uranium, and reactor use are discussed in Chapter 4. The following potential impacts for the no-action alternative and proposed action are considered to be less significant and are discussed in Appendixes G and H: (1) geology, seismology, and soils; (2) noise; (3) ecology; (4) land use; (5) cultural and paleontological resources; (6) infrastructure; and (7) socioeconomics. A summary of the significant or more important potential impacts discussed in Chapter 4 is presented below.

The annual collective dose to members of the public (i.e., those living and working within 80 km [50 mi] of the SRS) produced by routine operation of the proposed MOX facility would be expected to result in a latent cancer fatality (LCF) rate of approximately 0.0009/yr or less. Routine operation of the proposed MOX facility, the PDCF, and the WSB is expected to produce insignificant air quality impacts, and would not cause exceedance of any ambient air quality standards for criteria pollutants at the SRS. However, maximum levels of $PM_{2.5}$ in the vicinity of the SRS already exceed the annual standard of 15 $\mu g/m^3$. Facility construction would contribute temporarily less than 0.1% of this $PM_{2.5}$ standard level, and facility operation would contribute less than 0.01% of this level.

Construction and routine operation of the proposed facilities would not be expected to cause any disproportionately high and adverse impacts to low-income or minority populations in the SRS vicinity. Of the accidents evaluated, a hypothetical explosion accident at the proposed MOX facility had the highest estimated short-term impacts, approximately 50 latent cancer fatalities (LCFs) among members of the off-site public. The same accident also had the highest estimated 1-year exposure impact, approximately 200 LCFs among members of the off-site public. However, it is highly unlikely that such an accident would occur, and the risk to any population, including low-income and minority communities, is considered to be low. However, the communities most likely to be affected by a significant accident would be minority or low income, given the demographics and prevailing wind direction. The extent to which low-income or minority population groups would be affected would depend on the amount of material released and the direction and speed of the wind.

Transportation of uranium and plutonium feedstock materials, transuranic waste, fresh MOX fuel, and spent MOX fuel would result in approximately 3,400,000 km (2,114,400 mi) traveled by 1,548 truck shipments over the operations period of the proposed MOX facility. No LCFs would be expected from the radioactive nature of the cargo. (Estimated LCFs for members of the public and the transportation crews were 0.2 and 0.1, respectively.) One latent fatality from vehicle emissions was estimated, and no fatalities (0.081 fatality) from the physical trauma of potential vehicle accidents was estimated.

Chapter 4 of the DEIS also evaluates the use of MOX fuel in a generic reactor using a 40% MOX fuel core. For both normal operations and design-basis accidents, the impacts of using MOX fuel in a reactor would not be significantly different from the impacts of a reactor using 100% low enriched uranium fuel. For highly unlikely beyond-design-basis accidents, the impacts for a reactor using a 40% MOX fuel core could be up to 14% greater than for a reactor using 100% low enriched uranium fuel. Since no reactor licensee has yet sought the authority to use MOX fuel, the transportation of fresh MOX fuel is also evaluated on a generic basis, using a surrogate reactor located in the Midwest.

Table 2.1. Comparison of alternatives

Impact area	Continued storage (no action)	Proposed action
Human Health Risk		
Construction		
Radiological	Not applicable	Same exposure as SRS employees from existing SRS operations
Chemical	Not applicable	No adverse impacts from inhalation of construction-related emissions
Physical hazards		<1 fatality, 122 injuries annually over 3 to 5 years
Normal Operations		
Radiological (annual impacts)		
• Dose to collective public (person-Sv/yr)	0.029	0.016
• Annual LCFs	0.002	0.0009
• Dose to public MEI (mSv/yr)	0.065	6.1×10^{-5}
• Risk of LCF	4×10^{-6}	4×10^{-9}
• Collective dose to facility workers (person-Sv/yr)	1.4	2.6
• Annual LCFs	0.08	0.2
• Dose to average facility worker (mSv/yr)	$\leq$3.2	< 5
• Risk of LCF	$\leq$0.0002	< 0.0003
Chemical	Insufficient data	No adverse impacts from chemical exposures
Physical hazards	Insufficient data	<1 fatality, 41 injuries annually over 10 years
Accidents		
Radiological		
• Event	Beyond design basis earthquake	Explosion event (short-term exposure)
• Dose to collective public (person-Sv)	6.6	910
• LCFs	0.4	50
Chemical	No data	Large spills of nitrogen tetroxide, hydrazine hydrate, hydroxylamine nitrate or nitric acid could have adverse impact on SRS workers or general public and would require rapid emergency response actions.

The following discussion compares the primary and secondary benefits set forth above to the environmental and economic costs of the proposed action.

Construction and routine operation of the proposed MOX facility would not be expected to cause any disproportionately high and adverse impacts to low income or minority populations in the SRS vicinity. Of the accidents evaluated, a hypothetical explosion accident at the proposed MOX facility had the highest estimated short-term impacts, approximately 50 latent cancer fatalities (LCFs) among members of the off-site public. The same accident also had the highest 1-year exposure impact, approximately 200 LCFs among members of the off-site public. However, it is highly unlikely that such an accident would occur, and the risk to any population, including low-income and minority communities, is considered to be low. However, the communities most likely to be affected by a significant accident would be minority or low income, given the demographics and prevailing wind direction. The extent to which low-income or minority population groups would be affected would depend on the amount of material released and the direction and speed of the wind.

