust gases, a revised design may or may not incorporate the use of a sand filter. The small annual emissions using both HEPA and sand filters could increase if only HEPA filters were used. In addition, a sand filter would be more robust in the event of some potential accident scenarios.

4.4 Avoided Environmental Impacts Associated with Using MOX Fuel from Surplus Plutonium in Commercial Nuclear Power Reactors Versus LEU Fuel

As discussed in Chapter 4, Section 4.28.3, of the *SPD EIS* (DOE 1999b), using MOX fuel in commercial nuclear power reactors would preclude that part of the nuclear fuel cycle for the LEU that would be displaced by plutonium as the fissile material needed to maintain a nuclear reaction. The nuclear fuel cycle includes mining, possibly milling,[13] converting, and enriching uranium.

Typical uranium enrichment for unirradiated light-water reactor fuel is between 4.0 and 4.5 percent uranium-235. To create 1 metric ton (1.1 tons) of enriched uranium at these enrichment levels, it is necessary to mine 9 to 10 metric tons (10 to 11 tons) of natural uranium, depending on the enrichment level sought. (The higher the enrichment level, the more natural uranium is required.) The use of 45.1 metric tons (49.7 tons) of plutonium in MOX fuel as analyzed for the MOX Fuel Alternative of this *SPD Supplemental EIS* would displace 1,000 to 1,125 metric tons (1,102 to 1,240 tons) of LEU fuel at the same enrichment levels. Therefore, use of MOX fuel as analyzed in this *SPD Supplemental EIS* could eliminate the need to mine and enrich 10,000 to 10,125 metric tons (11,023 to 11,161 tons) of natural uranium.

The mining and enrichment of uranium results in increased radiological emissions to workers and the public. Although increased radiological emissions would also be associated with the fabrication of MOX fuel, these emissions are expected to be lower than those associated with creating LEU fuel. About 0.25 LCFs are expected among the public living within 80 kilometers (50 miles) of the uranium mining, conversion, and enrichment facilities involved with the uranium fuel cycle over a 10-year operating period; 0.0085 LCFs could be associated with normal operation of the facilities needed to produce MOX fuel for a comparable period. A similar reduction is expected in adverse impacts on involved workers. The expected LCFs for involved uranium workers would range between 8.3 and 9.4 over a 10-year operating period, versus 1.5 for involved workers at the facilities needed to produce MOX fuel over the same period.[14]

As discussed in Chapter 4, Section 4.28.3, of the *SPD EIS* (DOE 1999b), energy would be needed to support the processing and enrichment of a quantity of LEU equivalent to the MOX fuel produced each year at MFFF. As indicated in Section 4.1.7.7.3, the facilities needed to produce MOX fuel under the MOX Fuel Alternative would annually require approximately 170,000 to 270,000 megawatt-hours of electricity. The output of MFFF in this *SPD Supplemental EIS* is estimated to be 73 to 83 metric tons per year (80 to 91 tons per year) of MOX fuel. To produce an equivalent amount of LEU using gaseous diffusion technology, it is estimated that the uranium fuel cycle would require approximately 893,000 megawatt-hours per year of electricity.[15] Considerably less electricity (as much as 50 times less electricity, or about 18,000 megawatt-hours per year) would be annually needed to produce an equivalent amount of LEU using centrifuge or other modern uranium enrichment technologies, which are currently replacing the remaining operating gaseous diffusion plants.

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[13] *Milling refers to the step where uranium ore is processed to concentrate the uranium in a powder form. Uranium mills are used during conventional mining operations. Nearly all of the uranium produced in the United States is now produced through in situ processes whereby uranium is dissolved underground and pumped to the surface in a slurry that is separated to concentrate the uranium. This process does not require the use of a mill.*

[14] *Estimates of LCFs and other environmental impacts presented in this section for uranium mining, conversion, and enrichment facilities are based on information contained in the* Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement *(DOE 1996a:4-142–4-146). The impacts presented in that EIS were based on an annual production rate of 150 metric tons (165 tons) of enriched uranium and an estimated production rate at a proposed MOX facility of 73 to 83 metric tons per year (80 to 91 tons per year) of MOX fuel, with both types of fuel at an enrichment value of 4.0 to 4.5 percent. Accordingly, the impacts have been factored by a ratio of 73/150 to 83/150 to support a consistent comparison with expected MFFF throughputs.*

[15] *The figures in 10 CFR Part 51, Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions, Table S–3, are based on the production of about 30 metric tons per year (33 tons per year) of LEU fuel, assuming the use of gaseous diffusion for enrichment. MFFF is expected to produce 73 to 83 metric tons per year (80 to 91 tons per year) of MOX fuel.*

Ambient air quality is affected by emissions of chemical pollutants from the uranium fuel cycle. These pollutants are released during uranium processing and also from fossil fuel plants used to supply electricity for uranium enrichment. It is estimated that LEU processing and enrichment using gaseous diffusion technology would result in the release of an estimated 720 to 820 metric tons (790 to 900 tons) of carbon monoxide over 10 years (DOE 1999b) as opposed to operation of the facilities needed to produce MOX fuel at SRS, which are estimated to produce approximately 35 metric tons (38.6 tons) of carbon monoxide (NRC 2005a) over the same time period. Similarly, nitrogen dioxide emissions would decrease from between 29,000 and 33,000 metric tons (32,000 and 36,000 tons) over 10 years to approximately 430 metric tons (470 tons); sulfur dioxide emissions, from between 110,000 and 120,000 metric tons (120,000 and 130,000 tons) to approximately 16 metric tons (18 tons); and particulate matter, from between 28,000 and 32,000 metric tons (31,000 to 35,000 tons) to approximately 13 metric tons (14 tons) (DOE 1999b; NRC 2005a). But as noted above, electricity requirements assuming use of modern uranium enrichment technologies to produce LEU fuel would be much smaller than those assuming use of gaseous diffusion technology, with resulting reductions in emissions from fossil fuel plants assumed to generate this electricity.

4.5 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 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 no matter what entity (Federal, non-Federal, or private) is taking the actions (EPA 1999).

Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time. Cumulative effects can also result from spatial (geographic) and/or temporal (time) crowding of environmental perturbations (i.e., concurrent human activities and the resulting impacts on the environment are additive if there is insufficient time for the environment to recover).

The impacts of continued storage of surplus plutonium pits in existing facilities at Pantex would be small, as evaluated in the *Final Supplement Analysis for the Final Environmental Impact Statement for Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components* (DOE 2012i), and briefly described in Appendix A, Section A.2.1. Because the cumulative impacts of continued storage of surplus plutonium pits at Pantex are evaluated and accounted for in existing NEPA documents, they are not discussed further in this section.

The use of partial MOX fuel cores, as opposed to LEU fuel cores, would not result in any meaningful changes to the environmental impacts of commercial nuclear power plant operation (see Section 4.1 and Appendix I of this *SPD Supplemental EIS*). Thus, the use of MOX fuel would not change the cumulative impacts in the vicinity of the nuclear power reactors.

4.5.1 Methodology and Assumptions

In general, the following approach was used to estimate cumulative impacts for this *SPD Supplemental EIS*:

- The ROIs for impacts associated with the alternatives analyzed in this *SPD Supplemental EIS* were defined. These ROIs are described in Chapter 3, Table 3–1.
- The affected environment and baseline conditions were identified. Most of this information was taken from Chapter 3, Affected Environment, of this *SPD Supplemental EIS*.
- Past, present, and reasonably foreseeable actions and the effects of those actions were identified.
- Aggregate (additive) effects of past, present, and reasonably foreseeable actions were assessed.

Cumulative impacts were assessed by combining the effects of *SPD Supplemental EIS* alternative activities with the effects of other past, present, and reasonably foreseeable actions in the ROI. Many of these actions occur at different times and locations and may not be truly additive. For example, actions affecting air quality occur at different times and locations across the ROI; therefore, it is unlikely that the impacts would be completely additive. The effects were combined irrespective of the time and location of the impact, to envelop any uncertainties in the projected activities and their effects. This approach produces a conservative estimation of cumulative impacts for the activities considered.

4.5.2 Reasonably Foreseeable Actions

In addition to the alternatives evaluated in this *SPD Supplemental EIS*, actions that may contribute to cumulative impacts at SRS and LANL include onsite and offsite projects conducted by Federal, state, and local governments; the private sector; or individuals that are within the ROIs of the actions considered in this *SPD Supplemental EIS*. Information on present and future actions was obtained from a review of site-specific actions and NEPA documents to determine if current or proposed projects could affect the cumulative impacts analysis at the potentially affected sites. For those actions that are speculative, are not yet well defined, or are expected to have a negligible contribution to cumulative impacts, the actions are described but not included in the determination of cumulative effects. The potentially cumulative actions discussed here are the major projects that may contribute to cumulative impacts on or in the vicinity of the potentially affected sites.

4.5.2.1 U.S. Department of Energy Actions

4.5.2.1.1 Savannah River Site

Because the analysis presented earlier in this chapter includes an evaluation of the operational impacts for both MFFF and WSB, they are generally not addressed under cumulative impacts. Likewise, because construction of these facilities is under way, waste generated from construction activities is included in the baseline for existing SRS activities and is not addressed separately in this section.

Savannah River Site Salt Processing Alternatives Final Supplemental Environmental Impact Statement (Salt Processing EIS) (DOE/EIS-0082-S2) (DOE 2001). A process to separate the high-activity and low-activity waste fractions in HLW solutions is planned to replace the in-tank precipitation process evaluated in the *Defense Waste Processing Facility Supplemental Environmental Impact Statement* (DOE 1994). The *Salt Processing EIS* evaluates four alternatives: (1) small tank precipitation; (2) ion exchange; (3) solvent extraction; and (4) direct disposal in grout. The cumulative impacts analysis in this *SPD Supplemental EIS* includes the maximum impacts of the solvent extraction process, as selected in the DOE Record of Decision (ROD) for the *Salt Processing EIS* (66 FR 52752). On January 24, 2006, DOE issued a revised ROD (71 FR 3834) adopting an approach that implements interim salt processing until the solvent extraction process becomes operational.

Savannah River Site High-Level Waste Tank Closure Final Environmental Impact Statement (HLW EIS) (DOE/EIS-0303) (DOE 2002). DOE proposes to close the HLW tanks at F- and H-Areas at SRS in accordance with applicable laws and regulations, DOE orders and regulations, and the Industrial Wastewater Closure Plan for the F- and H-Area High-Level Waste Tank Systems (approved by SCDHEC), which specifies the management of residuals as waste incidental to reprocessing. The proposed action would begin after bulk waste removal has been completed. The *HLW EIS* evaluates three alternatives regarding the HLW tanks at SRS: (1) the Stabilize Tanks Alternative (referred to as the "Clean and Stabilize Tanks Alternative" in the Draft *HLW EIS*), (2) the Clean and Remove Tanks Alternative, and (3) the No Action Alternative. Under the Stabilize Tanks Alternative, the *HLW EIS* considers three options for tank stabilization: Fill with Grout (Preferred Alternative), Fill with Sand, and Fill with Saltstone. Under each alternative (except No Action), DOE would close 49 HLW tanks and associated waste-handling equipment, including evaporators, pumps, diversion boxes, and transfer lines. In the ROD issued on August 19, 2002 (67 FR 53784), DOE selected the Preferred Alternative identified in the *HLW EIS*, Stabilize Tanks—Fill with Grout.

In a 2012 supplement analysis, DOE addressed the potential environmental impacts from using additional tank cleaning technologies than those specifically analyzed in the *HLW EIS*, and from performing an evaluation using criteria specified in Section 3116(a) of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (Public Law 108-375) rather than the waste incidental to reprocessing criteria specified in DOE Manual 435.1-1, *Radioactive Waste Management*. DOE determined that these proposed actions did not constitute substantial changes from those evaluated in the *HLW EIS*, and that no significant new information was identified that would affect the basis for its original decision as documented in the ROD (DOE 2012c:14). In April 2012, after completion of cleaning operations for Tanks 18 and 19 in F-Area, DOE began filling these tanks with grout (DOE 2012d). Both were operationally closed in September 2012 (Key 2012).

In an August 2014 supplement analysis, DOE proposed to make certain changes to the tank closure processes as evaluated in the *HLW EIS* (DOE 2002) and the 2012 supplement analysis (DOE 2012d). These changes involved projects and technical proposals that had been modified or suspended, new processes that had been developed, and new performance assessments for the F- and H-Area tank farms. DOE determined that the proposed actions did not constitute substantial changes from those evaluated in the *HLW EIS*, and that there were no significant new circumstances or information relevant to environmental concerns bearing on the proposed actions (DOE 2014).

Environmental Assessment for Biomass Cogeneration and Heating Facilities at the Savannah River Site (DOE/EA-1605) (DOE 2008e). The proposed action analyzed in this environmental assessment is the construction and operation of new biomass cogeneration and heating facilities at SRS. The facilities would consist of: a new biomass cogeneration facility to replace the existing coal-fired D-Area powerhouse, and two new biomass heating plants at K- and L-Areas to replace the existing oil-fired K-Area Complex steam plant. The proposed biomass cogeneration and heating facilities would supply energy to F-, H-, K-, L-, and S-Areas at SRS. The project would help SRS meet its energy requirements for an initial term of 21 years, with the potential for many years of continued operation after the initial term. These facilities are now operational and are included in the baseline air pollutant concentrations in Chapter 3, Section 3.1.4.

Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement (WIPP SEIS II) (DOE/EIS-0026-S-2) (DOE 1997b). In 1980, the original *Final Environmental Impact Statement, Waste Isolation Pilot Plant* (DOE/EIS-0026) was issued. Supplemental environmental impact statements were issued in 1990 and in 1997. In addition, several supplement analyses have been issued. In a ROD issued in January 1998 (63 FR 3624), DOE decided to open WIPP for the disposal of CH-TRU and remote-handled transuranic (RH-TRU) waste. On June 30, 2004, DOE issued a revised ROD (69 FR 39456) to allow for shipments of polychlorinated biphenyl-contaminated TRU waste to WIPP from various DOE locations, including SRS.

Draft Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste (Draft GTCC EIS) (DOE/EIS-0375-D) (DOE 2011a). In February 2011, DOE issued the *Draft GTCC EIS* to evaluate the potential environmental impacts associated with the proposed development, operation, and long-term management of a facility or facilities for disposal of greater-than-Class C (GTCC) LLW and DOE GTCC-like waste. GTCC LLW has radionuclide concentrations exceeding the limits for Class C LLW established by NRC in 10 CFR Part 61. The *Draft GTCC EIS* also considers DOE waste having similar characteristics. Currently, there is no location for disposal of GTCC LLW and the Federal government is responsible for such disposal under the Low-Level Radioactive Waste Policy Amendments Act of 1985 (Public Law 99-240). DOE is preparing this *GTCC EIS* pursuant to Section 631 of the Energy Policy Act of 2005, which requires DOE to submit a report to Congress on disposal alternatives under consideration and await Congressional action before issuing a ROD. SRS is one of the six candidate DOE sites being considered for GTCC LLW disposal in the *Draft GTCC EIS*, which also include Hanford, Idaho National Laboratory, LANL, Nevada National Security Site, and WIPP. DOE is also considering two disposal locations in the WIPP vicinity and generic commercial sites in four regions of the country. DOE is evaluating several disposal technologies in the *Draft GTCC EIS*, including a geologic repository, intermediate depth boreholes, enhanced near-surface trenches, and above-grade vaults. Enhanced near-surface trenches and above-grade vaults are considered at SRS. Prior to implementation of any alternative examined in the *Draft GTCC EIS*, follow-on site specific NEPA review would be conducted as appropriate, to identify the location or locations within a given site for a geologic repository, intermediate depth borehole, trench, or vault facility for the disposal of GTCC LLW and GTCC-like wastes.

Final Complex Transformation Supplemental Programmatic Environmental Impact Statement (Complex Transformation SPEIS) (DOE/EIS-0236-S4) (DOE 2008j). On October 24, 2008, NNSA announced the availability of the *Complex Transformation SPEIS*, which analyzes the environmental impacts from the continued transformation of the U.S. nuclear weapons complex over the next 10 to 20 years. NNSA's proposed action is to continue currently planned modernization activities: (1) selection of a site to consolidate plutonium research and development, surveillance, and pit manufacturing; (2) selection of a site to consolidate special nuclear material throughout the complex; (3) selection of a site to consolidate, relocate, or eliminate duplicative facilities and programs and improve operating efficiencies; (4) identification of one or more sites for conducting NNSA flight test operations; and (5) acceleration of nuclear weapons dismantlement activities. SRS was assessed as a potential location for a consolidated nuclear production center, which entails consolidation of special nuclear material storage and production of 125 pits, with a potential surge capacity of 200 pits annually. On December 19, 2008 (73 FR 77644), the ROD was published selecting the preferred alternative, which did not include placing new facilities at SRS. Thus, there would be no cumulative impacts at SRS resulting from decisions made relative to the *Complex Transformation SPEIS*.

Final Long-Term Management and Storage of Elemental Mercury Environmental Impact Statement (Mercury Storage EIS) (DOE/EIS-0423) (DOE 2011k). The proposed action analyzed in this EIS is the long-term storage of up to 10,000 metric tons (11,000 tons) of elemental mercury within either existing or new facilities at one of seven sites throughout the United States, including SRS. At SRS, a new facility was proposed that would occupy 7.6 acres (3.1 hectares) of the approximately 330-acre (134-hectare) E-Area. The preferred alternative in the *Mercury Storage EIS* was the construction of a new facility at the Waste Control Specialists, LLC, site located near Andrews, Texas; implementing this alternative would result in no cumulative impacts at SRS. However, since publication of the *Mercury Storage EIS*, DOE has reconsidered the range of alternatives and has issued a *Final Long-Term Management and Storage of Elemental Mercury Supplemental Environmental Impact Statement* (*Final Mercury Storage Supplemental EIS*) (DOE/EIS-0423-S1) to consider three additional locations at or near WIPP (DOE 2013f); the preferred alternative is unchanged.

Environmental Assessment for the Proposed Use of the Savannah River Site Lands for Military Training (DOE/EA-1606) (DOE 2011i). DOE prepared this environmental assessment to evaluate potential environmental impacts regarding the use of SRS by the U.S. Departments of Defense and Homeland Security (DOD and DHS, respectively) for military training purposes. Alternatives considered are No Action (i.e., SRS would not be used for military training) and the proposed action (i.e., use of a specific area of SRS for non-live-fire tactical maneuver training). The purpose of the proposed action is to enable DOD and DHS to conduct low intensity, non-live-fire tactical maneuver training activities on SRS to support current and future mission requirements. Based on the analyses in the environmental assessment, DOE determined that the proposed action is not a major Federal action significantly affecting the quality of the human environment within the meaning of NEPA. Therefore, the preparation of an EIS is not required and DOE issued a Finding of No Significant Impact (DOE 2011h).

Supplement Analysis, Transportation of Depleted Uranium Hexafluoride for Conversion to Depleted Uranium Oxide (DOE-EIS-0283-SA-03) (DOE 2012g). This analysis addressed a revised transportation route and site for the conversion of depleted uranium hexafluoride to depleted uranium oxide for eventual use in the MFFF. The new conversion site is located in Richland, Washington, rather than Wilmington, North Carolina. The analysis concluded that, although the transportation route is longer than initially analyzed, the impacts are very small with no latent cancer fatalities or non-radiological accident fatalities expected. DOE determined that there were no new circumstances or information relevant to environmental concerns that bear on the proposed action or its impacts that would warrant additional NEPA analysis. The impacts presented in this supplement analysis are included in the transportation analysis performed for this *SPD Supplemental EIS*, and therefore, are not considered additional cumulative impacts.

Supplement Analysis, Savannah River Site Spent Nuclear Fuel Management Environmental Impact Statement (SRS SNF Management EIS) (DOE/EIS-0279-SA-01) (DOE 2013e). In this supplement analysis, DOE evaluated the impacts of managing a limited quantity of spent (used) nuclear fuel using Conventional Processing rather than Melt and Dilute technology. In addition, DOE evaluated the receipt and processing of HEU target residues from the Chalk River Laboratories in Canada. DOE concluded that the impacts of these actions were addressed in the *SRS SNF Management EIS*. H-Canyon operations are included in the baseline impacts of ongoing SRS operations. Therefore, this activity would not substantially contribute to increased cumulative impacts at SRS.