Continued storage of plutonium by the DOE at its present locations would not be expected to produce additional LCFs. (Annual LCFs of approximately 0.002 in the surrounding population of the storage sites [DOE 1999a] were estimated.) The annual collective dose to members of the public (i.e., those living and working within 80 km [50 mi] of the SRS) produced by routine operation of the proposed MOX facility would be expected to result in an LCF rate of approximately 0.0009/yr or less. Therefore, continued storage results in higher annual impacts.

No adverse impacts from chemical exposure of workers at the proposed MOX facility are anticipated. Less than one fatality, and approximately 120 worker injuries per year are anticipated during construction of the proposed facilities. Facility operations would result in about 40 injuries per year and less than one fatality per year.

Routine MOX facility operations are expected to produce insignificant air quality impacts and would not cause any ambient air quality standards for criteria pollutants at the SRS to be exceeded. However, note that maximum levels of $PM_{2.5}$ in the vicinity of the SRS already exceed the annual standard of 15 $\mu g/m^3$. Facility construction would contribute temporarily less that 0.1% of this $PM_{2.5}$ standard level, and facility operation would contribute less than 0.01% of this level.

Water consumption during operation of the proposed facilities would be about 11% of the F-Area groundwater capacity. Impacts to surface water are not expected during facility operations.

Waste management systems at the SRS would not be adversely affected by wastes generated by the proposed MOX facility, PDCF, and the WSB. Adequate storage capacity and handling procedures are in place at the SRS to process hazardous wastes generated during both construction and facility operations. Nonhazardous liquid and solid wastes would not adversely affect operation of the Central Sanitary Waste Treatment Facility at SRS.

Table 4.3. Annual estimated radiological impacts to facility workers, SRS employees, and the public from normal operations at the proposed facilities

Receptor	PDCF		MOX facility		WSB	
	Dose [person-Sv (person-rem)]	Latent cancer fatalities/yr[a]	Dose [person-Sv (person-rem)]	Latent cancer fatalities/yr[a]	Dose [person-Sv (person-rem)]	Latent cancer fatalities/yr[a]
Collective population						
Facility workers	1.97 (197)	0.1	0.15 (15)	0.009	0.50 (50)	0.03
SRS employees (13,295)[b]	0.00031 (0.031)	2×10^{-5}	0.00022 (0.022)	1×10^{-5}	–[c]	–
Public (1,042,000 persons off-site)	0.015(1.5)	0.0009	0.00073 (0.073)	4×10^{-5}	–	–

	PDCF		MOX facility		WSB	
	Dose [Sv (rem)]	LCF risk[d]	Dose [Sv (rem)]	LCF risk[d]	Dose [Sv (rem)]	LCF risk[d]
Maximally exposed individual						
Facility worker	0.020 (2.0)	0.001	0.017 (1.7)	0.001	0.020 (2.0)	0.001
SRS employee (225 m to the ENE)	5.6×10^{-7} (5.6×10^{-5})	3×10^{-8}	4.2×10^{-7} (4.2×10^{-5})	3×10^{-8}	–	–
Public (10,680 m to the N)	5.6×10^{-8} (5.6×10^{-6})	3×10^{-9}	5.2×10^{-9} (5.2×10^{-7})	3×10^{-10}	–	–

[a] Latent cancer fatalities are calculated by multiplying dose by the Federal Guidance Report (FGR) 13 health risk conversion factor of 0.06 fatal cancer per person-Sv (6×10^{-4} fatal cancer per person-rem) (Eckerman et al. 1999).

[b] *Source:* Birch (2001).

[c] Impacts from the WSB are included in the proposed MOX facility results.

[d] For annual individual exposure estimates, number represents the lifetime risk of fatality from a radiologically induced cancer.

PDCF: Average annual worker exposures are expected to remain below 0.005 Sv/yr (0.5 rem/yr), the SRS guideline. For 393 workers, an annual collective dose should not exceed 1.97 person-Sv (197 person-rem) with the potential for 0.1 LCFs/yr of operation. The maximum annual exposure to a single facility worker is expected to be maintained less than the DOE administrative limit of 0.02 Sv/yr (2 rem/yr) (DOE 1994). Such an exposure has an expected lifetime risk of developing a fatal cancer of approximately 0.001 (1 chance in 1,000).

WSB: Average annual worker exposures are expected to remain below 0.005 Sv/yr (0.5 rem/yr), the SRS guideline. For 100 workers, an annual collective dose should not exceed 0.50 person-Sv (50 person-rem) with the potential for 0.03 LCFs/yr of operation. The maximum annual exposure to a single facility worker is expected to be maintained at less than the DOE administrative limit of 0.02 Sv/yr (2 rem/yr). Such an exposure has an expected lifetime risk of developing a fatal cancer of approximately 0.001 (1 chance in 1,000).

SRS Employees

MOX facility and WSB: Normal operations were estimated to result in an annual collective SRS employee dose of 0.00022 person-Sv/yr (0.022 person-rem/yr), which corresponds to approximately 1×10^{-5} LCF/yr. The MEI dose was found to occur at a location 225 m (738 ft) east-northeast of the proposed MOX facility stack location. The MEI was estimated to receive a dose of 4.2×10^{-7} Sv/yr (4.2×10^{-5} rem/yr), which results in an annual fatal cancer risk of 3×10^{-8} (1 chance in 33 million).