Other. Memoranda of understanding between several vendors and the Savannah River National Laboratory were signed in 2010 and 2011. The companies agreed to explore opportunities to work on expedited development and deployment of small modular nuclear reactors at SRS. This activity has not advanced to selection of sites for the facilities, nor is information available on the design or potential environmental impacts of such reactors; thus, these proposals are not ripe for NEPA analysis and are not addressed further in this cumulative impacts section.

4.5.2.1.2 Los Alamos National Laboratory

Final Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico (LANL SWEIS) (DOE/EIS-0380) (DOE 2008f). In the *LANL SWEIS*, NNSA assessed three alternatives for the continued operation of LANL: (1) No Action, (2) Reduced Operations, and (3) Expanded Operations. NNSA decided in the ROD (73 FR 55833) to continue to implement the No Action Alternative – that is, to continue historical mission support activities at currently approved operational levels, with the addition of some elements of the Expanded Operations Alternative. These elements include increases in operation of some existing facilities and new facility projects needed for ongoing programs and protection of workers and the environment. However, most missions would continue to be conducted at LANL at current levels. Additionally, the ROD determined that NNSA would continue to implement actions necessary to comply with the March 2005 Compliance Order on Consent, which requires investigation and remediation of environmental contamination at LANL. Also, NNSA would not change pit production at LANL at this time. One project analyzed in the *LANL SWEIS*, the Los Alamos Science and Engineering Complex, has been cancelled (LANL 2013a).

Chemistry and Metallurgy Research Building Replacement Project at Los Alamos National Laboratory, Los Alamos, New Mexico, Supplemental Analysis (CMRR SA) (DOE/EIS-0350-SA-2) (DOE 2015). In 2003, NNSA issued the *Final Environmental Impact Statement for the Chemistry and Metallurgy Research Building Replacement Project at Los Alamos National Laboratory, Los Alamos, New Mexico (CMRR EIS)* (DOE 2003c) to evaluate potential impacts of alternatives for providing mission-critical analytical chemistry and materials characterization capabilities for NNSA programs. In 2004, the ROD (69 *FR* 6967) was issued which called for the construction of a two-building, partially above-ground, Chemistry and Metallurgy Research Building Replacement (CMRR) Facility at TA-55. The first building, the Radiological Laboratory/Utility/Office Building (RLUOB), was completed; however, further seismic and safety studies indicated that the CMRR Nuclear Facility (CMRR-NF) required design changes. These changes, as well as additional ancillary support requirements, such as additional equipment storage areas, soil storage areas, additional transportation needs, and worker parking areas, were addressed in the *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 (CMRR-NF SEIS)* (DOE 2011g). The ROD for the *CMRR-NF SEIS* (76 FR 64344) selected the Modified CMRR-NF Alternative for constructing and operating the CMRR-NF portion of the CMRR Project, but delayed selection of the appropriate Excavation Option

(Shallow or Deep) for implementing the construction of this building until after initiating final design activities. Subsequently changes have been made to mission needs, expected PF-4 programs, and facility hazard category thresholds. Due to these changes, NNSA determined that it was now possible to provide CMRR analytical chemistry (AC) and materials characterization (MC) capabilities using a combination of space available in RLUOB and space to be made available at PF-4 (DOE 2015).

Final Complex Transformation Supplemental Programmatic Environmental Impact Statement (DOE/EIS-0236-S4) (DOE 2008j). See Section 4.5.2.1.1 for a general discussion of the *Complex Transformation SPEIS*. With respect to LANL, the ROD (73 FR 77644) determined that manufacturing and research and development involving plutonium would remain at LANL and, in order to support these activities, NNSA would construct and operate the CMRR–NF. As noted above, however, the CMRR-NF was not constructed and NNSA plans on providing the AC and MC capabilities using a combination of space available in RLUOB and space to be made available at PF-4 (DOE 2015).

Draft Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste (GTCC EIS) (DOE/EIS-0375-D) (DOE 2011a). See Section 4.5.2.1.1 for a general discussion of the *GTCC EIS*. LANL is one of six candidate DOE sites being considered for GTCC LLW disposal in the *Draft GTCC EIS*. Specifically, a site in TA-54 is under consideration for the following disposal technologies: intermediate depth boreholes, enhanced near-surface trenches, and above-grade vaults. The primary function of TA-54 is the management of radioactive and hazardous chemical wastes.

Final Environmental Assessment for the Expansion of the Sanitary Effluent Reclamation Facility and Environmental Restoration of Reach S-2 Sandia Canyon at Los Alamos National Laboratory, Los Alamos, New Mexico (SERF EA) (DOE/EA-1736) (DOE 2010e). With respect to the Sanitary Effluent Reclamation Facility (SERF), the environmental assessment assessed the goal of reclaiming, treating, and reusing cooling tower water. Alternatives addressed include No Action, Partial Reuse, and Total Reuse. Under the No Action Alternative, the existing SERF would be used to treat a limited amount of sanitary effluent for reuse without any structural enlargement or addition of extra equipment, storage tanks, or other pumps or piping structures. Under both the Partial Reuse and Total Reuse Alternatives, the goal would be to recycle up to 100 percent of SERF effluent and reduce potable water demand in TA-3 by 60 and 75 percent, respectively.

Additional DOE activities planned for, or occurring at, LANL include the following:

- *SOC Training Center* – DOE is constructing a new training campus for the SOC (the protective force at LANL). The project includes a Tactical Training Center, an indoor firing range, and an office building, all at TA-16. The Tactical Training Center is almost complete and construction of the indoor firing range has been initiated (LANL 2013a).
- *Sandia Road* – The new Sandia Road is being constructed to allow access to Sandia Canyon as part of the Individual Permit project and as part of the mitigation action commitments made in the *SERF EA* to evaluate impacts on the Sandia Canyon wetlands associated with the expansion. DOE is completing a biological assessment to evaluate the potential impacts on threatened and endangered species in the project area (LANL 2013a).
- *Clean Fill Yard at Sigma Mesa* – Reuse of clean fill at LANL was one of the mitigation action commitments addressed in the *2008 Site-Wide Environmental Impact Statement Mitigation Action Plan Annual Report for Fiscal Year 2010* (LANL 2011c). In 2011, DOE completed the database development portion of the project and in 2012, the Clean Fill Yard opened on Sigma Mesa, providing a staging area for clean fill generated by projects so that it can be stored and distributed to other projects as required.
- *TA-49 Fire Center* – DOE has permitted the National Park Service to construct a Fire Center in TA-49. This project includes construction of a new, single-story multipurpose interagency building that would contain about 6,500 square feet (600 square meters) of space. The project includes replacement of temporary office trailers and structures currently on the site, realignment

of a short segment of the existing access road to the existing temporary buildings, paving and gravelling, and installation of utilities. The building is being designed to qualify for Leadership in Energy and Environmental Design (LEED) certification. Habitat disturbance would be both temporary and minimal at the Fire Center site, with less than 1 acre (0.4 hectare) of undeveloped land disturbed. Operation of this facility would have a negligible increase in utility usage for the site (LANL 2013a).

4.5.2.2 Other Actions

4.5.2.2.1 Savannah River Site

Nuclear facilities in the vicinity of SRS include Georgia Power's two-unit Vogtle Electric Generating Plant across the river from SRS; Energy*Solutions'* (formerly Chem-Nuclear Systems, LLC) commercial LLW disposal facility just east of SRS; and Starmet CMI, Inc. (formerly Carolina Metals), located southeast of SRS, which processes uranium-contaminated metals. The Vogtle Plant, Energy*Solutions* facility, and Starmet CMI facility are located approximately 11, 8, and 15 miles (18, 13, and 24 kilometers), respectively, from F- and H-Areas. NRC has issued the *Final Supplemental Environmental Impact Statement for Combined Licenses (COLs) for Vogtle Electric Generating Plant Units 3 and 4* (NRC 2011a) addressing two additional units at the Vogtle Plant, and has approved the combined construction and operating license for both units (NEI 2012). Due to the proximity of the plant to SRS, the cumulative impacts of expansion of the Vogtle Plant are addressed for each resource area, as appropriate. Annual monitoring reports filed with the State of South Carolina indicate that operation of the Energy*Solutions* facility and the Starmet CMI facility does not noticeably affect radiation levels in air or water in the vicinity of SRS. Therefore, they are not included in this assessment. Other nuclear facilities (e.g., Virgil C. Summer Nuclear Station, Unit 1, operated by South Carolina Electric and Gas) are too far (more than 50 miles [80 kilometers]) from SRS to have an appreciable cumulative effect (DOE 2002:5-3).

Numerous existing and planned industrial facilities (e.g., textile mills, paper product mills, and manufacturing facilities) operate within the counties surrounding SRS, with permitted air emissions and discharges to surface waters. Because of the distances between SRS and these private industrial facilities, there is little opportunity for interaction of plant emissions, and no major cumulative impacts on air or water quality are expected (DOE 2002:5-3).

An additional offsite facility having the potential to affect the nonradiological environment is South Carolina Electric and Gas Company's Urquhart Station. Urquhart Station is a three-unit, 250-megawatt, coal- and natural gas-fired steam electric plant in Beech Island, South Carolina, located about 18 miles (29 kilometers) north of SRS. Because of the distance between SRS and Urquhart Station, and the regional wind direction frequencies, there is little opportunity for any interaction of plant emissions, and no major cumulative impacts on air quality are expected (DOE 2002:5-3, 5-4).

4.5.2.2.2 Los Alamos National Laboratory

Numerous actions having potential cumulative impacts were addressed in the *CMRR-NF SEIS* (DOE 2011g). Most of these actions at other sites located in the general LANL area were not expected to affect cumulative impacts because of their distance from LANL; their routine nature; their relatively small size; and the zoning, permitting, environmental review, and construction requirements they must meet. Those actions with potential cumulative impacts are addressed in this section.

Los Alamos County Department of Public Utilities is the lead agency for the reconstruction of the Los Alamos Canyon Dam, which would enable recreation at the Los Alamos Canyon Reservoir. The project began in March 2011. Originally scheduled to be completed on November 15, 2011, construction work on the dam was completed in 2013; however, flooding during 2013 damaged the road leading to the reservoir and filled the reservoir with sediment and debris. Efforts are underway to repair the road and dredge the reservoir (Erickson 2013; LADPU 2011).

The Buckman Direct Diversion Project diverts water from the Rio Grande for use by the City of Santa Fe and Santa Fe County. The diversion project withdraws water from the Rio Grande approximately 3 miles (5 kilometers) downstream from where New Mexico State Road 502 crosses the river. The pipelines for this project largely follow existing roads and utility corridors. Potential impacts on fish and aquatic habitats below the proposed project due to effects on water flow are minimal (BDDP 2010a; BLM and USFS 2006). An independent peer review was conducted on behalf of the Buckman Direct Diversion Board to obtain an independent analysis and synthesis of existing information to support a description of potential tap water health risks. This review found no risk to human health from drinking water provided by the Buckman Direct Diversion Project (BDDP 2010b). A Memorandum of Understanding regarding water quality monitoring between the Buckman Direct Diversion Board and DOE was published on May 12, 2010, establishing the roles and responsibilities of each agency. The memorandum involves DOE's funding of sampling programs and analysis to ensure no contamination enters the water supply, as well as coordination and sharing of data obtained from sampling between both agencies (BDDP 2010a). In January 2011, the New Mexico Environment Department approved a fourth source of water to be distributed from the Buckman Direct Diversion Project to consumers in the City of Santa Fe and Santa Fe County. The Buckman Direct Diversion Project can provide up to 15 million gallons (57 million liters) per day of treated drinking water (BDDP 2013).

4.5.3 Cumulative Impacts

A cumulative impact analysis is only conducted for those resource areas having the greatest potential for cumulative impacts at SRS and LANL. Based on an analysis of the impacts presented in this chapter, these resource areas were considered to be land use, air quality, human health, socioeconomics, infrastructure, waste management, transportation, and environmental justice. At either SRS or LANL, activities are expected to have minimal environmental impacts with no interference with ongoing cleanup and remediation programs.

4.5.3.1 Land Use

4.5.3.1.1 Savannah River Site

Cumulative impacts on land use at SRS are presented in **Table 4–36**. Cumulative actions could occupy 10,575 to 10,625 acres (4,280 to 4,300 hectares) of land and would be generally compatible with existing land use plans and allowable uses. Within the boundaries of SRS, cumulative land use would involve 5.3 to 5.4 percent of the 198,344 acres (80,268 hectares) encompassing the site. Activities evaluated 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. Existing activities currently occupy approximately 9,900 acres (4,000 hectares) of SRS land. As noted in Section 4.5.2.2.1, a construction and operating license has been issued for Vogtle Units 3 and 4. Land impacted on a long-term basis from this project would total 379 acres (153 hectares) (NRC 2011a:4-2). Use of this acreage would not have a cumulative impact on land use at SRS and only a minimal impact within the larger ROI.

4.5.3.1.2 Los Alamos National Laboratory

Modification of PF-4 or other plutonium facilities would not contribute to cumulative impacts since less than 2 acres (0.8 hectares) of land would be temporarily disturbed.

4.5.3.2 Air Quality

4.5.3.2.1 Savannah River Site

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 similar-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 offsite 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.

Table 4–36 Cumulative Land Use Impacts at the Savannah River Site

Activity		*Land Use Commitment (acres)*
Past, Present, and Reasonably Foreseeable Future Actions		
Existing site activities [a]		9,900
High-Level Radioactive Waste Salt Processing Facility (DOE 2001:4-3)		203
Tank closure (DOE 2002:4-13)		14
Biomass cogeneration and heating (DOE 2008e:4, 8)		36
MFFF [b]		87
WSB [b]		15
Disposal of greater-than-Class C low-level radioactive waste (DOE 2011a:5-1)		60
Military training (DOE 2011i:8)		250
Mercury Storage Facility (DOE 2011k)		8
Subtotal -- Baseline Plus Other DOE Actions		**10,573**
SPD Supplemental EIS Alternatives [c]	No Action	50
	Immobilization to DWPF	2 to 52
	MOX Fuel	30
	H-Canyon/HB-Line to DWPF	30
	WIPP	30
Total [d]		**10,575 – 10,625**
Total Site Capacity [a]		**198,344**

DWPF = Defense Waste Processing Facility; MFFF = Mixed Oxide Fuel Fabrication Facility; MOX = mixed oxide; WIPP = Waste Isolation Pilot Plant; WSB = Waste Solidification Building.

[a] From Chapter 3, Section 3.1.1.1, assuming that 5 percent of the Savannah River Site is developed landscape.

[b] From Appendix F, Section F.7.1.1.

[c] Impact indicator values from this chapter.

[d] Total is a range that includes the minimum and maximum values from the *SPD Supplemental EIS* alternatives. Total may not equal the sum of the contributions due to rounding.

Note: To convert acres to hectares, multiply by 0.40469.

Table 4–37 compares the cumulative concentrations of nonradioactive air pollutants from operation of facilities at SRS to Federal and state regulatory standards. Maximum nonradioactive air pollutant concentrations at the site boundary from operation of SRS facilities would meet regulatory standards. In general, the contributions from *SPD Supplemental EIS* alternatives would be less than significance levels (defined in Section 4.1.1), except for the 1-hour nitrogen dioxide contribution under each alternative and the 24-hour $PM_{2.5}$ and 24-hour sulfur dioxide contributions under the Immobilization to DWPF Alternative and the PDC Option under the other action alternatives. It is unlikely that actual concentrations would be as high as those projected for existing activities at SRS because the values for the existing activities are based on the maximum permitted allowable emissions and not on actual emissions.

DOE expects that the recent replacement of the boilers in D- and K-Areas with new biomass 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 2,300 metric tons (2,500 tons), and sulfur dioxide by 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 would increase by about 25 metric tons (28 tons) (DOE 2008e:30-31). Overall, this would significantly reduce some air pollutant concentrations from SRS facilities and improve ambient air quality. Emissions of carbon dioxide and greenhouse gas emissions are expected to be reduced by about 90,000 metric tons (100,000 tons) per year by replacing these units with the biomass facilities (DOE 2012b).

Construction of the proposed Vogtle Units 3 and 4 would result in small temporary impacts on air quality near the Vogtle Plant. Operation of standby diesel generators and auxiliary power systems at Vogtle Units 3 and 4 would have small air quality impacts (NRC 2008).

Table 4–37 Cumulative Air Quality Impacts of Criteria Pollutants at the Savannah River Site

Activity		*Maximum Average Concentration (micrograms per cubic meter)*				
		Carbon Monoxide	***Nitrogen Dioxide***	***Particulate Matter*** PM_{10}	***Particulate Matter*** $PM_{2.5}$	***Sulfur Oxides***
Past, Present, and Reasonably Foreseeable Future Actions						
Ambient [a]		2,863	6.6	61	29	39.3
Existing site activities [a]		290	42	51	N/R	720
High-Level Radioactive Waste Salt Processing Facility (DOE 2001:4-14)		1.9	0.03	0.07	N/R	0.3
Tank closure (DOE 2002:4-7)		0.3	0.03	0.08	N/R	0.2
Biomass cogeneration and heating (DOE 2008e:31)		N/R [d]	N/R [d]	N/R [d]	N/R [d]	N/R [d]
Disposal of greater-than-Class C low-level radioactive waste (DOE 2011a: 10-52 -10-55)		N/R [e]	N/R [e]	N/R [e]	N/R [e]	N/R [e]
Subtotal Baseline Plus Other Actions		3,200	49	110	N/R [f]	760
SPD Supplemental EIS alternatives (operational contributions) [b]	No Action	37	0.091	1.3	1.1	22
	Immobilization to DWPF	41–55	0.074–0.12	1.8–2.3	1.8–2.1	81 [g]
	MOX Fuel	23–37	0.05–0.092	0.78–1.4	0.78–1.3	22 [g]
	H-Canyon/HB-Line to DWPF	23–37	0.05–0.092	0.78–1.4	0.78–1.3	22
	WIPP	23–37	0.05–0.092	0.78–1.4	0.78–1.3	22
Total [c]		**3,300**	**49**	**110**	**N/R** [f]	**840**
Most Stringent Standard or Guideline		10,000 (8 hours)	100 (annual)	150 (24 hours)	35 (24 hours)	1,300 (3 hours)

DWPF = Defense Waste Processing Facility; MOX = mixed oxide; N/R = not reported; PM_n = particulate matter less than or equal to *n* micrometers in aerodynamic diameter; WIPP = Waste Isolation Pilot Plant.

[a] From Chapter 3, Section 3.1.4.2.

[b] Impact indicator values from this chapter.

[c] The total equals the subtotal baseline plus other actions, and the maximum among the ranges for each alternative. The total may not equal the sum of the contributions due to rounding.

[d] Replacement of coal- and oil-fired units with biomass facilities is reflected in existing site activities.

[e] Emissions from possible construction and operation of a GTCC LLW disposal facility at SRS are reported as small or negligible. Contributions to ambient air pollutant concentrations were not reported.

[f] The $PM_{2.5}$ subtotal and total are not reported because no value for existing site activities was reported. Compliance with the PM_{10} standard was used as a surrogate to assess compliance with the $PM_{2.5}$ standards.

[g] Values would be somewhat higher because the contributions from at least one facility were not reported and are not included in the totals.

Note: This table presents concentrations for selected averaging times and pollutants for comparison of alternatives. The pollutants presented are the criteria pollutants evaluated in Section 4.1.1 for the *SPD Supplemental EIS* alternatives.

4.5.3.2.2 Los Alamos National Laboratory

Because of the small amount of land (less than 2 acres [0.8 hectares]) that could be disturbed during modifications at PF-4 and other plutonium facilities, air quality impacts are not expected. As noted in Section 4.1.1, there would be negligible incremental emissions, if any, of criteria or nonradioactive toxic air pollutants from operation of TA-55 facilities and from operation of the principal LANL support facilities. Therefore, the contribution to cumulative impacts would be negligible.