PDCF: Normal operations were estimated to result in an annual collective dose of 0.00031 person-Sv (0.031 person-rem) to the SRS employee population, resulting in an estimated 2×10^{-5} LCFs/yr of operation. An MEI located 225 m (738 ft) east-northeast of the facility stack location was estimated to receive an annual dose of 5.6×10^{-7} person-Sv (5.6×10^{-5} person-rem). The resulting lifetime latent cancer fatality is approximately 3×10^{-8} (1 chance in 33 million).

Members of the public

Operation of the facilities is considered to have an insignificant impact on members of the public. Maximally exposed individuals of the public were estimated to receive exposures that are about 10,000 times less than that received from the baseline radiological exposures as discussed in Section 3.10.3.

MOX facility and WSB: For members of the public, operations were estimated to result in an annual collective population dose of 0.00073 person-Sv/yr (0.073 person-rem/yr), which is about 3.2% of the estimated dose received by the public from air emissions from the SRS for the year 2000 (0.023 person-Sv [2.3 person-rem]), as discussed in Section 3.10. The number of expected annual LCFs from operations was estimated to be 4×10^{-5}. The MEI location was determined to be at the SRS fenceline, 10,680 m (35,040 ft) north of the proposed MOX facility stack location. An MEI at this location would receive an estimated annual dose of 5.2×10^{-9}Sv/yr (5.2×10^{-7} rem/yr). This dose corresponds to an annual fatal cancer risk of 3×10^{-10} and is 1.3% of the estimated dose received by the public MEI from air emissions from the SRS for the year 2000 (4×10^{-7} Sv [4×10^{-5} rem]), as discussed in Section 3.10.

PDCF: Normal operations were estimated to result in an annual collective population dose of 0.015 person-Sv (1.5 person-rem) that corresponds to approximately 0.0009 LCFs/yr of operation. Thus, the average member of the public would receive a dose of approximately 1.4×10^{-8} Sv (1.4×10^{-6} rem), with an expected lifetime risk of developing a fatal cancer of 9×10^{-10} (1 chance in 1.1 billion). The pubic MEI was estimated to receive an individual dose of 5.6×10^{-8} Sv (5.6×10^{-6} rem) that has an expected lifetime fatal cancer risk of 3×10^{-9} (1 chance in 330 million).

4.3.1.2 Chemical Exposure and Risk

4.3.1.2.1 Construction

The potential airborne emissions of criteria pollutants (a group of air pollutants for which federal ambient standards exist) from construction of the proposed MOX facility and supporting facilities are summarized in Section 4.3.2.1. Emissions of toxic air pollutants during construction would be very low (less than 1 kg/yr (2 lb/yr) [DCS 2002a]) and would not result in adverse health impacts. The potential ambient concentrations of criteria pollutants at or beyond the SRS boundary resulting from facility construction emissions were modeled. The estimated incremental criteria pollutant levels varied between 0.01% and 7% of the applicable ambient standard levels (see Table 4.5 in Section 4.3.2.1). The incremental annual concentration of $PM_{2.5}$ from construction of the facilities would be 0.24% of the ambient standard. However, the maximum measured annual average concentration of $PM_{2.5}$ in the vicinity of the SRS is already at 144% of the standard. The new primary ambient standard $PM_{2.5}$ level is based on the potential to cause adverse health impacts. Therefore, although the proportion of $PM_{2.5}$ that would be contributed to the annual average level by construction of the proposed facilities would be very small, measures to further minimize particulate emissions (and the potential for adverse health impacts) would be taken wherever possible.

Wastewater generated during construction would be transported to the SRS Central Sanitary Waste Treatment Facility for treatment (DCS 2002a). No adverse impacts from human exposure to contaminants in wastewater effluents are expected from the construction of the facilities.

Hazardous wastes generated during construction would be shipped off-site to permitted commercial recycling, treatment, and disposal facilities. Exposure to hazardous materials used during construction (e.g., paints, solvents) could be kept to a minimum by following good engineering practices, such as ensuring good ventilation and cleaning up small chemical spills as soon as they occur.

assumed to be condemned; all locally grown food was assumed to have been consumed.

- *General population:* All members of the public within an 80-km (50-mi) radius of the site where the accident might occur. Short-term and 1-year impacts to the general population were assessed on the basis of the same exposure pathways as for the public, or off-site, MEI.

During an accident, facility workers might be subject to severe physical and thermal (fire) forces and could be exposed to releases of chemicals and radiation. The risk to the facility workers would be very sensitive to the specific circumstances of each accident and would depend on how rapidly the accident developed, the exact location and response of the workers, the direction and amount of the release, the physical and thermal forces causing or caused by the accident, meteorological conditions, and characteristics of the room or building if the accident occurred indoors. Quantitative facility worker accident impacts are not provided in this DEIS. For most events, the applicant has conservatively assumed that consequences to the facility worker MEI would exceed the applicable performance requirements in 10 CFR 70.61 and has identified preventive or mitigative features in the facility's design basis in order to meet the performance requirements. However, it is recognized that worker injuries and fatalities would be possible from chemical, radiological, thermal, and physical forces if an accident did occur.