During the time period that surplus plutonium disposition activities would occur at LANL, other activities could occur which could result in increased concentrations of air pollutants to which the public could be exposed. These activities could include construction and operation of various facilities and remediation of material disposal areas as discussed in the 2008 *LANL SWEIS* (DOE 2008f:5-56). Some of these activities were projected to result in potential exceedances of ambient air quality standards, as analyzed, and additional mitigation measures could be required to continue to comply with the standards.

4.5.3.3 Human Health

4.5.3.3.1 Savannah River Site

Cumulative radiological health effects on the public in the vicinity of SRS are presented in terms of radiological doses, the associated excess LCFs in the offsite population, and the associated LCF risk to the hypothetical MEI. Radiological health effects on involved SRS workers are presented in terms of radiological doses and associated excess LCFs in the workforce.

Table 4–38 summarizes the annual cumulative radiological health effects from routine SRS operations, proposed DOE actions, and non-Federal nuclear facility operations (Vogtle Electric Generating Plant).

Table 4–38 Annual Cumulative Population Health Effects of Exposure to Radioactive Contaminants at the Savannah River Site

Activity		*Population within 50 Miles (80 kilometers)*		*MEI*	
		Dose (person-rem per year)	*Annual LCFs* [a]	*Dose (millirem per year)*	*Annual LCF Risk* [a]
Past, Present, and Reasonably Foreseeable Future Actions					
Existing site activities (Baseline) [b]		4.1	0.002	0.11	7×10^{-8}
High-Level Radioactive Waste Salt Processing Facility (DOE 2001:4-21)		18	0.01	0.31	2×10^{-7}
Tank closure (DOE 2002:4-17)		1.4×10^{-3}	8×10^{-7}	2.5×10^{-5}	2×10^{-11}
Disposal of greater-than-Class C low-level radioactive waste (DOE 2011a:10-79) [c]		-	-	-	-
Subtotal - Baseline Plus Other DOE Actions		**22**	**0.01**	**0.42**	$\mathbf{3 \times 10^{-7}}$
SPD Supplemental EIS alternatives [d, e]	No Action	0.54	0.0003	0.0066	4×10^{-9}
	Immobilization to DWPF	0.71	0.0004	0.0076	5×10^{-9}
	MOX Fuel	0.97	0.0006	0.010	6×10^{-9}
	H-Canyon/HB-Line to DWPF	0.97	0.0006	0.010	6×10^{-9}
	WIPP	0.97	0.0006	0.010	6×10^{-9}
Total for Savannah River Site		**23**	**0.01**	**0.43** [f]	$\mathbf{3 \times 10^{-7}}$
Vogtle Plant (NRC 2008:5-70, 2011a:5-14)		1.8	0.001	2.4	1×10^{-6}
Total for Region		**25**	**0.01**	**-** [f]	**-** [f]

DWPF = Defense Waste Processing Facility; LCF = latent cancer fatality; MEI = maximally exposed individual; MOX = mixed oxide; WIPP = Waste Isolation Pilot Plant.

[a] LCFs are calculated using a conversion of 0.0006 LCFs per rem or person-rem (DOE 2003a). The annual LCFs for the analyzed population represent the number of LCFs calculated by multiplying the listed doses by the risk conversion factor; no population LCFs are expected from any individual activity or from all combined activities. The annual MEI LCF risk represents the calculated risk of an LCF to an individual.

[b] Impact indicators are from Chapter 3, Section 3.1.6.1, of this *SPD Supplemental EIS*.

[c] It is not expected that the general public would receive any measurable radiation doses during waste disposal operations given the solid nature of greater-than-Class C LLW and the distance of potential waste handling activities from potentially affected individuals.

[d] The exposed population used to estimate population dose varies with the release location at SRS. Appendix C, Population Data, of this *SPD Supplemental EIS* presents estimates of year 2020 populations within 50 miles of F-Area, K-Area, and H-/S-Area. The rounded populations are 869,000, 809,000, and 886,000, respectively.

[e] Impact indicators are from Section 4.1.2.1. Only the highest doses and LFCs for each alternative are presented.

[f] The same individual would not be the MEI for all activities at SRS and the Vogtle Plant; therefore, MEI impacts for SRS and the Vogtle Plant have not been summed.

Note: Due to rounding, the column totals may be slightly different than those obtained by summing the individual values.

As shown in Table 4–38, the maximum cumulative offsite population dose is estimated to be 25 person-rem per year for the regional population. This population dose is not expected to result in any LCFs. Activities proposed under the *SPD Supplemental EIS* alternatives could result in annual doses of 0.54 to 0.97 person-rem with no associated LCFs. For perspective, the annual doses to the same local population from naturally occurring radioactive sources (311 millirem per person – see Chapter 3, Section 3.1.6.1) would be about 270,000 person-rem, from which approximately 160 LCFs would be inferred. The assumed population, about 860,000 persons in the year 2020, is the average of the populations within 50 miles (80 kilometers) of F-Area, K-Area, and H-/S-Area.

Table 4–38 indicates that the maximum dose to the MEI at SRS is estimated to be up to 0.43 millirem per year, below applicable DOE regulatory limits (10 millirem per year from the air pathway, 4 millirem per year from the liquid pathway, and 100 millirem per year for all pathways).[16] This is a very conservative estimate of potential dose to an MEI because the SRS activities contributing to this dose are not likely to occur at the same time and location.

Table 4–39 summarizes annual cumulative worker doses and annual LCFs from routine DOE operations and proposed DOE actions at SRS. As shown, the maximum cumulative annual SRS worker dose could total 540 to 860 person-rem, which could result in up to 1 annual LCF. In 2010, workers at SRS received 180 person-rem of radiation dose from normal operations (see Chapter 3, Section 3.1.6.1). Activities proposed under the *SPD Supplemental EIS* alternatives could produce annual workforce doses of 300 to 620 person-rem, expected to result in no annual LCFs. Doses to individual workers would be kept below the regulatory limit of 5,000 millirem per year (10 CFR 835.202). Further, ALARA principles would be implemented to maintain individual worker doses below the DOE Administrative Control Level of 2,000 millirem (DOE 2009a) and as low as reasonably achievable.

Table 4–39 Annual Cumulative Health Effects on Savannah River Site Workers from Exposure to Radioactive Contaminants

Activity		*Involved Workers* Dose (person-rem per year)	*Involved Workers* Annual LCFs [a]
Past, Present, and Reasonably Foreseeable Future Actions			
Existing site activities for 2010 (Baseline) [b, c]		180 [c]	0.1
High-Level Radioactive Waste Salt Processing Facility (DOE 2001:4-21)		6.5	0.004
Tank Closure (DOE 2002:S-14, 2-8, 4-17)		53	0.03
Disposal of greater-than-Class C low-level radioactive waste (DOE 2011a:10-79) [d]		5.2	0.003
Baseline Plus Other DOE Actions		**240**	**0.1**
SPD Supplemental EIS alternatives [e, f]	No Action	300	0.2
	Immobilization to DWPF [f]	620	0.4
	MOX Fuel	320	0.2
	H-Canyon/HB-Line to DWPF	310	0.2
	WIPP	360	0.2
Total [g]		**540 – 860**	**0.3 – 0.5**

DWPF = Defense Waste Processing Facility; LCF = latent cancer fatality; MOX = mixed oxide; WIPP = Waste Isolation Pilot Plant.

[a] LCFs calculated using a conversion of 0.0006 LCFs per rem or person-rem (DOE 2003a). The annual LCFs for the analyzed worker population represent the number of LCFs calculated by multiplying the listed doses by the risk conversion factor; rounding up from 0.5, up to 1 LCF could be annually expected from all combined activities.

[b] Impact indicators are from Chapter 3, Section 3.1.6.1, of this *SPD Supplemental EIS.*

[c] Includes 2,587 workers having a measurable dose – see Chapter 3, Section 3.1.6.1, of this *SPD Supplemental EIS*.

[d] The indicated doses and LCF risks are associated with the vault method of waste disposal at SRS. Doses and risks associated with the trench method of waste disposal at SRS would be smaller.

[e] Impact indicators are from Section 4.1.2.1.

[f] Only the highest doses and LCFs for each alternative are presented.

[g] The range reflects the differences of doses and LCFs for the alternatives addressed in this *SPD Supplemental EIS*.

Note: Due to rounding, the column totals may be slightly different than those obtained by summing the individual values.

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

4.5.3.3.2 Los Alamos National Laboratory

Cumulative radiological health effects on the public in the vicinity of LANL are presented in terms of radiological doses, associated excess LCFs in the offsite population, and associated LCF risk to a hypothetical MEI. Radiological health effects on involved workers are presented in terms of radiological doses and associated excess LCFs in the workforces.

Table 4–40 presents the estimated cumulative impacts on the public from: (1) radiological emissions and radiation exposure under the 2008 *LANL SWEIS* Expanded Operations Alternative (DOE 2008f); (2) operation of the CMRR AC and MC capabilities at PF-4 and RLUOB (DOE 2011g); (3) possible disposal of GTCC LLW at LANL (DOE 2011a); and (4) pit disassembly and conversion activities at LANL, as addressed in this *SPD Supplemental EIS*. The estimated doses under the *LANL SWEIS* Expanded Operations Alternative, which reflects the highest level of operations that is expected to occur at LANL, represent a conservative estimate of the doses that could result from ongoing LANL activities because they include doses associated with the continued operation of the Los Alamos Neutron Science Center (LANSCE) and ongoing remediation of material disposal areas (MDAs) at LANL. Operation of LANSCE is the predominant contributor to offsite dose to the population surrounding LANL. Remediation of MDAs at LANL is the predominant contributor to worker dose.

Table 4–40 Annual Cumulative Population Health Effects of Exposure to Radioactive Contaminants at Los Alamos National Laboratory

Activity		*Population within 50 Miles (80 kilometers)*		*MEI*	
		Dose (person-rem per year)	*Annual LCFs* [a]	*Dose (millirem per year)*	*Annual LCF Risk* [a]
LANL SWEIS Expanded Operations Alternative (DOE 2008f:5-221)		36	0.02	8.2	5×10^{-6}
CMRR AC and MC capabilities (DOE 2011g:4-57)		1.8	0.001	0.31	2×10^{-7}
Disposal of greater-than-Class C low-level radioactive waste (DOE 2011a:5-52, 8-72) [b]		–	–	–	–
SPD Supplemental EIS	PF-4 operations in TA-55 [c]	0.025 / 0.21	2×10^{-5} / 1×10^{-4}	0.0097 / 0.081	6×10^{-9} / 5×10^{-8}
Total		**38**	**0.02**	**8.6**	**5×10^{-6}**

AC = analytical chemistry; CMRR = Chemistry and Metallurgy Research Building Replacement; LCF = latent cancer fatality; MC = materials characterization; MEI = maximally exposed individual; PF-4 = Plutonium Facility; TA-55 = Technical Area 55.

[a] LCFs are calculated using a conversion of 0.0006 LCFs per rem or person-rem (DOE 2003a). The annual LCFs for the analyzed population represent the number of LCFs calculated by multiplying the listed doses by the risk conversion factor; no population LCFs are expected from any individual activity or from all combined activities. The annual MEI LCF risk represents the calculated risk of an LCF to an individual.

[b] Doses and risks are not presented in the reference cited (DOE 2011a). However, it is stated that doses to members of the public would be very low, generally indistinguishable from normal background radiation.

[c] Impact indicators are taken from Section 4.1.2.1 of this *SPD Supplemental EIS*. The first value in each column is the case where pit disassembly and conversion of 2 metric tons of plutonium occurs at LANL; the second value is the case where pit disassembly and conversion of 35 metric tons of plutonium occurs at LANL.

Note: Due to rounding, the column totals may be slightly different than those obtained by summing the individual values. To convert metric tons to tons, multiply by 1.1023.

The impacts from CMRR AC and MC capabilities are expected to be equal to or less than those that would have been realized from operation of CMRR-NF as evaluated in the *CMRR-NF SEIS*. The *LANL SWEIS* doses in Table 4–40 include operation of CMRR, but no adjustment is made to those numbers in this cumulative impacts analysis. Including CMRR contribution in the *LANL SWEIS* doses conservatively accounts for impacts that could occur during transition of CMRR AC and MC capabilities from the CMR Building to RLUOB and PF-4. A reduction in the cumulative dose would be realized when the existing CMR is completely shut down. Beyond activities at LANL, no other activities in the area surrounding LANL are expected to result in radiological impacts on the public.

The public would continue to receive doses from natural background radiation and other sources, as discussed in Chapter 3, Section 3.2.6.1. The projected dose from LANL operations is a small fraction of the dose persons living near LANL receive annually from natural background radiation.

The dose to the offsite MEI of 8.6 millirem per year is expected to remain within the 10-millirem-per-year limit required by 40 CFR Part 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities." No LCFs are expected for the MEI or the general population. The estimated doses shown in Table 4–40 are also very small fractions of the normal background dose received by the people in and around LANL. The dose to an individual from natural background radiation is about 469 millirem per year (Chapter 3, Section 3.2.6.1) compared to the total annual MEI doses projected from LANL operations of about 8.6 millirem per year.

As addressed in Section 4.1.2.1.5, preparation of surplus pit plutonium for potential WIPP disposal under the WIPP Alternative is not expected to result in substantial additional annual cumulative public doses and risks in the LANL region. Although detailed design and operational information is not available, preparation of pit plutonium at LANL for potential WIPP disposal is expected to represent a minor variation on operations at PF-4 involving pit disassembly and conversion.

Table 4–41 presents worker doses associated with normal LANL operations. If the *LANL SWEIS* Expanded Operations Alternative MDA Removal Option were implemented, collective worker doses from that option would average 540 person-rem per year. The addition of impacts from the operation of the CMRR AC and MC capabilities would not change this estimate because the workforce dose of approximately 61 person-rem per year was included in the estimate in the *LANL SWEIS* (DOE 2008f). The 540 person-rem projected dose under the Expanded Operations Alternative in the *LANL SWEIS* corresponds to 1 LCF in the worker population for every 3 years of operation. Workforce doses would decrease by about 140 person-rem per year after remediation of the MDAs is complete (DOE 2008f). Inclusion of GTCC LLW disposal activities at LANL (DOE 2011a) would add 5.2 person-rem per year for the vault method of waste disposal, but would not increase the annual risk to workers appreciably. Worker doses associated with operation of PF-4 were estimated by LANL (LANL 2013a).

Table 4–41 Annual Cumulative Health Effects on Los Alamos National Laboratory Workers from Exposure to Radioactive Contaminants

Activity		Involved Workers	
		Dose (person-rem per year)	***Annual LCFs*** [a]
LANL SWEIS Expanded Operations Alternative (DOE 2008f:5-221)		540	0.3
CMRR AC and MC capabilities		Included above	Included above
Disposal of greater-than-Class C low-level radioactive waste (DOE 2011a:5-54,55)		5.2 [b]	0.003 [b]
SPD Supplemental EIS	PF-4 operations in TA-55 [c]	29 / 190	0.02 / 0.1
Total [d]		**570 / 740**	**0.3 / 0.4**

AC = analytical chemistry; CMRR = Chemistry and Metallurgy Research Building Replacement; LCF = latent cancer fatality; MC = materials characterization; PF-4 = Plutonium Facility; TA-55 = Technical Area 55.

[a] LCFs are calculated using a conversion of 0.0006 LCFs per rem or person-rem (DOE 2003a). The annual LCFs for the analyzed worker population represent the number of LCFs calculated by multiplying the listed doses by the risk conversion factor; no LCFs would be annually expected from all combined activities.

[b] The indicated dose and LCF risk are associated with the vault method of waste disposal at LANL. Doses and risks associated with the trench and borehole methods of waste disposal would be smaller.

[c] Impact indicators are taken from Section 4.1.2.1 of this *SPD Supplemental EIS*.

[d] The first value in each column is the case where pit disassembly and conversion of 2 metric tons of plutonium occurs at LANL; the second value is the case where pit disassembly and conversion of 35 metric tons of plutonium occurs at LANL.

Note: Due to rounding, the column totals may be slightly different than those obtained by summing the individual values. To convert from metric tons to tons, multiply by 1.1023.

At LANL, to the extent under the WIPP Alternative that pit plutonium was prepared at LANL for potential WIPP disposal rather than at SRS, there could be additional annual occupational exposures among LANL workers. As addressed in Section 4.1.2.1.5, it is expected that these annual doses and risks would be enveloped by the doses and risks that could be experienced by workers performing the same activities at H-Canyon/HB-Line at SRS. No LCFs among LANL workers preparing plutonium for potential WIPP disposal would be expected.

ALARA principles would be implemented to insure that the doses to individual workers are maintained below the DOE Administrative Control Level of 2,000 millirem (DOE 2009a) and as low as reasonably achievable.

4.5.3.4 Socioeconomics

4.5.3.4.1 Savannah River Site

As shown in **Table 4–42**, cumulative employment at SRS from past, present, and reasonably foreseeable future actions could reach a peak of 9,000 to 9,900 persons. These values are conservative estimates of short-term future employment at SRS. Some of the employment would occur at different times and 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 and the PF-4 and MFFF Option) to about 2,100 (under the Immobilization to DWPF Alternative and the PDCF Option). By comparison, approximately 215,000 people were employed in the SRS ROI in 2011. In the ROI, in addition to the direct jobs, an estimated 2,500 indirect jobs[17] could be created. Anticipated fluctuations in ROI employment from activities at SRS are unlikely to greatly stress housing and community services in the ROI.

Table 4–42 Cumulative Employment Changes at the Savannah River Site

Activity		*Peak Operations Employment (persons)*
Past, Present, and Reasonably Foreseeable Future Actions		
Existing site activities for 2010 [a]		8,730
High-Level Radioactive Waste Salt Processing Facility (DOE 2001:4-29)		220
Tank closure (DOE 2002:4-14)		85
Biomass cogeneration and heating (DOE 2008e:41)		-40 [d]
Disposal of greater-than-Class C low-level radioactive waste (DOE 2011a)		51
Workforce restructuring (Pavey 2011)		-1,240
Subtotal - Baseline Plus Other Actions		**7,800**
SPD Supplemental EIS alternatives [b]	No Action	1,677
	Immobilization to DWPF	1,596 – 2,111
	MOX Fuel	1,357 – 1,716
	H-Canyon/HB-Line to DWPF	1,202 – 1,676
	WIPP	1,257 – 1,766
Total [c]		**9,000 – 9,900**
Total ROI Employment in 2011 [a]		**215,000**

DWPF = Defense Waste Processing Facility; MOX = mixed oxide; ROI = region of influence; WIPP = Waste Isolation Pilot Plant.

[a] From Chapter 3, Section 3.1.8, of this *SPD Supplemental EIS*.

[b] Impact indicator values include employment from concurrent operations from this chapter.

[c] Total is a range that includes the minimum and maximum values from the *SPD Supplemental EIS* alternatives. Totals may not equal the sum of the contributions due to rounding.

[d] The new facility would only require 20 employees, a reduction from the 60 workers currently employed at the D-Area powerhouse.

[17] *Indirect jobs were estimated using the 2.19 employment multiplier provided in Chapter 3, Section 3.1.8.*

In addition to the activities at SRS, construction of Units 3 and 4 at the Vogtle Plant 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 Plant is located outside the SRS ROI for socioeconomic impacts in nearby Burke County, the impacts associated with activity at the Vogtle Plant would affect conditions in Richmond and Columbia Counties in Georgia, which are included in the SRS ROI. Both adverse and beneficial socioeconomic impacts are anticipated from construction at the Vogtle Plant. The impacts in both scenarios are estimated to be small to moderate (NRC 2011a:2-8, 4-16, 4-18, 4-20).