Impacts: Estimated radiological impacts from the four hypothetical accident scenarios considered are presented in Tables 4.13, 4.14, and 4.15 and are discussed below. While the consequences of many of these accidents are significant, the likelihood of significant accidents will be very low (highly unlikely) through the use of safety systems discussed in DCS's Construction Authorization Request. Thus, the overall risk of significant accidents is now considered to be low.

SRS employee population: SRS employees were assumed to be unshielded from the passing plume of airborne radioactivity released during an accident. The impacts for the collective SRS employee population given in Table 4.13 were estimated for inhalation and external radiation exposure. External radiation exposure consisted of cloudshine and groundshine. Groundshine exposure was evaluated for 8 hours following an accident and was negligible, less than approximately 0.02% of the total dose, in all cases. The impacts presented in Table 4.13 are the highest potential impacts to the SRS employee population and were found to occur in the direction of the major F-Area facilities, toward the south-southwest. The dominant exposure pathway was inhalation for all accidents except for the hypothetical criticality events. For those hypothetical criticality events, exposure to cloudshine was estimated to account for approximately 70% of the collective dose; the remaining dose was estimated to result from inhalation.

The SRS employee MEI was estimated to receive a maximum dose, 0.68 Sv (68 rem), from the explosion event at the proposed MOX facility. This dose was from the inhalation pathway. For this dose, the chance of developing a latent fatal cancer was estimated to be 0.04 (about 1 chance in 25). SRS employee MEI impacts for all accidents considered are presented in Table 4.13.

Table 4.13. Estimated human health radiological impacts to SRS employees from hypothetical facility accidents

	SRS employee MEI			SRS employee population		
Facility/accident	Dose [Sv (rem)]	Chance of LCF[a]	Major exposure pathway	Dose [person-Sv (person-rem)]	Chance of LCF[a]	Major exposure pathway
Pit Disassembly and Conversion Facility						
Criticality	0.00070 (0.070)	4×10^{-5}	External	0.062 (6.2)	0.004	External
Earthquake	4.0×10^{-5} (0.0040)	2×10^{-6}	Inhalation	0.023 (2.3)	0.001	Inhalation
Explosion	0.00033 (0.033)	2×10^{-5}	Inhalation	0.19 (19)	0.01	Inhalation
Fire	1.2×10^{-6} (0.00012)	7×10^{-8}	Inhalation	0.00071 (0.071)	4×10^{-5}	Inhalation
Leak/spill	4.0×10^{-7} (4.0×10^{-5})	2×10^{-8}	Inhalation	0.00023 (0.023)	1×10^{-5}	Inhalation
Tritium release	0.026 (2.6)	0.002	Inhalation	18 (1,800)	1	Inhalation
Proposed MOX Facility						
Criticality	0.023 (2.3)	0.001	External	3.0 (300)	0.2	External
Explosion	0.68 (68)	0.04	Inhalation	390 (39,000)	20	Inhalation
Internal fire	0.026 (2.6)	0.002	Inhalation	15 (1,500)	0.9	Inhalation
Load handling	0.0010 (0.10)	6×10^{-5}	Inhalation	0.60 (60)	0.04	Inhalation
Waste Solidification Building						
Fire	0.022 (2.2)	0.001	Inhalation	11 (1,100)	0.7	Inhalation
Hydrogen explosion	0.093 (9.3)	0.006	Inhalation	49 (4,900)	3	Inhalation
Loss of confinement	0.040 (4.0)	0.002	Inhalation	20 (2,000)	1	Inhalation

[a] Latent cancer fatalities are calculated by multiplying dose by the FGR 13 health risk conversion factor of 0.06 fatal cancer per person-Sv (6×10^{-4} fatal cancer per person-rem) (Eckerman et al. 1999). Values are rounded to one significant figure.

Table 4.14. Estimated human health radiological impacts to the collective off-site public from hypothetical facility accidents

Facility/accident	Short-term exposure: Dose [person-Sv (person-rem)]	Short-term exposure: Fatalities (LCFs)[a]	Short-term exposure: Major exposure pathway	1-year exposure: Dose person-Sv (person-rem)]	1-year exposure: Fatalities (LCFs)[a]	1-year exposure: Major exposure pathway
Pit Disassembly and Conversion Facility						
Criticality	0.048 (4.8)	0.003	External	0.13 (13)	0.008	Ingestion
Earthquake	0.054 (5.4)	0.003	Inhalation	0.16 (16)	0.01	Ingestion
Explosion	0.44 (44)	0.03	Inhalation	1.3 (130)	0.08	Ingestion
Fire	0.0017 (0.17)	0.0001	Inhalation	0.0049 (0.49)	0.0003	Ingestion
Leak/spill	0.00053 (0.053)	3×10^{-5}	Inhalation	0.0016 (0.16)	0.0001	Ingestion
Tritium release	42 (4,200)	3	Inhalation	1,800 (180,000)	100	Ingestion
Proposed MOX Facility						
Criticality	1.3 (130)	0.08	Inhalation	9.6 (960)	0.6	Ingestion
Explosion	910 (91,000)	50	Inhalation	2,700 (270,000)	200	Ingestion
Internal fire	36 (3,600)	2	Inhalation	110 (11,000)	7	Ingestion
Load handling	1.4 (140)	0.08	Inhalation	4.1 (410)	0.2	Ingestion
Waste Solidification Building						
Fire	26 (2,600)	2	Inhalation	26 (2,600)	2	Inhalation
Hydrogen explosion	110 (11,000)	7	Inhalation	320 (32,000)	20	Ingestion
Loss of confinement	49 (4,900)	3	Inhalation	140 (14,000)	8	Ingestion

[a] Latent cancer fatalities are calculated by multiplying dose by the FGR 13 health risk conversion factor of 0.06 fatal cancer per person-Sv (6×10^{-4} fatal cancer per person-rem) (Eckerman et al. 1999). Values are rounded to one significant figure.