4.5.3.4.2 Los Alamos National Laboratory

As discussed in Section 4.1.3, expanded pit disassembly and conversion operations performed at PF-4 would require an increase of approximately 493 LANL employees, assuming pit plutonium is not prepared at LANL for potential WIPP disposal under the WIPP Alternative. This additional employment would cause no change in the socioeconomic conditions of the LANL ROI. The number of LANL employees supporting expanded pit disassembly and conversion 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). Future employment due to surplus plutonium disposition activities at LANL could reduce the adverse socioeconomic effects of an expected workforce reduction (LANL 2012d). Similarly, workers required to support operations at PF-4 would be drawn from the existing LANL workforce. In the ROI, in addition to the direct jobs, an estimated 499 indirect jobs could be created. Any fluctuations in ROI employment are unlikely to greatly stress housing and community services in the ROI.

To the extent under the WIPP Alternative that pit plutonium is prepared at LANL for potential WIPP disposal, there could be a requirement for additional employment. Although detailed information is not available regarding the levels of employment that could be required, as discussed in Section 4.1.3.1.5, it is expected that any additional direct employment at LANL would be enveloped by that estimated for SRS for performing the same WIPP preparation activities. Any additional direct employment at LANL would be expected to result in approximately the same number of indirect jobs in the LANL ROI. There could also be a need for additional employment at the principal LANL support facilities. Adding this potential additional employment to the employment estimated for expanded pit disassembly and conversion would still be expected to represent small fractions of the LANL and regional workforces with little resulting stress on housing and community services in the ROI.

4.5.3.5 Infrastructure

4.5.3.5.1 Savannah River Site

Table 4–43 presents the estimated annual cumulative infrastructure requirements from operations at SRS for electricity and water. Including activities evaluated in this *SPD Supplemental EIS*, projected 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. Table 4–43 indicates that SRS would remain well within its capacity to deliver electricity and water.

While Vogtle Units 3 and 4 would have a positive impact on electrical capacity within the SRS ROI, they would result in an increase in groundwater use. It has been concluded, however, that groundwater resources are sufficient to sustain the increase and that cumulative groundwater use for all four units would be small (NRC 2008:7-10, NRC 2011a:7-4).

Table 4–43 Annual Cumulative Infrastructure Impacts from Operations at the Savannah River Site

Activity		*Electricity Consumption (megawatt-hours per year)*	*Groundwater Usage (gallons per year)*
Past, Present, and Reasonably Foreseeable Future Actions			
Existing site activities [a]		310,000	320,000,000
High-Level Radioactive Waste Salt Processing Facility (DOE 2001:4-7, 4-38)		24,000	27,000,000
Tank closure (DOE 2002:1-12, 4-27)		0	1,631,000
Biomass cogeneration and heating (DOE 2008e:4, 37)		-52,560	Not reported
Disposal of greater-than-Class C low-level radioactive waste (DOE 2011a)		5,050	1,400,000
Subtotal - Baseline Plus Other Actions		**286,490**	**350,031,000**
SPD Supplemental EIS alternatives [b]	No Action	270,000	41,000,000
	Immobilization to DWPF	220,000 – 310,000	41,000,000 – 57,000,000
	MOX Fuel	170,000 – 270,000	25,000,000 – 41,000,000
	H-Canyon/HB-Line to DWPF	170,000 – 270,000	25,000,000 – 41,000,000
	WIPP	170,000 – 270,000	25,000,000 – 41,000,000
Total [c]		**460,000 – 600,000**	**380,000,000 – 410,000,000**
Total Site Capacity [a]		**4,400,000**	**2,950,000,000**

DWPF = Defense Waste Processing Facility; MOX = mixed oxide; WIPP = Waste Isolation Pilot Plant.
[a] From Chapter 3, Section 3.1.9, of this *SPD Supplemental EIS*.
[b] Operations infrastructure requirements show the range for each alternative from Section 4.1.7.7.
Note: Total is a range that includes the minimum and maximum values from the *SPD Supplemental EIS* alternatives. Totals may not equal the sum of the contributions due to rounding. To convert gallons to liters, multiply by 3.7854.

4.5.3.5.2 Los Alamos National Laboratory

Table 4–44 presents the estimated annual cumulative infrastructure requirements at LANL for electricity and water. Including activities proposed in this *SPD Supplemental EIS*, projected site and Los Alamos County activities would annually require approximately 880,000 megawatt-hours of electricity and 1.67 billion gallons (6.32 billion liters) of water. Table 4–44 indicates that LANL would remain within its capacity to deliver electricity and water.

Table 4–44 Annual Cumulative Infrastructure Impacts at Los Alamos National Laboratory

Activity		*Electricity Consumption (megawatt-hours per year)*	*Water Usage (gallons per year)*
Past, Present, and Reasonably Foreseeable Future Actions			
Existing site activities (DOE 2011g:4-113)		563,000	412,000,000
CMRR AC and MC capabilities (DOE 2011g:4-35)		161,000	16,000,000
Subtotal – Existing Activities Plus CMRR AC and MC capabilities		**724,000**	**428,000,000**
Current Los Alamos County requirements (DOE 2011g:4-113)		150,000	1,241,000,000
Disposal of greater-than-Class C low-level radioactive waste (DOE 2011a)		5,050	900,000
Subtotal - Baseline Plus Other Actions		**879,050**	**1,670,000,000**
SPD Supplemental EIS alternatives [a]	No Action	960	820,000
	Immobilization to DWPF	960 – 1,900	820,000 – 2,700,000
	MOX Fuel	960 – 1,900	820,000 – 2,700,000
	H-Canyon/HB-Line to DWPF	960 – 1,900	820,000 – 2,700,000
	WIPP	960 – 1,900	820,000 – 2,700,000
Total [b]		**881,000**	**1,673,000,000**
Total Site Capacity [c]		**1,226,000**	**1,807,000,000**

AC = analytical chemistry; CMRR = Chemistry and Metallurgy Research Building Replacement; DWPF = Defense Waste Processing Facility; MC = materials characterization; MOX = mixed oxide; RLUOB = Radiological Laboratory/Utility/Office Building; WIPP = Waste Isolation Pilot Plant.
[a] Operations infrastructure requirements show the range for each alternative from Section 4.1.7.7.
[b] The maximum value is shown.
[c] Total site electrical capacity is for the entire service area, including LANL and other Los Alamos County users. Total site water capacity includes LANL's current site requirement, the current Los Alamos County requirement, and the available system capacity (DOE 2011g).
Note: To convert gallons to liters, multiply by 3.7854.

To the extent under the WIPP Alternative that pit plutonium was prepared at LANL for potential WIPP disposal rather than at SRS, there could be an increased annual requirement for water at LANL associated with the possible employment of additional workers, plus an increased annual requirement for other infrastructure resources such as electricity. This additional annual infrastructure requirement is expected to be within LANL's existing capacity (see Section 4.1.7.7.5).

4.5.3.6 Waste Management

4.5.3.6.1 Savannah River Site

Table 4–45 lists cumulative volumes of LLW, MLLW, hazardous waste, and solid nonhazardous sanitary wastes that would be generated at SRS from all construction and operational activities including the waste that would be generated under the *SPD Supplemental EIS* alternatives. Cumulative waste volumes from existing site activities are projected over 30 years, a period of time that exceeds the projected periods of construction or operation of all plutonium facilities under the action alternatives addressed in this *SPD Supplemental EIS*. Cumulative TRU waste projections for SRS are discussed in Section 4.5.3.6.3. The cumulative waste volumes also include wastes from possible disposal of GTCC waste at SRS pursuant to the *Draft GTCC EIS* (DOE 2011a:1-9, 5-89). Also, SRS is being considered for use as a military training site; however, negligible waste generation is expected from this action (DOE 2011i:44).

Table 4–45 Total Cumulative Waste Generation at the Savannah River Site (cubic meters)

Activity (duration or reference)		*Solid LLW*	*Solid MLLW*	*Solid Hazardous Waste*	*Solid Nonhazardous Waste*
Past, Present, and Reasonably Foreseeable Future Actions					
Existing site activities (30 years) [a]		390,000	2,580	2,520	2,490,000
ER/D&D; 35-Year Forecast (DOE 2002:5-11)		61,600	3,100 [b]	3,100 [b]	N/R
HLW Salt Processing Facility [c] (DOE 2001:4-36)		920	13	43	7,670 [d]
Tank closure (DOE 2002:4-25) [e]		1,284	257	43	428
Biomass cogeneration and heating (DOE 2008e:36) (30 years)		0	0	0	438,000 [f]
GTCC LLW facilities (DOE 2011a:5-89) [g]		250	0	440	780,000
GTCC LLW disposal at SRS (DOE 2011a:1-9)		12,000	170	0	0
Subtotal - Baseline Plus Other Actions		**466,000**	**6,100**	**6,100**	**3,700,000**
SPD Supplemental EIS alternatives	No Action	16,000	0	66	31,000
	Immobilization to DWPF	14,000 – 24,000	900	910 – 960	18,000 – 39,000
	MOX Fuel	12,000 – 34,000	0 – 210	7 – 7,000	17,000 – 43,000
	H-Canyon/HB-Line to DWPF	11,000 – 32,000	0 – 210	7 – 7,000	15,000 – 42,000
	WIPP	10,000 – 31,000	0 – 210	5 – 7,000	13,000 – 39,000
Total		**480,000 – 500,000**	**6,100 – 7,000**	**6,100 – 13,000**	**3,700,000**

D&D = decontamination and decommissioning; DWPF = Defense Waste Processing Facility; ER = environmental restoration; GTCC = greater-than-Class C; HLW = high-level radioactive waste; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; MOX = mixed oxide; N/R = not reported; SRS = Savannah River Site; WIPP = Waste Isolation Pilot Plant.

[a] Except for HLW, volumes were obtained from Chapter 3, Section 3.1.10.1, of this *SPD Supplemental EIS*, assuming the 5-year average annual generation rate would continue for 30 years. HLW is currently stored in waste storage tanks as discussed in Chapter 3, Section 3.1.10.2.

[b] A projected 6,200 cubic meters of waste is estimated for combined MLLW and hazardous waste (DOE 2002:5-11); half was assumed for each type of waste.

[c] Under the preferred solvent extraction cesium separations process, salt waste processing could also generate about 45,400 cubic meters of liquid radioactive waste that would be evaporated (DOE 2001:4-36).

[d] Assuming 910 metric tons of sanitary solid and industrial waste to be disposed of at the Three Rivers Regional Landfill, and a non-compacted waste density of 0.1186 metric tons per cubic meter (200 pounds per cubic yard).

[e] Under the preferred Fill-with-Grout option, tank closure activities could also generate about 48,600 cubic meters of liquid radioactive waste that would be evaporated (DOE 2002:4-25).

[f] Assuming 30 years of wood ash generation at a rate of about 7,300 metric tons per year (DOE 2008e:35), and a wood fly ash density of 490 kilograms per cubic meter (31 pounds per cubic foot) (Naik 2002:47).

[g] Highest potential construction and operations generation volume from either the trench, borehole, or vault alternative as shown in Table 5.3.11-1 of the *Draft GTCC EIS* (DOE 2011a).

Note: Total may not equal the sum of the contributions due to rounding. To convert cubic meters to cubic feet, multiply by 35.314; metric tons to tons, multiply by 1.1023.

Under some alternatives, there could be minor additions to the total number of HLW canisters resulting from DWPF vitrification of HLW. Under the Immobilization to DWPF Alternative, approximately 95 additional canisters containing vitrified HLW could be produced at DWPF. Under the MOX Fuel Alternative, approximately 2 additional canisters containing HLW could be generated from processing 4 metric tons (4.4 tons) of non-pit plutonium for MOX fuel fabrication. Under the H-Canyon/HB-Line to DWPF Alternative, 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 this alternative could result in the generation of 20 to 48 additional canisters containing vitrified HLW. Finally, under all action alternatives up to approximately 5 additional canisters containing vitrified HLW could be generated if H-Canyon/HB-Line is used for pit conversion to plutonium oxide. DOE would store canisters of vitrified HLW in S-Area at SRS pending their offsite disposition.

Increases in the generation of LLW, MLLW, hazardous waste, and solid nonhazardous waste are also projected. LLW would be sent to E-Area for disposal in slit trenches or engineered trenches, stored in low-activity waste vaults, or transported off site to Federal or commercial disposal facilities. MLLW would be temporarily stored at permitted SRS storage facilities and transported to offsite treatment, storage, and disposal facilities.

Consistent with the *Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* ROD (63 FR 41810), hazardous waste would continue to be disposed off site. Solid nonhazardous waste would continue to be disposed of at the Three Rivers Regional Landfill, consistent with current practices. Efforts would be made to recycle as much of the solid nonhazardous waste as reasonably possible to reduce the need for its disposal.

Although operation of the proposed biomass cogeneration and heating plants at D-, K-, and L-Areas would generate wood ash that would be disposed of at landfills such as the Three Rivers Regional Landfill, DOE expects an overall decrease in the quantities of solid nonhazardous wastes requiring disposal. This is because the biomass fuels to be burned in the new plants would reduce the amount of fly and bottom ash (compared to coal ash) entering SRS landfills by more than 95 percent. Furthermore, the biomass fuels to be burned would otherwise require disposal space in landfills (DOE 2008e:36).

Construction of Vogtle Units 3 and 4 would result in negligible quantities of solid hazardous and nonhazardous waste, while its operation would principally generate solid LLW and used fuel. Generation of solid LLW is not expected to exceed 162 cubic meters (212 cubic yards) per year. Used fuel would be stored on site until an offsite facility becomes available to accept HLW and used fuel. DOE personnel at the Nevada National Security Site have concluded that operation of Vogtle Units 3 and 4 would result in small environmental impacts from radioactive waste disposal (NRC 2008:3-15; 6-12 – 6-14). Further, because radioactive waste generated at SRS and Vogtle Units 3 and 4 would use different waste management facilities, there would be no cumulative impact.

4.5.3.6.2 Los Alamos National Laboratory

Table 4–46 lists cumulative volumes of LLW, MLLW, hazardous waste, and solid nonhazardous sanitary wastes that would be generated at LANL from all construction and operational activities, including the waste that would be generated under the *SPD Supplemental EIS* alternatives. Cumulative waste volumes from existing site activities are projected over 30 years, a period of time that exceeds the projected periods of construction or operation of all plutonium facilities under the action alternatives in this *SPD Supplemental EIS*. Cumulative TRU waste projections for LANL are discussed in Section 4.5.3.6.3. Volumes of other wastes from existing site activities are derived from the *CMMR-NF SEIS* (DOE 2011g:4-119), which updates project waste generation volumes presented in the 2008 *LANL SWEIS* (DOE 2008f). Since publication of the *CMRR-NF SEIS*, the Los Alamos Science and Engineering Complex project, referred to in the *LANL SWEIS* as the "Science Complex," was cancelled; however, projected waste generation from this project is negligible. The cumulative waste volumes also include wastes from possible disposal of GTCC waste at LANL pursuant to the *Draft GTCC EIS*

(DOE 2011a:1-9, 5-89). Also considered in the cumulative analysis is the maximum potential waste generation under the Removal with Off-Site Disposal Alternative as presented in the *SERF EA* (DOE 2010e:78).

Table 4–46 Total Cumulative Waste Generation at Los Alamos National Laboratory (cubic meters)

Activity (duration or reference)		*Solid LLW*	*Solid MLLW*	*Solid Hazardous Waste*	*Solid Nonhazardous Waste*
Past, Present, and Reasonably Foreseeable Future Actions					
Existing site activities (30 years) [a]		570,000 – 2,800,000	8,200 – 420,000	48,000 – 86,000	1,500,000 – 1,600,000
GTCC waste facilities (DOE 2011a:5-89) [b]		250	0	440	780,000
GTCC waste disposal at LANL (DOE 2011a:1-9)		12,000	170	0	0
Expansion of SERF and environmental restoration of Reach S-2 of Sandia Canyon (DOE 2010e) [c]		0	0	38,300	38,300
Subtotal – Baseline Plus Other Actions		**580,000 – 2,900,000**	**8,400 – 430,000**	**87,000 – 125,000**	**2,300,000 – 2,400,000**
SPD Supplemental EIS alternatives	No Action	200	2	0	0
	Immobilization to DWPF	200 – 4,000	2 – 87	0 – 4	0
	MOX Fuel	200 – 4,000	2 – 87	0 – 4	0
	H-Canyon/HB-Line to DWPF	200 – 4,000	2 – 87	0 – 4	0
	WIPP	200 – 4,000	2 – 87	0 – 4	0
Total		**580,000 – 2,900,000**	**8,400 – 430,000**	**87,000 – 125,000**	**2,300,000 – 2,400,000**

DWPF = Defense Waste Processing Facility; GTCC = greater-than-Class C; LANL = Los Alamos National Laboratory; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; MOX = mixed oxide; SERF = Sanitary Effluent Reclamation Facility; WIPP = Waste Isolation Pilot Plant.

[a] Volumes were obtained from Chapter 4, Table 4–57, of the *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 2011g:4-119), which provides a revised annual average waste generation rate for LANL operations subsequent to the *LANL SWEIS* (DOE 2008f) and assuming the annual average generation rates continue for 30 years. Chemical waste is reported in pounds (using a 4,000-pounds-per-cubic-meter conversion factor) and is assumed to be hazardous waste for analysis purposes.

[b] Highest potential construction and operations generation volume from either the trench, borehole, or vault alternative as shown in Table 5.3.11-1 of the *Draft GTCC EIS* (DOE 2011a:5-89).

[c] Under the Removal with Off-Site Disposal Alternative, up to 76,500 cubic meters of solid hazardous and nonhazardous waste could be generated; half was assumed for each type of waste.

Note: Total may not equal the sum of the contributions due to rounding. To convert cubic meters to cubic feet, multiply by 35.314.

Generation rates of LLW, MLLW, hazardous waste, and solid nonhazardous waste are expected to remain relatively unchanged at LANL under all alternatives.

4.5.3.6.3 Transuranic Waste Disposal at WIPP

The environmental impacts from construction and operation of WIPP have been addressed in several NEPA analyses, particularly the supplemental environmental impact statement (*WIPP SEIS II*) issued in 1997 (DOE 1997b). *WIPP SEIS II* evaluated the impacts from disposal at WIPP of a waste quantity equivalent to that established by the WIPP Land Withdrawal Act, as well as a larger quantity of waste taking into account other sources of waste such as TRU waste that was not generated from defense activities. The *WIPP SEIS II* conclusion that WIPP could be operated safely and that WIPP would not be expected to result in any long-term (over 10,000 years) impacts on human health (DOE 1997b) supported DOE's decision to develop WIPP for TRU waste disposal (63 FR 3624) (see Appendix A, Section A.2.2).

To address the cumulative impacts from disposal of TRU waste at WIPP, the quantities of wastes generated from proposed activities in this *SPD Supplemental EIS* and other applicable DOE activities are compared against the unsubscribed WIPP capacity for CH-TRU waste disposal. The WIPP Land Withdrawal Act establishes a total WIPP capacity for TRU waste disposal of 175,600 cubic meters (6.2 million cubic feet), as well as restrictions on disposal of RH-TRU waste. Based on these statutory limitations and agreements between DOE and the State of New Mexico, and considering past and projected disposals of TRU waste from across the DOE complex, an unsubscribed disposal capacity of 24,700 cubic meters (872,000 cubic feet) of CH-TRU waste was assumed for purposes of the *SPD Supplemental EIS* (see Section 4.1.4). The estimate of unsubscribed disposal capacity was made using DOE's *Annual Transuranic Waste Inventory Report – 2012* (DOE 2012e: Table 3-1), which does not include any GTCC or GTCC-like waste considered for WIPP disposal as an alternative evaluated in the *Draft GTCC EIS* (DOE 2011a), or CH-TRU waste considered for WIPP disposal in the *Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington* (*TC&WM EIS*) (DOE/EIS-0391) (DOE 2012h) (see below). All of the TRU waste projected from the activities addressed in this *SPD Supplemental EIS* is expected to be CH-TRU waste. Therefore, cumulative impacts from disposal of TRU waste at WIPP would be enveloped by the analyses in *WIPP SEIS II* if the cumulative volumes of CH-TRU waste projected for disposal at WIPP were within the WIPP CH-TRU waste unsubscribed disposal capacity.

Under all alternatives evaluated in the *SPD Supplemental EIS*, significant quantities of CH-TRU waste would be generated at SRS and LANL and shipped to WIPP for disposal. Disposal of CH-TRU waste at WIPP is discussed in Section 4.1.4 and Appendix B, Section B.3. Taking into account CH-TRU generation at both SRS and LANL, **Table 4–47** lists the ranges of cumulative CH-TRU waste generation under all *SPD Supplemental EIS* alternatives and the impacts these volumes would have on the unsubscribed WIPP CH-TRU waste disposal capacity. The range of CH-TRU volume generation was evaluated in Table 4–47 considering both SRS and LANL because CH-TRU waste would be shipped to WIPP from both sites, and to consider the sites separately could result in double-counting the TRU waste volumes.

Table 4–47 Total Cumulative Contact-Handled Transuranic Waste Generation at the Savannah River Site and Los Alamos National Laboratory (cubic meters)

	Alternative				
Activity	*No Action*	*Immobilization to DWPF*	*MOX Fuel*	*H-Canyon/ HB-Line to DWPF*	*WIPP*
Subtotal baseline plus other actions at SRS	7,350 [a]				
Subtotal baseline plus other actions at LANL	9,880 [a]				
SPD Supplemental EIS alternatives	6,000	12,000 – 13,000	12,000 – 13,000	7,100 – 8,200	25,000 – 27,000
Percent of unsubscribed WIPP capacity [b]	24	47 – 52	47 – 52	29 – 33	104 – 108 (65) [c]

DWPF = Defense Waste Processing Facility; LANL = Los Alamos National Laboratory; MOX = mixed oxide; SRS = Savannah River Site; WIPP = Waste Isolation Pilot Plant.

[a] Baseline CH-TRU waste volumes at SRS and LANL are already included in the subscribed CH-TRU waste projected in the *Annual Transuranic Waste Inventory Report – 2012* (DOE 2012e:Table 3-1); therefore, these quantities are not included in the percent of unsubscribed WIPP capacity calculations.

[b] WIPP unsubscribed capacity for CH-TRU waste is approximately 24,700 cubic meters.

[c] The greatest impact on the WIPP unsubscribed capacity (about 108 percent) occurs under the WIPP Alternative, assuming generation of approximately 24,300 cubic meters of CH-TRU waste at SRS and 2,400 cubic meters of CH-TRU waste at LANL. The cumulative CH-TRU waste volume under the WIPP Alternative would drop to 65 percent if CCOs were used for packaging surplus plutonium for WIPP disposal as opposed to POCs, and FFTF fuel was shipped as waste directly to WIPP.

Note: To convert cubic meters to cubic feet, multiply by 35.314.

Depending on the alternative, the volume of CH-TRU waste that could be generated would represent from 24 to 108 percent of the WIPP unsubscribed CH-TRU waste disposal capacity.[18] Because disposal of the maximum projected volume of CH-TRU waste under the WIPP Alternative would exceed WIPP's unsubscribed CH-TRU waste disposal capacity, implementation of this volume of waste under this alternative would require mitigative actions such as waste volume reduction and/or statutory amendment. Under the MOX Fuel and WIPP Alternatives, however, less CH-TRU waste would be generated if the portion of non-pit plutonium inventory that is unirradiated FFTF fuel was direct-shipped as waste to WIPP and if CCOs were used for packaging other surplus plutonium for WIPP disposal rather than the assumed POCs.[19] Under this waste packaging option, disposal of CH-TRU waste at WIPP under the WIPP Alternative would be within WIPP's CH-TRU waste unsubscribed disposal capacity. Future decisions about the disposal of TRU waste would be made in the context of the needs of the entire DOE complex.

Additional Actions

GTCC and GTCC-Like Waste. The *Draft GTCC EIS* evaluated an alternative whereby up to 11,600 cubic meters (409,000 cubic feet) of GTCC LLW and DOE-generated GTCC-like waste would be disposed at WIPP, consisting of about 5,700 cubic meters (201,000 cubic feet) of contact-handled waste and 5,900 cubic meters (208,000 cubic feet) of remote-handled waste (DOE 2011a:Table S-1). The *Draft GTCC EIS* defines GTCC LLW as LLW generated by NRC and Agreement State licensees and having radionuclide concentrations that exceed the limits for Class C LLW. The *Draft GTCC EIS* defines GTCC-like waste as radioactive waste that is owned or generated by DOE and has characteristics similar to those of GTCC LLW such that a common disposal approach may be appropriate. GTCC-like waste consists of LLW and non-defense generated TRU waste that has no identified path for disposal. Certain GTCC LLW and GTCC-like waste analyzed in the *Draft GTCC EIS* and reflected above would be eligible for disposal at WIPP if Congressional action is taken, including but not limited to amending legislation (e.g. the WIPP Land Withdrawal Act as amended). Adding the GTCC LLW and GTCC-like waste to the projected volumes in Table 4–47, the total quantity of TRU waste, GTCC LLW, and GTCC-like waste could meet or exceed the WIPP unsubscribed CH-TRU waste disposal capacity under the Immobilization to DWPF, MOX Fuel, and WIPP Alternatives.

Waste from Hanford Tanks. On March 11, 2013, DOE issued its Preferred Alternative (78 FR 15358) for Certain Tanks Evaluated in the *TC&WM EIS* (DOE 2012h). This Preferred Alternative is limited to 20 of the 177 underground waste storage tanks identified and evaluated in the *TC&WM EIS*. The total volume of waste in these 20 tanks is approximately 3.1 million gallons (12 million liters), which was evaluated as candidate mixed TRU waste for purposes of analysis. DOE prefers to retrieve, treat, package, and characterize and certify, for disposal at WIPP, the wastes that are properly and legally classified as mixed TRU waste. DOE issued a ROD (78 FR 75913) for the *TC&WM EIS* on December 13, 2013. The ROD stated that "DOE is not deciding to implement its preferred or any other alternative associated with this matter in this ROD."

For the purposes of analysis in the *TC&WM EIS*, the waste in the 20 tanks was evaluated based on the assumption that 11 of the tanks contain mixed CH-TRU waste and 9 contain mixed RH-TRU waste. DOE has not, however, completed the process to classify the waste in any of these 20 tanks. Initiating retrieval of tank waste as mixed TRU waste would be contingent on DOE's obtaining the applicable and necessary permits, ensuring that the WIPP Waste Acceptance Criteria and all other applicable regulatory

[18] Under all alternatives, including the No Action Alternative, approximately 6,000 cubic meters (210,000 cubic feet) of CH-TRU waste would be generated by the fabrication of 34 metric tons (37.5 tons) of surplus plutonium into MOX fuel, in accordance with previous decisions. Under the No Action Alternative, the 13.1 metric tons (14.4 tons) of surplus plutonium remain in storage, and do not contribute to TRU waste generation and disposal at WIPP. See Tables 4–20 and 4–21 for more information.

[19] If this waste packaging option was fully implemented, the cumulative CH-TRU waste volume under the MOX Fuel Alternative would drop from a maximum of 52 percent of the unsubscribed WIPP CH-TRU waste disposal capacity (assuming 2 metric tons [2.2 tons] of surplus plutonium are disposed of at WIPP) to approximately 44 percent. The cumulative CH-TRU waste volume under the WIPP Alternative would drop from 108 percent of the unsubscribed WIPP CH-TRU waste disposal capacity to approximately 65 percent.

requirements have been met, and making a documented determination that the waste is properly and legally classified as mixed TRU waste. Further, retrieval of the waste at Hanford would not commence until DOE had issued a ROD.

As part of the Basic Inventory analyzed in *WIPP SEIS II*, DOE evaluated the receipt and disposal at WIPP of 57,000 cubic meters (2.01 million cubic feet) of CH-TRU waste and 29,000 cubic meters (1.02 million cubic feet) of RH-TRU waste from Hanford (DOE 1997b). The amount of tank-generated mixed CH-TRU waste and mixed RH-TRU waste would be well within the quantities evaluated for Hanford TRU waste in *WIPP SEIS II*.

If the preferred alternative were implemented, wastes from the 11 tanks that potentially contain mixed CH-TRU waste would account for some fraction of the unsubscribed CH-TRU waste capacity at WIPP. Based on the evaluation in the *TC&WM EIS*, the estimate of potential disposal volume for these 11 tanks is 1,500 cubic meters (53,000 cubic feet). This represents about 6 percent of the unsubscribed WIPP CH-TRU disposal capacity. Adding this waste to the projected volumes in Table 4–47, the total volume would exceed the WIPP CH-TRU waste unsubscribed disposal capacity under the WIPP Alternative. DOE issued a ROD for the *TC&WM EIS* on December 13, 2013 (78 FR 75913). The ROD stated that "DOE is not deciding to implement its preferred or any other alternative associated with this matter in this ROD."

Management and Storage of Elemental Mercury. In the *Final Mercury Storage Supplemental EIS*, DOE addressed the environmental impacts of storage of elemental mercury at three alternative locations at or near WIPP. Mercury storage under these alternatives would entail the construction and operation of a surface facility outside the area used at WIPP for TRU waste management operations including underground disposal. In the *Final Mercury Storage Supplemental EIS*, the evaluated environmental impacts ranged from none, to negligible, to minor for various resource areas, and with minimal potential cumulative impacts on these same resource areas (DOE 2013f).

4.5.3.7 Transportation

The assessment of cumulative impacts for past, present, and reasonably foreseeable future actions involving radioactive material transport concentrates on radiological impacts from offsite transportation throughout the nation that would result in potential radiation exposure to the general population, in addition to those impacts evaluated in this *SPD Supplemental EIS*. Cumulative radiological impacts from transportation are measured using the collective dose to the general population and workers because dose can be directly related to LCFs using a cancer risk coefficient.

In addition to the impacts addressed in Section 4.1.5, the cumulative impacts from transport of radioactive material consist of impacts from historical shipments of radioactive waste and used (irradiated) fuel; reasonably foreseeable actions that include transportation of radioactive material identified in Federal, non-Federal, and private environmental impact analyses; and general radioactive material transportation that is not related to a particular action. The timeframe of impacts was assumed to begin in 1943 and continue to some foreseeable future date. Projections for commercial radioactive material transport extend to 2073 based on available information.

Table 4–48 provides a summary of total collective radiation doses for workers and the general population and collective doses from past, present, and reasonably foreseeable future transportation activities. This table lists activities having documented transportation impacts and that are not related to those considered in this *SPD Supplemental EIS*.

Historical Shipments. The impact values provided for historical shipments related to SRS include shipments of used fuel from 1953 through 1993 (then called spent nuclear fuel). Used fuel data are available from 1970 through 1993. These data were linearly extrapolated to account for shipments from 1953, when SRS began operations, to 1969 (Jones and Maheras 1994).

There are considerable uncertainties in these historical estimates of collective dose. For example, the population densities and transportation routes used in the dose assessment were based on 1990 census data and the U.S. highway network as it existed in 1995. Using 1990 census data overestimates historical collective doses because the U.S. population has continuously increased over the time covered in this assessment. On the contrary, using interstate highway routes as they existed in 1996 may slightly underestimate doses for shipments that occurred in the 1950s and 1960s, because a larger portion of the transport routes would have been on non-interstate highways, where population may have been closer to the road. By the 1970s, the structure of the interstate highway system was largely fixed and most shipments would have been made using interstate routing.

Transportation impacts associated with the *SPD EIS* were assumed to be addressed in this *SPD Supplemental EIS*.

Table 4–48 Transportation-Related Radiological Collective Doses and Risks Not Related to this *SPD Supplemental EIS* Analysis

Category	*Worker*		*General Population*	
	Collective Dose (person-rem)	*Risk (LCF)*	*Collective Dose (person-rem)*	*Risk (LCF)*
Site-Specific Historical Shipments (1953—1993) [a]				
Used fuel shipments to SRS	49	0.03	25	0.02
Subtotal	**49**	**0.03**	**25**	**0.02**
Past, Present, and Reasonably Foreseeable DOE Actions [b]				
Naval reactor disposal	5.8	0.00	5.8	0.00
Treatment of Mixed Low-Level Radioactive Waste EIS [c]	18	0.01	1.34	0.00
WM PEIS [d]	15,550	9.3	18,430	11.1
WIPP SEIS II	790	0.47	5,900	3.54
Idaho High-Level Waste and Facility Disposition Final EIS	520	0.31	2,900	1.74
Sandia National Laboratories SWEIS	94	0.06	590	0.35
Tritium Production in Commercial Light Water Reactor EIS	16	0.01	80	0.05
LANL SWEIS - 1999	580	0.35	310	0.19
LANL SWEIS - 2008	910	0.55	287	0.17
Plutonium Residues at Rocky Flat EIS	2.1	0.00	1.3	0.00
Surplus Disposition HEU	400	0.24	520	0.31
Molybdenum-99 Production EIS	240	0.14	520	0.31
Import of Russian Plutonium-238 EA	1.8	0.00	4.4	0.00
Pantex SWEIS	250	0.15	490	0.29
NTS SWEIS	N/A	N/A	155	0.09
NNSS Site-Wide EIS [e]	5,600	3.36	1,400	0.84
Storage and disposition of fissile material	N/A	N/A	2,400 [f]	1.44
Stockpile stewardship	N/A	N/A	38 [f]	0.02
Container system for Naval used fuel	11	0.01	15	0.01
S3G and D1G Prototype Reactor Plant Disposal EIS	2.9	0.00	2.2	0.00
S1G Prototype Reactor Plant Disposal EIS	6.7	0.00	1.9	0.00
ETTP DUF_6 Transport to Portsmouth Gaseous Diffusion Plant	99	0.06	3.2	0.00
Spent Nuclear Fuel PEIS	360	0.22	810	0.49
Foreign Research Reactor Spent Nuclear Fuel EIS [g]	90	0.05	222	0.13
Private Fuel Storage Facility Final EIS [h]	30	0.02	190	0.11
Draft GTCC EIS [i]	500	0.3	160	0.09
TC&WM EIS [j]	3,100	1.9	440	0.26
West Valley Waste Management EIS	520	0.31	410	0.25
West Valley Demonstration Project EA for the D&D and Removal of Certain Facilities	14	0.01	11	0.01
West Valley Decommissioning EIS [k]	400	0.24	72	0.04
Paducah DUF_6 Conversion Final EIS [l]	770	0.46	31	0.02
Portsmouth DUF_6 Conversion Final EIS [m]	520	0.31	29	0.02

Category	Worker		General Population	
	Collective Dose (person-rem)	Risk (LCF)	Collective Dose (person-rem)	Risk (LCF)
Y-12 SWEIS [n]	Not listed	Not listed	309	0.2
Nuclear Infrastructure PEIS [o]	10	0.01	192	0.12
Subtotal [p]	**31,400**	**18.8**	**36,900**	**22.1**
Past, Present, and Reasonably Foreseeable Non-DOE Actions				
Enrichment Facility in Lea County EIS [q]	1,500	0.90	450	0.27
Eagle Rock Enrichment Facility [r]	3,350	2.01	60,000	36
GE Global Laser Enrichment [s]	242	0.15	419	0.25
American Centrifuge Plant [t]	285	0.17	390	0.23
Vogtle Early Site Permit EIS [u]	0.51	0.00	0.90	0.00
Subtotal [o]	**5,380**	**3.23**	**61,300**	**36.8**
General Radioactive Material Transport				
1943–1982 [v]	230,000	138	170,000	102
1983–2073 [w]	154,000	92	168,000	101
Subtotal (1943–2073)	**384,000**	**230**	**338,000**	**203**
Total Impacts (up to 2073) [p]	**421,000**	**252**	**436,000**	**262**

D&D = decontamination and decommissioning; DUF_6 = depleted uranium hexafluoride; EA = environmental assessment; EIS = environmental impact statement; ETTP = Eastern Tennessee Technology Park; GTTC = greater-than-Class C; HEU = highly enriched uranium; LANL = Los Alamos National Laboratory; LCF = latent cancer fatality; N/A = not available (the data are provided as a sum for workers and the public); NNSS = Nevada National Security Site; PEIS = programmatic environmental impact statement; SRS = Savannah River Site.

[a] Jones and Maheras 1994.
[b] Unless specified otherwise, all values are taken from the *Final Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE 2008h).
[c] JEGI 1998.
[d] The values are for the low-level and mixed low low-level radioactive waste transportation impacts on NNSS, based on the amended ROD for the *WM PEIS*, 65 FR 10061, February 25, 2000.
[e] DOE 2013b.
[f] Includes worker and general population doses.
[g] DOE 1996b.
[h] NRC 2001.
[i] DOE 2011a.
[j] DOE 2012h.
[k] DOE 2010d. The impacts are expressed as a range to reflect all potential alternatives to complete closure that could be pursued after 2020.
[l] DOE 2004c.
[m] DOE 2004b.
[n] DOE 2011e.
[o] DOE 2000b. Impacts reflect Alternative 2, Option 7.
[p] The summed values are rounded to three significant figures.
[q] NRC 2005e. The values presented in this table are for 30 years of operation.
[r] NRC 2011b.
[s] NRC 2012.
[t] NRC 2006.
[u] NRC 2008.
[v] These estimates are very conservative because few shipments were made in the 1950s and 1960s. Also, the non-exclusive shipment dose estimates are based on a very conservative method. See the text for the dose estimates for 1975 and 1983 shipments.
[w] The annual dose estimates are similar to those for the period 1975–1982.

Reasonably Foreseeable Actions. The values provided for reasonably foreseeable actions could lead to some double counting of impacts. For example, the LLW transportation impacts in the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DOE 1997a) may also be included in the individual DOE facilities' sitewide EISs. Also, for foreseeable actions where no preferred alternative was identified or no ROD has been issued, the impact values are included for the alternative having the largest transportation impacts. Transportation impacts associated with the *Complex Transformation SPEIS* were assumed to be addressed in other NEPA documents listed in Table 4–48, such as the *LANL SWEIS* (DOE 2008f) and the *Final Site-Wide Environmental Impact Statement for the Y–12 National Security Complex* (DOE 2011e).

General Radioactive Materials Transports. General radioactive material transports are shipments not related to a particular action; they include shipments of radiopharmaceuticals, industrial and radiography sources, and uranium fuel cycle materials, as well as shipments of commercial LLW to commercial disposal facilities. The collective dose estimates from transportation of these types of materials were based on the following: (1) for the period 1943 through 1982, an NRC analysis documented in NUREG-0170 for shipments made in 1975 (NRC 1977); and (2) for the period 1983 through 2073, an analysis of unclassified shipments in 1983, documented in the *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE 1995). The NRC report estimated collective doses to the workers and population of 5,600 and 4,200 person-rem, respectively, for transports in 1975. The modes of transportation included truck, rail, and plane. The collective doses to workers and population for 1943 through 1982 (39 years) were estimated to be 230,000 and 170,000 person-rem, respectively (NRC 1977). The collective doses to workers and populations for shipments in 1983 using a combination of truck and plane shipments were estimated to be 1,690 and 1,850 person-rem, respectively (DOE 1995). These doses were calculated using more-refined models than those used in the 1977 NRC report. Even though the number of shipments was larger than those of the 1977 NRC report, the estimated doses are smaller by a factor of 2 to 3. The collective doses over 91 years, from 1983 through 2073, would be 154,000 and 168,000 person-rem for workers and the general population, respectively.

Table 4–49 provides impacts on transport workers and the general population from future transportation activities considered in this *SPD Supplemental EIS* in comparison to the cumulative impacts estimated in Table 4–48. 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 (the alternatives in this *SPD Supplemental EIS*, historical shipments, reasonably foreseeable actions, and general transportation) was estimated to be about 421,000 person-rem (252 LCFs) for the period 1943 through 2073 (131 years). The general population collective dose was estimated to be about 436,000 person-rem (262 LCFs). Worker and general population collective doses as estimated in this *SPD Supplemental EIS* range from about 230 to 650 person-rem, and from about 150 to 580 person-rem, respectively, with no LCFs expected. 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 2004 through 2008 was about 560,000, with less than a 1 percent fluctuation in the number of deaths from one year to the next (CDC 2007, 2008a, 2008b, 2011a, 2011b). 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 515, or an average of about 4 LCFs per year. The transportation-related LCFs represent about 0.0009 percent of the overall annual number of cancer deaths; therefore, their contribution is indistinguishable from the natural fluctuation in the total annual death rate from cancer. Note that 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*.