Table 4.15. Estimated human health radiological impacts to the maximally exposed member of the public from hypothetical facility accidents

Facility/accident	Short-term exposure Dose [mSv (mrem)]	Short-term exposure Chance of LCF[a]	Short-term exposure Major exposure pathway	1-year exposure Dose [mSv (mrem)]	1-year exposure Chance of LCF[a]	1-year exposure Major exposure pathway
Pit Disassembly and Conversion Facility						
Criticality	0.0038 (0.38)	2×10^{-7}	External	0.012 (1.2)	7×10^{-7}	Ingestion
Earthquake	0.0011 (0.11)	7×10^{-8}	Inhalation	0.0023 (0.23)	1×10^{-7}	Inhalation/Ingestion
Explosion	0.0094 (0.94)	6×10^{-7}	Inhalation	0.019 (1.9)	1×10^{-6}	Inhalation/Ingestion
Fire	3.5×10^{-5} (0.0035)	2×10^{-9}	Inhalation	7.1×10^{-5} (0.0071)	4×10^{-9}	Inhalation/Ingestion
Leak/spill	1.2×10^{-5} (0.0012)	7×10^{-10}	Inhalation	2.3×10^{-5} (0.0023)	1×10^{-9}	Ingestion
Tritium release	0.90 (90)	5×10^{-5}	Inhalation	66 (6,600)	0.004	Ingestion
Proposed MOX Facility						
Criticality	0.098 (9.8)	6×10^{-6}	External	0.66 (66)	4×10^{-5}	Ingestion
Explosion	20 (2,000)	0.001	Inhalation	39 (3,900)	0.002	Inhalation/Ingestion
Internal fire	0.79 (79)	5×10^{-5}	Inhalation	1.6 (160)	0.0001	Inhalation/ingestion
Load handling	0.030 (3.0)	2×10^{-6}	Inhalation	0.061 (6.1)	4×10^{-6}	Inhalation/ingestion
Waste Solidification Building						
Fire	0.54 (54)	3×10^{-5}	Inhalation	0.69 (69)	4×10^{-5}	Inhalation
Hydrogen explosion	2.4 (240)	0.0001	Inhalation	4.8 (480)	0.0003	Inhalation/ingestion
Loss of confinement	1.0 (100)	6×10^{-5}	Inhalation	2.1 (210)	0.0001	Inhalation/Ingestion

[a] Latent cancer fatalities are calculated by multiplying dose by the FGR 13 health risk conversion factor of 0.06 fatal cancer per person-Sv (6×10^{-4} fatal cancer per person-rem) (Eckerman et al. 1999). Values are rounded to one significant figure.

Members of the public: As discussed above, impacts to the public were assessed for a short-term period immediately following the accident and for a 1-year exposure period following the accident that includes the short-term exposures. With the exception of nuclear criticality accident events, inhalation was the dominant exposure pathway for the public in the short term. Maximum inhalation doses would occur to the west-northwest of the SRS and would be more than 100 million times any external exposure. For the 1-year exposure to the public, the ingestion pathway was the dominant exposure pathway. The highest potential 1-year ingestion dose would be to the southwest of the SRS. Inhalation would account for the remainder of the dose except in the case of the criticality accidents where external exposure and inhalation make up the balance of the dose. Further details of the accident risk analysis are given in Appendix E.

The hypothetical explosion accident at the proposed MOX facility was estimated to result in the largest short-term exposure. An estimated collective dose of 910 person-Sv (91,000 person-rem) was projected to be received by a population of approximately 309,900 persons extending out to 80 km (50 mi) to the west-northwest of the proposed MOX facility. The average individual dose was projected to be approximately 2.9 mSv (290 mrem), about 80% of the value an individual would receive on an annual basis from existing natural and man-made sources in the SRS vicinity. However, persons living closer to the accident location would receive a higher dose on average as discussed below for the hypothetical public MEI. The collective population dose received from this accident is estimated to have a risk of an additional 50 LCFs in the affected population.

The largest 1-year collective population dose was estimated to be 2,700 person-Sv (270,000 person-rem), again from the hypothetical explosion accident at the proposed MOX facility. This impact was calculated for winds blowing toward the southwest, where 18,010 people reside. However, only 37 person-Sv (3,700 person-rem) of this dose results from inhalation. The remainder of the dose is attributable to ingestion of contaminated food. For the purposes of this DEIS, all contaminated food that would be grown in the affected area is assumed to be eaten. Because the amount of contaminated food exceeds the amount that would be consumed by persons living within the affected area, it is further assumed that some of the contaminated food would be shipped out of the region and consumed by persons living outside the region. Therefore, the collective dose estimated above includes doses to persons both within the affected area and outside the region. As shown in Table 4.15, the public MEI was estimated to receive a dose of 0.039 Sv (3.9 rem) for this hypothetical accident, based on individual consumption rates presented in Appendix E. Assuming that all 18,010 persons received the MEI dose, which would be an overestimate of the dose, the corresponding collective dose would be about one-quarter of the total collective dose estimated above. Therefore, the people living within the affected area would receive less than one-quarter of the collective dose estimated above.