Table 4–49 Cumulative Transportation Impacts for this *SPD Supplemental EIS*

Category	*Collective Worker Dose (person-rem)*	*Collective General Population Dose (person-rem)*
Transportation Impacts in this *SPD Supplemental EIS*	**230 to 650**	**150 to 580**
Other Nuclear Material Shipments		
Historical (used fuel to SRS)	49	25
Past, present, and reasonably foreseeable DOE actions	31,400	36,900
Past, present, and reasonably foreseeable non-DOE actions	5,380	61,300
General radioactive material transport (1943 to 2073)	384,000	338,000
Total Collective Dose (up to 2073)	**421,000**	**436,000**
Total Latent Cancer Fatalities [a]	**252**	**262**

SRS = Savannah River Site.
[a] Total latent cancer fatalities are calculated assuming 0.0006 latent cancer fatalities per person-rem of exposure (DOE 2003a).

As presented in Appendix E, Section E.12, the annual incremental risk of a traffic fatality due the activities analyzed in this *SPD Supplemental EIS* would be small compared to the total number of traffic fatalities that occur annually in the U.S. (over 32,000 fatalities per year). Over the 131-year period cited above, the increased cumulative number of traffic fatalities due to the activities analyzed in this *SPD Supplemental EIS* would be negligible compared to the total number of traffic fatalities that would occur in the United States over this period.

4.5.3.8 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.

4.5.3.8.1 Savannah River Site

The analysis of alternatives in this chapter indicates no high and adverse human health and environmental impacts on any population within the SRS ROI. Impacts on minority or low-income populations would be comparable to those on the population as a whole. No cumulative disproportionately high and adverse human health and environmental effects on minority or low-income populations are expected as a result of the small incremental dose associated with implementing any of the alternatives considered in this *SPD Supplemental EIS*.

4.5.3.8.2 Los Alamos National Laboratory

The analysis of alternatives in this chapter indicates no high and adverse human health and environmental impacts on any population within the LANL ROI. Impacts on minority or low-income populations would be comparable to those on the population as a whole. No cumulative disproportionately high and adverse human health and environmental effects on minority or low-income populations are expected as a result of the small incremental dose associated with implementing any of the alternatives considered in this *SPD Supplemental EIS*.

Concerns have been expressed that impacts on indigenous populations surrounding LANL may be greater than those on the general population as a consequence of their cultural affiliation with the natural environment. Council on Environmental Quality guidance on environmental justice analysis directs Federal agencies to "collect, maintain, and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence" and to communicate the risk of those consumption patterns to the public (CEQ 1997:Section 4-4). It is possible that certain practices or lifestyles could subject individual persons near LANL to higher doses through exposure to radioactive materials in the environment (including plants and animals).

To assist in identifying the potential impacts from differential patterns of subsistence consumption and cultural practices, dose analyses were performed for a number of specific receptors during preparation of the 2008 *LANL SWEIS* (DOE 2008f). One of these receptors, identified as an offsite resident, was assumed to consume all components of his or her diet from locally produced foods (that is, no dilution by store-bought or processed foods from outside the LANL vicinity). A second receptor, termed a special pathways receptor, also derived all his or her food locally, but additionally, consumed increased amounts of fish, deer, and elk from the areas surrounding LANL and drank surface water and cota (a tea made from local plants). This special pathways receptor also is exposed to additional amounts of contaminated soils and sediments from performing outdoor activities on or near LANL. These special exposure and diet pathways do not represent any particular person or group, but were evaluated to assess the potential impacts on receptors that practice traditional habits and diet that could cause larger exposures to environmental contaminants. Such a receptor would receive an additional dose of up to 4.5 millirem per year from these special pathways (see *LANL SWEIS*, Appendix C, Section C.1.4 [DOE 2008f]). Based on the last 5 years of LANL operations, the dose to a maximally exposed member of the public would be about 1.1 millirem per year from site emissions (see Chapter 3, Section 3.2.6.1). Normal operation of the proposed pit disassembly and conversion at PF-4 is not expected to increase the doses from these special pathways, which are dominated by biological uptake of legacy contamination. Therefore, if the MEI associated with this *SPD Supplemental EIS* were also assumed to be the LANL site MEI and a special pathways receptor, the maximum dose would be up to 5.7 millirem per year (4.5 millirem associated with special pathways, 1.1 millirem from other site operations, and about 0.081 millirem associated with normal operations from pit disassembly and conversion at PF-4, assuming pit disassembly and conversion of 2.5 metric tons [2.8 tons] per year of plutonium – see Table 4–4). This dose would represent an increase of a little more than 1 percent above the approximately 469 millirem that a person residing near LANL would normally receive each year from natural background radiation. In terms of an increased risk of a fatal cancer, the special pathways dose, the dose from normal operations, and the incremental dose from pit disassembly and conversion at PF-4, would represent an annual estimated risk of 3×10^{-6}, or about 1 chance in 330,000.

This analysis indicates that a person whose lifestyle would subject them to the special exposure pathways would receive a higher dose than a member of the general population or other members of minority or low-income groups. Although the dose is higher, it is well below the 100 millirem per year dose criterion for protection of the public (DOE Order 458.1) and a small fraction of the background dose received by all persons. Therefore, there would be no cumulative disproportionately high and adverse human health and environmental effects on such a receptor.

4.5.4 Global Commons Cumulative Impacts

Cumulative effects may also occur on a global scale. Both ozone depletion and global climate change are addressed below as they relate to the alternatives.

4.5.4.1 Ozone Depletion

The alternatives addressed in this *SPD Supplemental EIS* are not expected to use or discharge substantial quantities of ozone-depleting substances (ODSs) as regulated under 40 CFR Part 82, "Protection of Stratospheric Ozone." Construction and operation of plutonium facilities would be accomplished using materials and equipment formulated to be compliant with laws and regulations to reduce the use of ODSs. Any release of ODSs would be incidental to the conduct of the analyzed activities. Emissions of ODSs would be very small and would represent a negligible contribution to the destruction of the Earth's protective ozone layer. DOE is working to reduce use of ODSs complex-wide based on Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*; Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*; and DOE Order 436.1, *Departmental Sustainability*.

4.5.4.2 Global Climate Change

The "natural greenhouse effect" is the process by which part of terrestrial radiation is absorbed by gases in the atmosphere, warming the Earth's surface and atmosphere. This greenhouse effect and the Earth's radiation balance are affected largely by water vapor, carbon dioxide, and trace gases, which absorb infrared radiation and are referred to as "greenhouse gases."

The Intergovernmental Panel on Climate Change (IPCC) identifies increases in atmospheric concentrations of certain gases as a cause of changes in the Earth's atmospheric energy balance and an influence on global climate. Warming of the global climate is referred to as "global warming." Water vapor (approximately 1 percent of the atmosphere) is the most common and dominant greenhouse gas; only small amounts of water vapor are produced as the result of human activities. The principal greenhouse gases resulting from human activities are carbon dioxide, methane, nitrous oxide, and halocarbons. Halocarbons include chlorofluorocarbons; hydrofluorocarbons, which are replacing chlorofluorocarbons as refrigerants; and perfluorocarbons, which are byproducts of aluminum smelting. Other gases of concern include sulfur hexafluoride, which is widely used in insulation for electrical equipment. These gases are released in different quantities and have different potencies in their contributions to global warming (IPCC 2007; Justus and Fletcher 2006). Executive Order 13514 lists carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride as the priority greenhouse gases that Federal agencies are to reduce.

Sources of anthropogenic carbon dioxide include combustion of fossil fuels such as natural gas, oil, gasoline, and coal. The IPCC estimates that carbon dioxide atmospheric levels have risen by more than 35 percent since the preindustrial period (beginning in 1750) as a result of human activities. Emissions of other greenhouse gases have also risen. Annual global emissions of carbon dioxide from fossil fuel combustion in 2008 were 29.4 billion metric tons (32.4 billion tons), while preliminary estimates for 2010 were 33.5 billion metric tons (36.9 billion tons) (CDIAC 2011a, 2011b). Emissions of greenhouse gases are stated in terms of equivalent emissions of carbon dioxide based on their global warming potential.

The IPCC lists potential impacts from warming of the climate system, including expansion of seawater volume; decreases in mountain glaciers and snow cover resulting in sea-level rise; changes in arctic temperatures and ice; changes in precipitation, ocean salinity, and wind patterns; and changes in extreme weather (IPCC 2007:3–8).

The release of anthropogenic greenhouse gases and their potential contribution to climate change are inherently cumulative phenomena. Cumulative impacts of the emission of carbon dioxide and other greenhouse gases from the alternatives addressed in this *SPD Supplemental EIS*, and other activities at SRS and throughout the region, would contribute to the changes related to global climate discussed above. As described in this chapter, the alternatives considered in this *SPD Supplemental EIS* could produce various quantities of carbon dioxide from construction and operation of the plutonium facilities. Specifically, the emission estimates for the alternatives account for facility-specific fuel-burning sources from construction activity, mobile source emissions from material shipments, emissions from employee vehicles, and indirect emissions from increased electricity use.

The greenhouse gases emitted by operation of the surplus plutonium capabilities 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 2010 totaled about 6.822 billion metric tons (7.520 billion tons) of carbon dioxide equivalent (EPA 2012). By way of comparison, the maximum annual operational emissions of carbon dioxide under the *SPD Supplemental EIS* alternatives would equal about 0.0025 percent of the United States' total emissions in 2010. Emissions from the proposed surplus plutonium capabilities at SRS and LANL contribute in a small way to the climate change impacts described above, in combination with past and future emissions from all other sources. 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. Carbon dioxide emissions for all alternatives are presented in **Table 4–50**, including the emissions from shipment of MOX fuel to commercial nuclear power reactors. In addition to carbon dioxide, there may be emissions of other greenhouse gases.

Table 4–50 Annual Carbon Dioxide Emissions by Alternative from Operation of Plutonium Facilities

Alternative	*Emissions (metric tons per year)*		
	Emissions other than Unirradiated MOX Fuel Shipments [a]	*Emissions from Shipping Unirradiated MOX Fuel to TVA Reactors*	*Emissions from Shipping Unirradiated MOX Fuel to Generic Reactors* [b]
No Action	150,000	Not applicable	1,400
Immobilization to DWPF	180,000	140	1,400
MOX Fuel	160,000	170	1,700
H-Canyon/HB-Line to DWPF	150,000	160	1,600
WIPP	160,000 [c]	140	1,400

DWPF = Defense Waste Processing Facility; MOX = mixed oxide; TVA = Tennessee Valley Authority; WIPP = Waste Isolation Pilot Plant.

[a] Includes emissions from fuel use; electricity use; employee vehicles; and shipments of waste, construction materials, and materials other than unirradiated MOX fuel based on the option having the highest emissions.

[b] Shipment of unirradiated MOX fuel to generic commercial nuclear power reactors assumed for analysis purposes to be located in the northwestern United States.

[c] Emissions may be reduced to the extent under the WIPP Alternative that plutonium was prepared at LANL rather than SRS for potential WIPP disposal.

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

Emissions of carbon dioxide and other greenhouse gases resulting from the nuclear energy life cycle are discussed in Section 3.16.1.2 of the *Final Supplemental Environmental Impact Statement for Sequoyah Nuclear Power Plant Units 1 and 2, License Renewal, Hamilton County, Tennessee* (TVA 2011). Electric generation from nuclear power plants produces no direct emissions of carbon dioxide.

The IPCC has concluded that emissions of greenhouse gases and the impacts on global climate and the resulting environmental, economic, and social consequences could be significant (IPCC 2007:3-8). At present there is no consensus on methodology that would allow DOE to estimate quantitatively the specific impacts (if any) that incremental climate change would produce in the vicinity of SRS or elsewhere. Nonetheless, DOE has begun planning and implementation of measures for sustainability and adaptation at its sites around the country (DOE 2010a).

It has been projected that regional climate changes in the southeastern United States, including at SRS, could include continued warming in all seasons and an increase in the rate of warming. The number of very hot days has been projected to rise at a greater rate than the average temperature. Climate models do not agree on changes in precipitation in most of the southeastern United States. However, the frequency, duration, and intensity of droughts may increase as a result of higher temperatures. Increased intensity of hurricanes may result in higher winds and rainfall. The increase in temperature could result in increased heat stress for people, decreased forest growth and crop productivity, damage to infrastructure, decline in dissolved oxygen in surface waters, increases in fish kills and loss of aquatic species diversity, and decline in production of livestock. Changes in the distribution of native plants and animals may occur, threatened and endangered species may be lost, native species may be displaced by invasive species, and more frequent and intense wildfires may occur (U.S. Global Change Research Program 2009:111-116). Some of these effects may eventually necessitate adaptation of activities at SRS.

Regional climate change projections for the southwestern United States, including LANL and WIPP, include continued atmospheric warming and declines in spring snowpack. Increased water shortages may lead to increased conflicts over water use. Changes in natural and managed ecosystems are likely to be substantial as a result of changes in temperature and drought patterns, wildfire, invasive species, and pests. The frequency of wildfires would be expected to change as a result of changes in temperature and precipitation which would result in changes in available fuel and the types of ecosystems. Warming and an intensified water cycle may also result in increased risk of flooding as a result of increased frequency of heavy rains and decreased flood-buffering capability of the landscape resulting from vegetation die-off and wildfire (U.S. Global Change Research Program 2009:129-134). Some of these effects may eventually necessitate adaptation of activities at LANL.

4.6 Deactivation, Decontamination, and Decommissioning

The management of DOE physical assets, including the facilities addressed in this *SPD Supplemental EIS*, would be subject to the requirements of DOE Order 430.1B, *Real Property and Asset Management*, and related directives. After operations, the facilities would be dispositioned in accordance with a process that begins once DOE determines that a facility is no longer needed to support program missions and declares it surplus. Facility disposition would be performed in compliance with applicable DOE, other Federal agency, and state requirements. Depending on regulatory determinations, decisions about some facilities may require consideration of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). General discussions of deactivation and decontamination and decommissioning activities are provided in this section.

4.6.1 Deactivation

When missions have been completed and facilities are no longer needed, deactivation and stabilization would be performed to reduce the risk of radiological exposure, reduce the need for and costs associated with long-term maintenance, and prepare the buildings for productive future use or closure.

All feed materials, including chemicals and any remaining surplus plutonium, would be removed from the facilities to leave them in a low-cost condition for surveillance and maintenance. After completion of the initial deactivation effort, the facilities would be surveyed to ensure that any contamination is contained and worker and public safety is maintained. Finally, a formal closeout would be conducted using the procedures set forth in the *Multi-Agency Radiation Survey and Site Investigation Manual* (NRC/EPA/DOE 2000). Closeout activities would include inspection of support systems, such as heating, ventilating, and air conditioning and water systems, to determine if they are in a condition for reuse.

4.6.2 Decontamination and Decommissioning

DOE has anticipated the need for eventual decontamination and decommissioning of the proposed plutonium facilities, based on decades of experience with operation of nuclear facilities and implementation of pollution prevention and waste minimization initiatives. Process functions are compartmentalized, and equipment that constitutes a risk to health and safety is enclosed in concrete structures to allow for isolation from the environment. Protective coatings are applied to concrete surfaces in the process areas to reduce the amount of contamination adsorbed into the concrete. Stainless steel cell and area liners are provided in some areas to facilitate removal of contamination where accumulation of radioactive material could increase personnel radiation exposure. Ventilation of processing areas minimizes the contamination of surfaces by airborne contaminants. Process equipment is designed to minimize areas where radioactive materials can accumulate. For example, piping systems are designed to be fully drained.

> **Decontamination**
> The removal of radioactive or chemical contamination from facilities, equipment, or soils by washing, heating, chemical or electrochemical action, mechanical cleaning, or other techniques.
>
> **Decommissioning**
> Actions taken at the end of facility life to make it suitable for reuse or retire it from service, including surveillance, maintenance, decontamination, and dismantlement.

The nature, extent, and timing of future decontamination and decommissioning activities are not presently known. Although some choices currently exist, both technically and under environmental regulations for performing final decontamination and decommissioning, DOE expects that there will be additional options available in the future. DOE may decide to completely demolish and remove the facility, or to reuse the facility for some other purpose consistent with the site mission at that time.[20] For DOE facilities, a formal Decontamination and Decommissioning Plan must be developed to comply with applicable Federal and state requirements and regulations. For MFFF, current plans are for the operator to deactivate the facility and request that NRC terminate the license once the facility's mission for surplus plutonium disposition is completed. MFFF would then become the responsibility of DOE, and DOE may decide to reuse or decommission it.

No meaningful alternatives or analysis of impacts can be formulated at this time. Neither the means to conduct decontamination and decommissioning, nor the impacts of these actions, are foreseeable in the sense of being susceptible to meaningful analysis now. Accordingly, decontamination and decommissioning activities are not analyzed quantitatively in this *SPD Supplemental EIS*. Once proposals concerning decontamination and decommissioning activities are developed, DOE would at that time undertake any additional NEPA analysis that may be necessary or appropriate. It is noted, however, that NRC's *MFFF EIS* includes a preliminary analysis of the radiological impacts that could result from deactivating the facility. NRC's *MFFF EIS* also analyzes the radiological and other impacts that could result from completely decommissioning the facility pursuant to applicable NRC requirements, including 10 CFR Part 20, Subpart E, "Radiological Criteria for License Termination." Impacts from decommissioning PDCF and WSB were included in the *MFFF EIS* (NRC 2005a:4-55).

Following completion of their missions, H-Canyon/HB-Line, DWPF, and the K-Area Complex at SRS, and PF-4 at LANL, would undergo a period of deactivation and stabilization, as would PDCF and PDC if either of these facilities is constructed and operated.[21] Major activities would include complete de-inventory of accountable material, flushing and cleaning of equipment, and disconnection of utilities. The facilities would be placed in a stable condition requiring minimal surveillance and referred to as "cold, dark, and dry." After completion of this period, the facilities would be maintained in a safe, minimal surveillance condition until a decision is reached on their ultimate disposition. At this time, both H-Canyon/HB-Line and the K-Area Complex are listed in Appendix K-1 of the SRS Federal Facility Agreement as facilities to be decommissioned. It was assumed in current end-state planning and associated cost estimation models for hardened structures such as H-Canyon and the K-Area Complex that these structures would be dispositioned in place. This does not, however, indicate that a decision has been made to implement this strategy. No decision on ultimate disposition would be made until the required review processes (which may include the CERCLA process) have been completed.

4.7 Irreversible and Irretrievable Commitments of Resources

This section describes the major irreversible and irretrievable commitments of resources that have been identified under each alternative. A commitment of resources is irreversible when primary or secondary impacts limit future options for a resource. A commitment of resources is irretrievable when resources that are used or consumed are neither renewable nor recoverable for future use. This section discusses the commitment of resources in four major categories: land, labor, utilities, and materials.

Table 4–51 presents irreversible and irretrievable commitments of resources related to construction activities at SRS. Only construction that has not been started is considered a future commitment of resources. Construction of MFFF and WSB has been analyzed in previous NEPA documents (DOE 1999b, 2008i; NRC 2005a), and is under way. Construction of these facilities is, therefore, not considered in this *SPD Supplemental EIS*, except for optional minor modifications to MFFF to enable oxidation of metallic plutonium. Construction resource use is presented as a range for the Immobilization to DWPF, MOX Fuel, H-Canyon/HB-Line to DWPF, and WIPP Alternatives, reflecting the range of pit disassembly and conversion options addressed for each of these alternatives.

[20] To illustrate, the building housing K-Reactor was not demolished after the end of reactor operations, but was deactivated (in terms of its original mission), and the K-Area Complex was reused to store surplus plutonium and to house KIS.
[21] DWPF has been designed to facilitate decontamination for future decommissioning, and its operation facilitates the decommissioning of other SRS facilities such as the waste tank farms.