As discussed below, no interdiction of contaminated food was assumed in the analysis of doses to the public during the 1-year post-accident exposure period. The current FDA recommendations (FDA 1998) include a protective action guide (PAG) of 5 mSv (0.5 rem) committed effective dose equivalent (CEDE) and 50 mSv (5 rem) committed dose equivalent to a individual tissue or organ, whichever is more limiting. These intervention levels of dose are radiation doses at which protective actions should be considered. The maximum public MEI dose of 0.039 Sv (3.9 rem) would exceed the FDA PAG of 5 mSv (0.5 rem) CEDE.

Impacts were assessed for an MEI living at the SRS boundary for both short-term and 1-year exposures. In both cases, maximum impacts were found to occur to a hypothetical individual located 9,070 m (5.6 mi) northwest of the facilities. As shown in Table 4.15 , the highest estimated dose to the public MEI was 20 mSv (2,000 mrem) in the short term from inhalation exposure from a hypothetical explosion accident at the proposed MOX facility. The maximum 1-year exposure accident impacts were estimated to result from the hypothetical tritium release from the PDCF. An exposure of 66 mSv (6,600 mrem) was estimated, with 0.90 mSv (90 mrem) from the inhalation pathway and the remainder from the ingestion pathway. The resulting health effects for the public MEI in the short term and after 1 year were estimated to be a chance of contracting a latent fatal cancer over their lifetime of 0.001 (1 chance in 1,000) and 0.004 (about 1 chance in 250), respectively.

Should an accident occur, potential nearby receptors would be the most vulnerable immediately after the event because they might not be aware of the accident and might not receive notification in time to take protective actions. However, those individuals farther from an accident would be more likely to receive notification in time and would be in a position to reduce doses by taking protective actions. The consequences reported here assume that no protective actions are taken. Protective actions include sheltering or evacuation in the short-term and the banning of locally grown food in the long-term. Further, the results presented here are based on the assumption that an accident occurs immediately before harvest. This is a conservative assumption because the direct deposition of radioactivity on crops would cause the highest ingestion exposures. In addition, this analysis assumes that individuals are not sheltered during the accident and passing of the radioactive plume. Thus, the estimated accident impacts presented in this DEIS are considered to bound future possible outcomes.

The radiological risks of accidents described in this DEIS are considered to be low because either the likelihood of these accidents would be significantly diminished, or sufficient controls would be applied to ensure the dose consequences are much lower than those presented here. The requirements to reduce the risk of accidents that could result in high consequences are contained in the NRC's regulations in 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material," and the DOE's 10 CFR Part 830 "Nuclear Safety Management." In order to obtain a license to possess and use special nuclear material from the NRC, for example, the applicant must show that the risk of each credible high-consequence event is limited through the use of engineered controls, administrative controls, or both. Pursuant to this and other performance requirements, mitigation measures identified in Chapter 5 of this DEIS include those controls identified by the applicant to reduce the risks of potential accidents.

4.3.5.3 Chemical Human Health Risk

An analysis of potential impacts from accidental chemical releases was conducted. The analysis considered maximum inventories of stored chemicals at the proposed facilities and each chemical's physical characteristics (e.g., volatility) and its toxic concentration levels. Liquid storage containers with the largest chemical inventories were assumed to be punctured (e.g., by a forklift), resulting in a spill of the entire chemical contents of the container on an outdoor concrete surface. For conservatism, it was assumed that the spill would occur onto an

4.3.7.2 Impacts of the No-Action Alternative

For all the storage sites, radiological and nonradiological risks from continued storage of surplus plutonium would be small regardless of the racial and ethnic composition of the populations surrounding the sites, and independent of the economic status of individuals constituting the populations. Continued storage would have no disproportionately high and adverse effects on minority or low-income populations.

4.3.7.3 Impacts of the Proposed Action

4.3.7.3.1 Construction

No radiological risks and only very low chemical exposure and risk are expected during construction. Chemical exposure would be limited to toxic air pollutants released at levels below applicable standards and would not result in any high adverse health impacts. Because the health impacts on the general population within the 80-km (50-mi) assessment area during construction would be negligible, impacts on the minority and low-income population would not be significant.

4.3.7.3.2 Routine Operations

Radiological impacts to the general public during routine operation of the proposed facilities would be minimal and would not cause any adverse health impacts. The facilities are expected to produce an annual latent cancer risk of approximately 1 in 250 million for the MEI member of the public. The annual collective dose to members of the public living and working within 80 km (50 mi) of SRS associated with the facilities is expected to produce an LCF risk of approximately 0.0009 or less. In addition, no surface releases that might enter local streams or interfere with subsistence activities by low-income or minority populations are expected to occur. Because the health impacts of routine operations on the general public would be negligible, there would be no disproportionately high adverse impact on low-income or minority population groups within the 80-km (50-mi) assessment area.

4.3.7.3.3 Accidents

An explosion release at the proposed MOX facility has the potential for causing up to 200 latent cancer fatalities in the area surrounding SRS. However, it is highly unlikely that such an accident would occur. Therefore, the risk to any population, including low-income and minority communities, is considered to be low. In the unlikely event of an accident at the proposed MOX facility, the PDCF, or the WSB, the communities most likely affected would be minority or low income, given the demographics within 80 km (50 mi) of the proposed MOX facility.

In the event that accidents producing significant contamination occurred, appropriate measures would be taken to ensure that the impacts to low-income and minority populations would be minimized (see Section 5.2.11). The extent to which low-income or minority population groups would be affected would depend on the amount of material released and the direction and speed at which airborne material was dispersed from the facility by the wind. Although the overall risk would be very small, the greatest short-term risk of exposure following an airborne release would be to the population located to the west-northwest of SRS, while the greatest one-year risk would be to population groups residing to the southwest of the site. Airborne releases following an accident would likely have a larger impact area than would an accident that released contaminants directly onto the soil surface. A surface release entering local streams could temporarily interfere with subsistence activities by low-income and minority populations located within a few kilometers downstream of SRS.

Monitoring of contaminant levels in soil and surface water following an accident would provide the public with information on the extent of any contaminated areas. Analysis of contaminated areas to decide how to control use of high health risk areas would reduce the potential impact to local residents.

4.3.7.3.4 Decommissioning

Impacts of decommissioning are not expected to disproportionally affect low income or minority populations in the SRS vicinity. A detailed analysis of impacts would be prepared by DOE in a NEPA document specifically on decommissioning and site closure if plans call for full decommissioning of the facilities. Important elements of the environmental analysis in the DOE NEPA document would likely address the disposal process and locations of disposal sites for structural materials and facility components resulting from decommissioning.

4.3.8 Sand Filter Technology Option

Sand filters are air filtration systems used to prevent the release of radioactive material from nuclear facilities to the atmosphere. In a sand filter, the airborne radioactive material is forced through large beds of stone, gravel, and sand that capture and retain radioactive material. Filtered air is discharged to the atmosphere from a nearby stack.

As discussed in Sections 1.4.1 and 2.2.5, the use of sand filters was identified during the EIS scoping process as a potential substitute for final high-efficiency particulate air (HEPA) filters. Differences in impacts between sand filters and HEPA filters are discussed below. Specifically, this section presents the impacts to human health, air quality, hydrology, waste management, potential accident impacts, and facility decommissioning.

Relative to radiological impacts during routine operations, those human receptors who would be affected by such a change would be the proposed MOX facility workers, SRS employees, and the public. However, the differences in emissions between the two filter types is not significant. Thus, the impacts presented in Section 4.3.2.2 on routine operational impacts from the facilities would contribute a negligible amount of $PM_{2.5}$ (0.009% of the annual standard) and only when emergency generators were used. It should be noted that all of the air quality analyses are based on very conservative assumptions (e.g., maximum concentrations for all facilities), and it is not likely that NAAQS exceedances would occur at the SRS.

During normal operations, the contribution of the MOX, PDCF, and WSB facilities to cumulative radiological dose to the public would be small (7% or less of total dose; see Table 4.24). The cumulative dose to an MEI would increase by 0.94% as a result of facility operations. The estimated risk of a latent cancer fatality resulting from cumulative dose to the MEI is extremely small (4×10^{-7}). The estimated number of latent cancer fatalities resulting from cumulative collective dose to the off-site population is 0.02. These very small numbers mean that statistically, radiological doses from plant operations would not be expected to cause any latent cancer fatalities in the off-site population.

Cumulative collective dose to workers at SRS would increase approximately 11% as a result of MOX, PDCF, and WSB facility operations. The number of expected latent cancer fatalities among workers resulting from cumulative dose (that resulting from dose contributions from the SRS baseline, the proposed action, and other reasonably foreseeable future actions) is 1.3. For most types of waste, facility operations would contribute relatively small volumes to the cumulative waste generation volumes at the SRS (see Table 4.25), and existing waste treatment facilities at the SRS have sufficient capacity to treat this cumulative total (see Section 4.3.4.2). The largest proportionate increase would be in the amount of TRU waste (approximately 24% increase).

The cumulative impacts of the facilities to land development, electricity usage, and groundwater usage at the SRS would be quite small and well within existing SRS capacity (see Table 4.24). Construction of the facilities would result in a slight increase (1.9%) in the amount of developed land at the SRS, but the cumulative amount of developed land on the SRS would remain quite small (3.8% of the total site). Facility operations would use 186,000 MWh/yr of electricity (3.7% of SRS capacity). Cumulative electricity demand resulting from facility operations and all existing and planned actions would be only 13% of SRS capacity. Facility operations would use 76 million L/yr (20.1 million gal/yr) of groundwater (0.02% of SRS capacity). Cumulative groundwater demand would be only 2.4% of SRS capacity.