Table 4–51 Irreversible and Irretrievable Commitments of Construction Resources at the Savannah River Site [a]

Resource	Alternative				
	No Action	Immobilization to DWPF	MOX Fuel	H-Canyon/HB-Line to DWPF	WIPP
Land Use					
Disturbed land (acres)	50	2–52	0–50	0–50	0–50
Labor					
Full-time equivalent (person-year)	6,200	2,000–7,300	960–6,200	960–6,200	980–6,300
Utilities					
Electricity (megawatt-hours)	110,000	54,000–160,000	minimal–140,000	minimal–140,000	minimal–140,000
Diesel fuel, gasoline (gallons)	2,400,000	11,000–2,400,000	minimal–2,400,000	minimal–2,400,000	minimal–2,400,000
Water (gallons)	24,000,000	6,600–24,000,000	minimal–24,000,000	minimal–24,000,000	minimal–24,000,000
Materials					
Asphalt (tons)	minimal	800	minimal–200	minimal–200	minimal–200
Concrete (cubic yards)	120,000	minimal–120,000	minimal–120,000	minimal–120,000	minimal–120,000
Crushed stone, sand, and gravel (tons)	190,000	1,100–190,000	minimal–570,000	minimal–570,000	minimal–570,000
Lumber (board feet)	minimal	11,000	minimal	minimal	minimal
Soil (cubic yards)	130,000	9,500–140,000	minimal–130,000	minimal–130,000	minimal–130,000
Steel (tons)	22,000	1,700–23,000	minimal–22,000	minimal–22,000	minimal–22,000

DWPF = Defense Waste Processing Facility; MOX = mixed oxide; WIPP = Waste Isolation Pilot Plant.

[a] WSB construction requirements are not included in this table because the facility has been analyzed in previous NEPA documents and is currently under construction. Except for the few resources required to optionally install metal oxidation furnaces for the action alternatives, MFFF construction requirements are also not included in this table because the facility has been analyzed in previous NEPA documents and is currently under construction.

Note: To convert acres to hectares, multiply by 0.40469; gallons to liters, multiply by 3.7854; cubic yards to cubic meters, multiply by 0.76456; tons to metric tons, multiply by 0.90718; board feet to cubic inches, multiply by 144; 1 full-time equivalent = 2,080 worker hours.

Source: DOE 1999b; SRNL 2013; SRNS 2012a; WSRC 2008a.

The estimates in Table 4–51 for the MOX Fuel, H-Canyon/HB-Line to DWPF, and WIPP Alternatives reflect the option of constructing PDC with a plutonium throughput of 3.5 metric tons (3.9 tons) per year. If a reduced-scale PDC is constructed, the commitment of resources attributable to PDC construction would be reduced (see Section 4.3). Under all action alternatives, there could be some minor additional commitment of resources at SRS to modify the K-Area Complex to enable pit disassembly, or to modify H-Canyon/HB-Line or MFFF to support pit conversion activities, if these facilities are optionally used for pit disassembly and conversion activities. Any modifications, however, to the K-Area Complex, H-Canyon/HB-Line, or MFFF would require little or no additional steel, asphalt, concrete, soil, lumber, or crushed stone, sand, and gravel. Assuming pit disassembly takes place at the K-Area Complex and plutonium conversion at H-Canyon/HB-Line, there would be no change in land use at K- or H-Area, and no to minimal land disturbance, but there would be minor commitments of labor and utilities to add equipment within existing structures. Assuming plutonium conversion takes place at MFFF, there would be no change in land use, and no to minimal land disturbance, but there would be some minor commitments of labor and utility resources to install additional metal oxidation furnaces, gloveboxes, and other equipment within MFFF.

Minor modifications to PF-4 at LANL under the No Action Alternative to enhance pit disassembly and conversion of 2 metric tons (2.2 tons) of plutonium are under way consistent with existing NEPA analysis (see Appendix B, Section B.2.1). Assuming pit disassembly and conversion of 35 metric tons (38.6 tons) of plutonium takes place at PF-4 under two pit disassembly and conversion options under the action alternatives, there would be no change in LANL land use. Installing equipment to enable an enhanced pit disassembly and conversion capability would require about 320 full-time equivalents. There would be minimal use of additional steel, asphalt, concrete, lumber, or crushed stone, sand, and gravel. There could be some movement or disturbance of soil covering less than 2 acres (0.8 hectares). Equipment installation at PF-4 is projected to require approximately 660 megawatt-hours of electricity, 3,500 gallons (13,000 liters) of diesel fuel, and 2.6 million gallons (9.8 million liters) of water. Under the WIPP Alternative, some additional resources could be required to enhance LANL's capability to prepare surplus plutonium for potential WIPP disposal.

Table 4–52 presents irreversible and irretrievable commitments of resources related to facility operations, over the projected periods of operation, of the pit disassembly and conversion, plutonium disposition, and principal plutonium support facilities at SRS. The totals do not include utility resource use for operations at H-Canyon/HB-Line or E-Area. The annual utility resource use at H-Canyon/HB-Line and E-Area would not significantly change, depending on the mix of plutonium activities that may take place. For DWPF, for which proposed plutonium activities would represent only a portion of facility operations, only the incremental commitment of resources necessary to implement each alternative is considered. For the Immobilization to DWPF, MOX Fuel, H-Canyon/HB-Line to DWPF, and WIPP Alternatives, uses of labor, utility, and materials are frequently presented as ranges, reflecting the range of pit disassembly and conversion options addressed for each alternative.

Table 4–52 Irreversible and Irretrievable Commitments of Operations Resources at the Savannah River Site [a]

Resource	Alternative				
	No Action	*Immobilization to DWPF [b]*	*MOX Fuel [b]*	*H-Canyon/HB-Line to DWPF [b]*	*WIPP [b]*
Labor					
Full-time equivalent (person-years)	30,000	28,000–34,000	29,000–35,000	27,000–33,000	27,000–33,000
Utilities					
Electricity (megawatt-hours)	4,800,000	4,100,000–5,200,000	4,200,000–5,300,000	4,000,000–5,100,000	3,700,000–4,800,000
Diesel fuel, gasoline (gallons)	9,500,000	6,000,000–6,400,000	6,500,000–8,500,000	6,400,000–8,400,000	6,100,000–8,200,000
Water (gallons)	750,000,000	680,000,000–870,000,000	590,000,000–780,000,000	570,000,000–760,000,000	550,000,000–740,000,000
Materials					
Absorbents (pounds)	0	6,300	0	0	0
Aluminum nitrate (pounds)	0	260–120,000	47,000–160,000	62,000–180,000	0–120,000
Aluminum sulfate (pounds)	21,000	0–25,000	0–25,000	0–25,000	0–25,000
Argon (cubic feet)	330,000,000	290,000,000–330,000,000	340,000,000–380,000,000	320,000,000–360,000,000	300,000,000–350,000,000
Argon-methane (P-10) (cubic feet)	8,500,000	8,300,000	9,500,000	9,100,000	8,400,000–8,500,000
Bentonite (pounds)	11,000	0–13,000	0–13,000	0–13,000	0–13,000
Boric acid (pounds)	0	140–150	0–8	71–78	0–8
Carbon dioxide (cubic feet)	390,000	690,000–730,000	53,000–92,000	350,000–390,000	150,000–370,000
Chlorine (cubic feet)	22,000	0–26,000	0–26,000	0–26,000	0–26,000
Cleaning solvents (pounds)	3,100	0–3,700	0–3,700	0–3,700	0–3,700
Copper formate (pounds)	0	1,200–1,300	0–67	600–670	0–67
Corrosion inhibitor (pounds)	0	1,300	0	0	0
Dodecane (gallons)	38,000	38,000	43,000	41,000	38,000
Fly ash (pounds)	2,000,000	27,000,000–28,000,000	2,300,000–3,700,000	15,000,000–16,000,000	2,200,000–3,600,000
Formic acid (pounds)	0	46,000–49,000	0–2,600	23,000–26,000	0–2,600
Gadolinium nitrate (pounds)	0	0–160,000	64,000–220,000	11,000–170,000	0–160,000
Glass frit (pounds)	0	8,000,000–8,100,000	11,000–38,000	240,000–270,000	0–27,000
Helium (cubic feet)	12,000,000	8,000,000–13,000,000	9,300,000–14,000,000	8,700,000–13,000,000	8,800,000–14,000,000

Resource	Alternative				
	No Action	**Immobilization to DWPF [b]**	**MOX Fuel [b]**	**H-Canyon/HB-Line to DWPF [b]**	**WIPP [b]**
Hydraulic fluid (gallons)	0	270	0	0	0
Hydrazine (pounds)	33,000	33,000	37,000	36,000	33,000
Hydrogen (cubic feet)	8,600,000	8,400,000–8,600,000	9,600,000–9,800,000	9,200,000–9,400,000	8,400,000–8,600,000
Hydrogen peroxide (pounds)	32,000	32,000	36,000	35,000	32,000
Hydroxylamine nitrate (pounds)	200,000	200,000	220,000	210,000	200,000
Inert materials (pounds)	0	0	110,000	0	320,000–470,000
Liquid nitrogen (pounds)	37,000	6,400–36,000	7,000–36,000	7,000–36,000	7,000–36,000
Lubricating oils (gallons)	5,200	960–7,100	0–6,200	0–6,200	0–6,200
Manganese nitrate (pounds)	220	220	250	240	220
Nitric acid (pounds)	1,700,000	430,000–6,200,000	2,700,000–8,400,000	2,000,000–7,700,000	340,000–6,100,000
Nitrogen (cubic feet)	3,400,000,000	3,500,000,000–7,600,000,000	3,900,000,000–11,000,000,000	3,700,000,000–10,000,000,000	3,400,000,000–10,000,000,000
Nitrogen tetroxide (cubic feet)	3,100,000	3,100,000	3,500,000	3,400,000	3,100,000
Oxalic acid dehydrate (pounds)	270,000	380,000–500,000	350,000–460,000	350,000–470,000	270,000–380,000
Oxygen (cubic feet)	760,000	790,000–1,300,000	900,000–1,400,000	840,000–1,400,000	920,000–1,500,000
Phosphoric acid (pounds)	5,300	0–6,300	0–6,300	0–6,300	0–6,300
Polyelectrolyte (pounds)	5,300	0–6,300	0–6,300	0–6,300	0–6,300
Polyphosphate (pounds)	0	1,100	0	0	0
Porogen (pounds)	6,500	6,500	7,400	7,100	6,500
Portland cement (pounds)	7,000,000	13,000,000	8,000,000–8,300,000	10,000,000–11,000,000	7,700,000–8,000,000
Potassium fluoride (pounds)	19,000	0–80,000	32,000–110,000	5,600–86,000	0–80,000
Potassium fluoride solution (gallons)	0	0	0	1,400	0
Potassium nitrate (pounds)	0	140–150	0–8	71–78	0–8
Silver nitrate (pounds)	22,000	22,000	26,000	24,000	22,000
Sodium carbonate (pounds)	9,000	9,000	10,000	9,900	9,000
Sodium hydroxide (pounds)	1,800,000	1,600,000–6,700,000	2,600,000–7,700,000	1,500,000–6,600,000	610,000–5,700,000
Sodium hypochlorite (pounds)	0	750	0	0	0
Sodium nitrite (pounds)	0	140,000	0–7,700	68,000–76,000	0–7,700
Sodium sulfite (pounds)	16,000	16,000	18,000	17,000	16,000
Sodium titanate (pounds)	0	10,000–11,000	0–590	5,300–5,900	0–590
Sodium tetraphenylborate (pounds)	0	170,000–180,000	0–9,700	86,000–96,000	0–9,700
Slag (pounds)	0	25,000,000–26,000,000	0–1,400,000	13,000,000–14,000,000	0–1,400,000
Steel (pounds)	2,300,000	2,800,000	4,900,000	2,500,000	9,300,000–16,000,000
Sulfuric acid (pounds)	10,000	0–12,000	0–12,000	0–12,000	0–12,000
Tributyl phosphate (gallons)	15,000	15,000–16,000	17,000	16,000	15,000
Uranyl nitrate (gallons)	77,000	77,000	88,000	84,000	77,000
Zinc stearate (pounds)	9,700	9,700	11,000	11,000	9,700
Zirconium oxide (pounds)	1,600,000	1,600,000	1,800,000	1,700,000	1,700,000

DWPF = Defense Waste Processing Facility; MOX = mixed oxide; WIPP = Waste Isolation Pilot Plant.

[a] The base annual resource requirements under all alternatives include those for operating MFFF and WSB for a minimum of 34 metric tons of pit, metal, and oxide plutonium originally declared surplus, and for storage of surplus plutonium at the K-Area Complex. The table includes resource use at SRS for pit disassembly and conversion, plutonium disposition, and the principal plutonium support facilities.

Resource	Alternative				
	No Action	*Immobilization to DWPF* [b]	*MOX Fuel* [b]	*H-Canyon/HB-Line to DWPF* [b]	*WIPP* [b]

[b] Uses of labor, utility, and resources under the Immobilization to DWPF, MOX Fuel, H-Canyon/HB-Line to DWPF, and WIPP Alternatives are frequently presented as ranges reflecting the pit disassembly and conversion options addressed under each alternative. The values under the WIPP Alternative reflect preparation of 7.1 metric tons (7.8 tons) of surplus pit plutonium at SRS for potential WIPP disposal.

Note: To convert pounds to kilograms, multiply by 0.45359; gallons to liters, multiply by 3.7854; cubic feet to cubic meters, multiply by 0.028317; metric tons to tons, multiply by 1.1023; 1 full-time equivalent = 2,080 worker hours.

Source: DCS 2002, 2004; DOE 1994, 1999b, 2008i; SRNL 2013; SRNS 2012a; WSRC 2008a.

Table 4–53 presents for each alternative the irreversible and irretrievable commitments of resources related to facility operations, over the projected periods of operation, of pit disassembly and conversion activities at LANL. Resource use for the No Action Alternative reflects a total PF-4 throughput of 2 metric tons (2.2 tons), while that for each action alternative reflects a total PF-4 throughput ranging from 2 metric tons (2.2 tons) to 35 metric tons (38.6 tons). The listed values reflect only those resources required for the activities analyzed in this *SPD Supplemental EIS*, rather than those for operation of the entire PF-4 facility.

Table 4–53 Irreversible and Irretrievable Commitments of Operational Resources at Los Alamos National Laboratory [a]

Resource	Alternative				
	No Action	*Immobilization to DWPF* [b]	*MOX Fuel* [b]	*H-Canyon/HB-Line to DWPF* [b]	*WIPP* [b]
Labor					
Full-time equivalent (person-years)	1,000	1,000–8,100	1,000–8,100	1,000–8,100	1,000–8,100
Utilities					
Electricity (megawatt-hours)	6,700	6,700–42,000	6,700–42,000	6,700–42,000	6,700–42,000
Diesel fuel, gasoline (gallons) [c]	N/A	N/A	N/A	N/A	N/A
Water (gallons)	5,700,000	5,700,000–60,000,000	5,700,000–60,000,000	5,700,000–60,000,000	5,700,000–60,000,000
Materials					
Argon (cubic feet)	26,000,000	26,000,000–450,000,000	26,000,000–450,000,000	26,000,000–450,000,000	26,000,000–450,000,000
Helium (cubic feet)	19,000,000	19,000,000–330,000,000	19,000,000–330,000,000	19,000,000–330,000,000	19,000,000–330,000,000
Hydrogen (cubic feet)	14	14–250	14–250	14–250	14–250
Isotonic solution (gallons)	80	80–1,400	80–1,400	80–1,400	80–1,400
Inert materials (pounds)	0	0	0	0	0 – 140,000
Liquid nitrogen (pounds)	64,000	64,000–1,100,000	64,000–1,100,000	64,000–1,100,000	64,000–1,100,000
Nitric acid (pounds)	21	21–370	21–370	21–370	21–370
Nitrogen (cubic feet)	780	780–14,000	780–14,000	780–14,000	780–14,000
Oxygen (cubic feet)	3,400,000	3,400,000–60,000,000	3,400,000–60,000,000	3,400,000–60,000,000	3,400,000–60,000,000
Sodium nitrate (pounds)	1	1–15	1–15	1–15	1–15
Sodium sulfate (pounds)	1	1–15	1–15	1–15	1–15
Steel (pounds)	1,900	1,900–34,000	1,900–34,000	1,900–34,000	1,900–7,000,000
Sulfuric acid (pounds)	12	12–220	12–220	12–220	12–220

DWPF = Defense Waste Processing Facility; MOX = mixed oxide; N/A = not applicable; WIPP = Waste Isolation Pilot Plant.

[a] Additional resources would be used at SRS under each alternative. See Table 4–52.

[b] Uses of labor, utility, and resources under the Immobilization to DWPF, MOX Fuel, H-Canyon/HB-Line to DWPF, and WIPP Alternatives are presented as ranges reflecting a PF-4 throughput of 2 to 35 metric tons of plutonium.

[c] Diesel fuel is used at PF-4 for testing diesel generators. Diesel generator testing is independent of the particular mix of activities that take place at PF-4.

Note: To convert pounds to kilograms, multiply by 0.45359; gallons to liters, multiply by 3.7854; cubic feet to cubic meters, multiply by 0.028317; metric tons to tons, multiply by 1.1023; 1 full-time equivalent = 2,080 worker hours.

Source: LANL 2013a.

Under the WIPP Alternative, the upper end of the range in Table 4–53 for inert materials and steel reflect the optional preparation, using POCs, of 7.1 metric tons (7.7 tons) of pit plutonium at LANL for potential WIPP disposal. In addition under this option, there could be additional requirements for labor, utilities, and other materials such as industrial gases. There could also be reductions under this alternative in the resource requirements provided in Table 4–52 for SRS.

4.8 Relationship Between Local Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

The relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity for key environmental resources is described in the following paragraphs:

- Land would be disturbed at SRS and LANL to construct or modify new or existing plutonium facilities. After construction or modification, the plutonium facilities would occupy land, but less land than that disturbed during construction. At SRS, the proposed locations for any new facilities would be within or adjacent to developed industrial landscapes at F- and K-Areas. The new facility proposed under existing NEPA documentation for the No Action Alternative (PDCF) would disturb approximately 50 acres (20 hectares) of land, but would ultimately increase the SRS industrial landscape by less than 23 acres (9.3 hectares). Under the Immobilization to DWPF Alternative, 2 to 50 acres (0.8 to 20 hectares) of land would be disturbed at SRS during construction, depending on the pit disassembly and conversion option, but the SRS industrial landscape would ultimately increase by 2 to 25 acres (0.8 to 10 hectares). Under the MOX Fuel, H-Canyon/HB-Line to DWPF, and WIPP Alternatives, 30 or 50 acres (12 or 20 hectares) of land would be disturbed during construction, if PDC or PDCF is constructed, but the SRS industrial landscape would increase by 18 or 23 acres (7.3 or 9.3 hectares), respectively. If neither facility is constructed, pit disassembly and conversion would be performed using existing facilities, such as H-Canyon/HB-Line, DWPF, and MFFF. At LANL, pit disassembly and conversion would occur within the existing PF-4; depending on the pit disassembly and conversion option, less than 2 acres (0.8 hectares) of land would be temporarily disturbed.

- After the operational life of the plutonium facilities, DOE could deactivate, decontaminate, and decommission the facilities in accordance with applicable regulatory requirements and then close in place or restore the areas occupied by the facilities to brownfield sites that would be available for other industrial use. Appropriate CERCLA and/or NEPA reviews would be conducted before initiation of decontamination and decommissioning actions. In all likelihood, none of the sites would be restored to a natural terrestrial habitat. Deactivation, decontamination, and decommissioning processes are described in Section 4.6.

- Groundwater would be used to meet process and sanitary water needs over the short-term impact period. After use and treatment, this water would be released through permitted outfalls into surface water streams. The withdrawal, use, and treatment of water are not likely to affect the long-term productivity of this resource.

- Air emissions associated with implementation of any of the alternatives would add small amounts of radiological and nonradiological constituents to the air of the SRS and LANL regions. During the short-term impact period, these emissions would result in additional radioactive exposure or air loading, but are not expected to affect compliance by SRS or LANL with radiation exposure or air quality standards. No significant residual environmental effects on long-term environmental productivity are expected.

- The management and disposal of LLW and solid and liquid wastes would require energy and space at treatment, storage, or disposal facilities at SRS (e.g., Z-Area Saltstone Facility, E-Area Vaults, Three Rivers Regional Landfill) and LANL (e.g., waste management facilities at TA-54, the Radioactive Liquid Waste Treatment Facility). Land used at SRS for LLW and solid waste disposal, or at LANL for LLW disposal, would require a long-term commitment of terrestrial resources.

Activities at depleted uranium supply, depleted uranium conversion, and commercial nuclear power reactor sites would be conducted at existing facilities in accordance with ongoing operations. Therefore, future use of these facilities would not be related to surplus plutonium activities, but would be dictated by other ongoing activities. The short-term use of these facilities for surplus plutonium disposition activities is not expected to change their planned closure dates, and therefore, should not result in an incremental change in the potential long-term productivity of these sites.

4.9 Mitigation

This section summarizes mitigation measures that could be implemented to avoid or reduce potential environmental impacts that could result from implementing the alternatives. As specified in the Council on Environmental Quality's NEPA regulations (40 CFR 1508.20), mitigation includes:

- Avoiding the impact altogether by not taking a certain action or parts of an action
- Minimizing impacts by limiting the degree or magnitude of the action and its implementation
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment
- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action
- Compensating for the impact by replacing or providing substitute resources or environments

All of the alternatives have the potential to affect one or more resource areas. If mitigation measures above and beyond those required by regulations are needed to reduce impacts, DOE is required to describe mitigation commitments in the ROD and prepare a Mitigation Action Plan (10 CFR 1021.331). The Mitigation Action Plan would explain how, before implementing a proposed action, certain measures would be planned and implemented to mitigate adverse environmental impacts.

Table 4–54 summarizes potential mitigation measures that are discussed in more detail in the following sections. The table identifies a series of potential mitigation measures in the first column, and in the remaining columns, those environmental resource areas that could benefit from the potential mitigation measure. In general, activities associated with construction and operation of plutonium facilities would follow standard practices such as BMPs for minimizing impacts on environmental resources as required by regulation, permit, or guidelines. No potential adverse impacts have been identified that would require additional mitigation measures beyond those required by regulation or achieved through BMPs, as discussed in previous sections of this chapter. For any alternative, stewardship practices that are protective of the air, water, land, and other natural and cultural resources affected by DOE operations would be implemented in accordance with an environmental management system established pursuant to DOE Order 436.1, *Departmental Sustainability*, which was prepared to incorporate the requirements of Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*.

Table 4–54 Potential Mitigation Measures [a]

Mitigation Measure	*Resource Area*											
	Land Use and Visual Resources	*Geology and Soils*	*Water Resources*	*Air Quality and Noise*	*Ecological Resources*	*Human Health*	*Cultural Resources*	*Socioeconomics*	*Infrastructure*	*Waste Management*	*Transportation*	*Environmental Justice*
Potential Mitigation Measures During Facility Construction												
Use of existing facilities in industrial areas [b]	●	●	●	●	●		●		●	●		
Erosion and sediment control plans		●	●		●							
Sequencing or scheduling of work		●		●	●			●	●		●	
Spill prevention control and countermeasures		●	●			●				●		●
Use of low-sulfur, more-refined fuels				●	●	●						●
Dust suppression measures		●		●	●	●						
High-efficiency particulate air filters, ventilation systems				●	●	●						●
Silencers/mufflers, hearing protection programs				●		●						
Preconstruction characterization/surveys of site		●	●		●		●					
Personal protective equipment				●		●						
Potential Mitigation Measures During Facility Operations												
Water conservation practices			●						●	●		
Spill prevention control and countermeasures		●	●		●	●				●		
Personal protective equipment				●		●						
Confinement and shielding systems				●		●						
Ventilation and filter systems			●	●	●	●						
Emergency preparedness and response plans						●					●	●
Radiological Protection and As Low As Reasonably Achievable Program						●						
High-efficiency electric equipment/off-peak use									●			
Pollution prevention and waste minimization									●	●	●	
Public outreach and training						●						●
Scheduling								●	●		●	

[a] This *SPD Supplemental EIS* does not quantitatively analyze activities for deactivation and decommissioning of facilities.

[b] If implemented under the MOX Fuel, H-Canyon/HB-Line to DWPF, or WIPP Alternatives, PDC would be constructed largely within existing facilities at K-Area. If implemented under any alternative, PDCF would be new construction at F-Area collocated with MFFF. Implementing the immobilization capability under the Immobilization to DWPF Alternative would involve limited new construction at K-Area. H-Canyon/HB-Line and DWPF are operational facilities at H- and S-Areas, respectively, while PF-4 is an operational facility at LANL.

4.9.1 Land Use and Visual Resources

Several measures could be considered for mitigating impacts on land use and visual resources, including the following:

- The requirements of the site land use and permitting process would be followed.
- Existing facilities and buildings would be used whenever possible, such as H-Canyon/HB-Line, DWPF, and the K-Area Complex at SRS, and PF-4 at LANL, or facilities already under construction, such as MFFF.
- The disturbance of new land at SRS would be largely limited to areas already designated for industrial use (e.g., F- and K-Areas).
- Connected actions and interdependent facilities would be collocated to reduce land disturbance at SRS (e.g., WSB located adjacent to MFFF; if constructed, PDCF located adjacent to MFFF).
- Existing infrastructure and rights-of-way would be used at SRS and LANL.
- An environmental supervisor may be designated for construction activities to ensure protection of vegetation and adherence to ground disturbance limits.
- Restoration and landscaping of open areas would occur upon completion of construction-related activities.

In addition, impacts on visual resources could be mitigated by using soil berms and vegetation to screen buildings and roadways, reducing building sizes and stack heights, or using directional or lower intensity exterior lighting.

4.9.2 Geology and Soils

Facility construction or modification may disturb soil. At all areas at SRS or LANL used for construction or facility modification, adherence to BMPs for soil erosion and sediment control during land-disturbing activities would minimize soil erosion and loss. In general, limiting the amount of time soils are exposed, limiting the area disturbed during any phase of a construction project, and applying protective coverings to denuded areas during construction (e.g., mulching and/or geotextiles) until such time as disturbed areas could be revegetated or otherwise covered by facilities would reduce the potential for soil loss. Soil loss would be further reduced by the use of appropriate sedimentation and erosion control measures as weather conditions dictate, including silt fences, earth dikes, velocity dissipaters, drainage swales, sediment traps, check dams, temporary or permanent sediment basins, sod stabilization, temporary reseeding, vegetative buffer strips, protection of trees, and preservation of mature vegetation. Stockpiles of soil removed during construction would be covered with a geotextile or temporary vegetative covering and enclosed by a silt fence to prevent loss by erosion.

4.9.3 Water Resources

The locations for new facilities at SRS were selected to avoid the disturbance of wetlands or other surface water bodies. In addition, there would be no direct discharge of effluents to surface waters or groundwater during facility construction or operations; therefore, no appreciable impacts on water quality are expected.

Wastewater from construction at SRS would be collected, temporarily stored, treated, and/or disposed of as required by SCDHEC regulations. All sanitary wastewater from operations would be treated at the SRS CSWTF before being released under existing NPDES permits, minimizing impacts on surface waters.

Potential impacts from stormwater discharges during construction would be mitigated by compliance with the SWPPP required by SCDHEC to receive a construction general permit. SWPPP practices might include, but not necessarily be limited to, use of appropriate sedimentation and erosion control measures, such as those summarized in Section 4.9.2.

Surface waters would be protected from spills of hazardous materials by the development and implementation of Spill Prevention, Control, and Countermeasure and Oil Removal Contingency Plans in instances where hazardous materials are being handled. These plans would include provisions for storage of hazardous materials and refueling of construction equipment within the confines of protective berms, secondary containment, recovery plans, and notification and activation protocols. Spills would also be reduced by keeping vehicles and equipment in good working order to prevent oil and fuel leaks, and by training to reduce spills resulting from human error.

Groundwater use for facility construction and operations would be well within available SRS capacity; therefore, no mitigation would be required. Water conservation practices (e.g., using rainwater for irrigation) would be implemented as part of LEED certification.

At LANL, modifications to PF-4 would not result in direct discharge of effluents to surface waters or groundwater. Wastewater would be collected, treated, and disposed of in accordance with existing capabilities and regulatory requirements. Surface waters would be protected by implementing the same types of mitigation measures as those described above for SRS.

Although groundwater use for facility modification and operations would be within available LANL capacity, the total water demand within LANL and Los Alamos County has increased in recent years. Water reduction goals at LANL include reducing the use of potable water by at least 16 percent of the 2007 level by fiscal year 2015 (DOE 2011g). As addressed in Chapter 3, Section 3.2.9, NNSA has initiated a number of conservation and water-reuse projects at LANL, including installation of systems intended to gather data on water usage for various site applications.

4.9.4 Air Quality and Noise

At both SRS and LANL, construction or modification of facilities or capabilities under all alternatives would result in some emissions of criteria and hazardous air pollutants, of which particulate matter would be a primary concern. Construction equipment criteria pollutant emissions would be minimized by using more-refined fuels (e.g., low-sulfur diesel fuel) and by maintaining equipment to ensure that emissions control systems and other components are functioning at peak efficiency. Soils and unconsolidated sediments exposed in excavations and slope cuts during new facility construction would be subject to wind or rain erosion if left exposed. In addition, fugitive dust emissions would result from land disturbed by heavy equipment and motor vehicles, causing suspension of soil particles into the air. Construction emissions would be mitigated using water and/or surfactants to control dust emissions from exposed areas, revegetation of exposed areas, watering of roadways, and minimizing construction activities under dry or windy conditions. No open burning would be conducted.

Facility operations would result in airborne emissions of various pollutants, including radionuclides, and organic and inorganic constituents. These emissions would be controlled using Best Available Control Technology to ensure that emissions are compliant with applicable standards. Impacts would be mitigated by use of glovebox confinement and air filtration systems (e.g., double HEPA filters, sand filters) to remove radioactive particulates before discharging process exhaust air to the atmosphere, and internal scrubbers to reduce chemical gas concentrations.

Construction and operations workers could be exposed at both sites to noise levels higher than acceptable limits, particularly for confined areas, as specified in Occupational Safety and Health Administration noise regulations. DOE has implemented hearing protection programs that meet or exceed Occupational Safety and Health Administration standards to minimize noise impacts on workers. These include the use of standard silencing packages on construction equipment, sequencing and scheduling work shifts, administrative controls, engineering controls, and personal hearing protection (DOE 1999b).

At SRS, noise impacts on the public would be mitigated by locating the plutonium facilities away from SRS boundaries. Noise impacts on ecological resources would be mitigated by locating the facilities away from ecologically sensitive areas. At LANL, there would be some temporary additional noise from modification of PF-4, much of it due to additional worker traffic. Subsequent operation of PF-4 would not increase noise levels over existing activities, although there could be some additional noise due to additional worker traffic to support additional activities.

4.9.5 Ecological Resources

At SRS, ecological impacts during facility construction would be mitigated using techniques such as avoidance of undisturbed habitat and timing land-disturbing activities to avoid the breeding period of wildlife and the migration period in the case of migratory avifauna. The selected sites for construction of new facilities would be predominantly in previously disturbed or developed areas. The new facility construction would not be located near ecologically sensitive areas harboring threatened or endangered species.

Clearing of vegetation would be conducted in accordance with the *Natural Resources Management Plan for the Savannah River Site* developed by the U.S. Forest Service (DOE 2005b). Compliance with this plan would minimize impacts on ecological resources. Following construction, the cleared and graded areas not covered with facilities, parking lots, or roads would be landscaped. This landscaping would provide habitat for some wildlife species, mitigating some loss of habitat caused by construction.

Implementation of soil erosion and sediment control and SWPPPs would prevent runoff and dust from entering sensitive habitats and nearby streams. Construction disturbance of nearby streams would be avoided. Accidentally scarred or damaged trees would be replaced consistent with the *Natural Resources Management Plan for the Savannah River Site* (DOE 2005b). Construction crews would also receive environmental briefings, as appropriate, to alert them to nearby ecologically sensitive areas.

At LANL, although some ground disturbance may occur as part of installation of a construction trailer and a temporary parking area, the Permit Requirements Identification process would be used to ensure that all permits are in place and no natural resources are impacted. Erosion and runoff control measure would be implemented. Detailed resource maps would be used with global positioning system overlays to evaluate the impacts of alternative sites for the trailer and parking area. TA-55 is a well characterized industrial area, and priority would be given to previous trailer locations, where pads already exist along with adequate parking and utility access (LANL 2013a). Threatened and endangered species would be protected in accordance with the LANL *Threatened and Endangered Species Habitat Management Plan* (LANL 2011a).

4.9.6 Human Health and Safety

At SRS and LANL, construction workers would be limited to a radiological dose of 100 millirem per year because they are categorized as members of the public. Potential exposure from excavation of contaminated soil would be prevented by sampling the soil for radioactive contamination before excavation begins. If contaminated soil is discovered, appropriate techniques would be applied in accordance with an Operations and Management Plan to remediate the conditions and ensure worker safety.

Several features have been incorporated into the design of the proposed plutonium disposition facilities to mitigate radiation exposures to workers and the public. These include, but are not limited to, confinement (e.g., gloveboxes), shielding, ventilation, and air filtration systems.

At both sites, mitigation measures to ensure radiation protection would include formal analysis by workers, supervisors, and radiation protection personnel of methods to reduce exposure of workers to the lowest practicable level. For all activities involving radiation work, the principle of maintaining ALARA doses would be followed. Examples of ALARA measures include minimizing time spent in high-radiation areas, maximizing distances from sources of radiation, using shielding, and/or reducing the radiation source. The radiological limit for an individual worker is 5,000 millirem per year; as part of the ALARA program, however, the maximum dose to a worker involved in operations would be kept below the DOE Administrative Control Level of 2,000 millirem per year (10 CFR Part 835).

SRS adheres to programs used to ensure mitigation of human health and safety impacts to the maximum extent practicable. The Radiological Protection Program provides mitigation by ensuring that radiological exposures and doses to all personnel are maintained to ALARA levels and by providing job-specific instructions in job hazard analyses to the facility workers regarding the use of personal protective equipment. The Emergency Preparedness Program mitigates accident consequences by ensuring that appropriate organizations (e.g., fire department, operations, medical, and security) are available to respond to emergency situations and take appropriate actions to recover from anticipated events while reducing the spread of contamination and protecting facility personnel and the public (WSRC 2007h:8-142).

At LANL, a Health, Safety, and Radiation Protection Program is conducted addressing the possible impacts that could result from working with ionizing radiation, hazardous and chemical materials, and biohazard materials. An Emergency Management and Response Program combines Federal and local emergency response capabilities and provides planning, preparedness, and response capabilities that can aid in containing and remediating the effects of accidents or adverse operational impacts. A Fire Protection Program ensures that personnel and property are adequately protected against fire or related incidents (DOE 2008f: 5-26).

At both SRS and LANL, occupational safety risks to workers would be mitigated by adherence to Federal and state laws; Occupational Safety and Health Administration regulations; DOE requirements including regulations and orders; and plans and procedures for performing work. DOE regulations addressing worker health and safety include 10 CFR Part 851, "Worker Safety and Health Program," and 10 CFR Part 850, "Chronic Beryllium Disease Prevention Program." Workers are protected from specific hazards by training, monitoring, use of personal protective equipment, and administrative controls (i.e., job hazard analyses).

4.9.7 Cultural Resources

As described in Section 4.1.7.6, archaeological surveys were previously performed at SRS in anticipation of PDCF being constructed. At both SRS and LANL, current surveys would be performed before necessary land disturbance associated with new construction. DOE could mitigate potential impacts by locating laydown yards on previously disturbed land to avoid known archaeological sites. If the site cannot be avoided, a data recovery plan for impact mitigation would be developed and approved for implementation by the South Carolina and New Mexico SHPOs. Given the highly disturbed areas proposed for construction, in the unlikely event of a cultural resources discovery, it would be handled in accordance with 36 CFR 800.11 (for historic properties) and 43 CFR 10.4 (for American Indian human remains, funerary objects, objects of cultural patrimony, and sacred objects), as required. Mitigation actions would also conform to the terms of the programmatic memorandums of agreement in place at SRS (SRARP 1989:Appendix C) and LANL (DOE 2006b). Further, implementing requirements and procedures would be followed in accordance with applicable SRS and LANL Cultural Resources Management Plans (DOE 2005a, 2006b; LANL 2006c; SRARP 1989).

4.9.8 Infrastructure

Under the *SPD Supplemental EIS* alternatives, new plutonium facilities would be constructed, or existing facilities modified, in areas with existing utility infrastructure. At both SRS and LANL, under all alternatives, consumption of energy, fuel, and water resources would be within the capabilities of the existing infrastructure. Impacts on the regional electrical grid would be minimized by incorporating high-efficiency motors, pumps, lights, and other energy-saving equipment into the design of new facilities, and by scheduling some operations during off-peak times. Impacts on water use would be mitigated by using water-conserving processes and equipment. Impacts on fuel use would be mitigated by using fuel-efficient processes, equipment, and vehicles (e.g., hybrids).

Pursuant to DOE Order 436.1, *Departmental Sustainability*, and Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance,* DOE has established goals for energy efficiency and water conservation improvements at DOE sites, including reductions in energy and potable water consumption, use of advanced electric metering systems, use of sustainable building materials and practices, and use of innovative renewable and clean energy sources (DOE 2010a). Working to implement these goals by incorporation of LEED principles would further reduce impacts on site infrastructure.

4.9.9 Waste Management

Waste management impacts would primarily be mitigated through waste minimization efforts designed to minimize the volumes and hazardous nature of waste generated for shipment to offsite locations. The No Action Alternative provides the lowest projected cumulative waste generation in the short term, but waste generation is expected to increase over the long term when the plutonium is removed from storage for permanent disposition.

In response to the Hazardous and Solid Waste Amendments of 1984 and the Pollution Prevention Act of 1990, DOE has implemented successful pollution prevention and waste minimization programs at SRS and LANL.[22] Although some of the plutonium facilities are still being constructed, or are in the early stages of engineering and design, the program would integrate pollution prevention practices that include waste stream minimization, source reduction and recycling, and procurement processes that preferentially procure "green" products made from recycled materials (i.e., sustainable acquisition). The facility designs would minimize the size of radiologically controlled areas, thereby minimizing generation of radioactive waste. To the extent practicable, the facilities would not use solvents regulated by the Resource Conservation and Recovery Act, minimizing the generation of hazardous and mixed wastes. Wastewater would be recycled to the extent possible to minimize effluent discharge (DOE 1999b).

Additional waste minimization or mitigation may be required for the volumes of CH-TRU waste that could be generated under some alternatives. Particularly under the WIPP Alternative, the maximum volume of CH-TRU waste projected to be generated could exceed WIPP's unsubscribed CH-TRU waste disposal capacity. Implementing this volume of waste would require mitigative actions such as waste volume reduction and/or statutory amendment. Projected waste volumes could be reduced by modifying processing or packaging methods. In addition, following removal of legacy TRU waste from storage at LANL for shipment to WIPP, the future TRU waste storage capacity at LANL is expected to be smaller than the current capacity. Careful planning may be needed to expedite the throughput of TRU waste within TA-55 facilities and to characterize, package, and ship this TRU waste to WIPP.

4.9.10 Transportation

Measures that could be used to mitigate transportation impacts include transporting materials and wastes only during periods of light traffic volume, providing vehicle escorts, avoiding high-population areas, avoiding high-accident areas, and training drivers and emergency response personnel. As described in Appendix E, Section E.4, the Department of Homeland Security is responsible for coordinating the response to accidents involving radioactive materials and waste, with DOE maintaining many of the resources that would be used if such an event were to occur.

4.9.11 Environmental Justice

No mitigation measures are expected to be necessary under any of the alternatives because no disproportionately high and adverse impacts on minority or low-income populations have been identified.

[22] *Impetus was given to the DOE pollution prevention and waste minimization program by the October 5, 2009, Executive Order 13514,* Federal Leadership in Environmental, Energy, and Economic Performance.