Determination of the cumulative impacts of facilities construction and operation on the SRS workforce is complicated by the fact that employment is not expected to be constant during the life of the facility and other existing and planned actions at the SRS discussed in the beginning of Section 4.5.1. The analysis presented here considered the timelines of workforce projections for the SRS baseline and reasonably foreseeable future actions and the year in which the workforce would be highest. The results of these conservative analyses are presented in Table 4.26. Overall, employment at the SRS has decreased from 22,070 in September 1993 to 14,193 in September 2000. Projections indicate that site employment will continue to decline to approximately 10,000 by 2010 (DOE 1999c). Facility construction would result in a peak workforce of 1,000 in 2005. Facility operations would support 480 workers annually (3.2% of the total projected for the SRS).

Table 4.24. Estimated annual cumulative radiological dose and latent cancer fatalities resulting from MOX, PDCF, and WSB facility operations and other activities at the SRS

	Dose to maximally exposed individual[a]				Collective dose to off-site population				Collective dose to workers	
Source	Air pathway (rem)	Liquid pathway (rem)	Total dose (rem)	Latent cancer fatalities[b]	Air pathway (person-rem)	Liquid pathway (person-rem)	Total dose (person-rem)	Latent cancer fatalities[b]	Total dose (person-rem)	Latent cancer fatalities[b]
SRS baseline[c]	4.0×10^{-5}	1.4×10^{-4}	1.8×10^{-4}	1.1×10^{-7}	2.3	3.9	6.2	3.7×10^{-3}	163	0.1
MOX, PDCF, and WSB	6.1×10^{-6}	–[d]	6.1×10^{-6}	3.7×10^{-9}	1.6	–[d]	1.6	9.6×10^{-4}	257	1.5×10^{-1}
SNF management[e]	1.5×10^{-5}	5.7×10^{-5}	7.2×10^{-5}	4.3×10^{-8}	0.6	0.2	0.8	4.5×10^{-4}	55	3.3×10^{-2}
HEU disposition[f]	2.5×10^{-6}	–[d]	2.5×10^{-6}	1.5×10^{-9}	0.2	–[d]	0.2	9.6×10^{-5}	11.3	6.8×10^{-3}
Tritium extraction facility[g]	2.0×10^{-5}	–[d]	2.0×10^{-5}	1.2×10^{-8}	0.8	–[d]	0.8	4.6×10^{-4}	4.0	2.4×10^{-3}
Plutonium residue management[h]	5.7×10^{-7}	–[d]	5.7×10^{-7}	3.4×10^{-10}	0.006	–[d]	0.006	3.7×10^{-5}	7.6	4.6×10^{-3}
Defense waste processing facility[i]	1.0×10^{-6}	–[d]	1.0×10^{-6}	6.0×10^{-10}	0.07	–[d]	0.07	4.2×10^{-5}	118	7.1×10^{-2}
Salt processing[j]	3.1×10^{-4}	–[d]	3.1×10^{-4}	3×10^{-9}	18.1	–[d]	18.1	1.1×10^{-2}	29	1.7×10^{-2}
DOE complex miscellaneous components[k]	4.4×10^{-6}	4.2×10^{-8}	4.4×10^{-6}	2.7×10^{-11}	0.007	2.4×10^{-4}	0.007	4.3×10^{-6}	2	1.2×10^{-3}
Tank closure[l]	2.5×10^{-8}	–[d]	2.5×10^{-8}	1.5×10^{-11}	0.0014	–[d]	0.0014	8.4×10^{-7}	1,600	1.0
Vogtle Nuclear Power Plant[m]	5.4×10^{-7}	5.4×10^{-5}	5.5×10^{-5}	3.3×10^{-8}	0.04	0.003	0.05	2.7×10^{-5}	–[d]	–[d]
Total	4.0×10^{-4}	2.5×10^{-4}	6.5×10^{-4}	3.9×10^{-7}	23.6	4.1	27.7	1.7×10^{-2}	2,247	1.3
MOX, PDCF, and WSB contribution to total (%)	1.5	0.00	0.94	0.94	6.8	0.00	5.8	5.8	11.4	11.4

See next page for footnotes.

There would also be regional costs and benefits associated with construction and operation of the proposed MOX facility. At the regional level, excluding costs and benefits that cannot be quantified, the proposed MOX facility would produce an overall net benefit of $1,840 million (see Table 4.28).

4.6.2 National Costs and Benefits

The primary national benefit of construction and operation of the proposed MOX facility would be a reduction in the supply of weapons-grade plutonium available for unauthorized use. Once the plutonium component in MOX fuel has been irradiated in commercial nuclear reactors, the isotopic composition of the plutonium would be more proliferation resistant. Moreover, since the plutonium would then be part of the resultant high-level nuclear waste, the plutonium would no longer be available for other uses. Compared with the no-action alternative — in which the weapons-grade plutonium would continue to be stored at several existing DOE locations — converting surplus plutonium into MOX fuel and irradiating it better ensures its security, since it would reduce the number of locations where the various forms of plutonium are stored (DOE 1997a). Converting surplus weapons-grade plutonium into MOX fuel is thus viewed as better ensuring that weapons-usable material would not be obtained by rogue states and terrorist groups. Implementing the proposed action would promote the above nonproliferation objectives.

For the no-action alternative, although the costs and benefits of continued storage of plutonium in the present DOE locations are not re-evaluated in this analysis, these issues are discussed in the SPD EIS (DOE 1999a). Continued storage of plutonium by the DOE at its present locations would not be expected to produce additional latent cancer fatalities (LCFs). Annual LCFs of approximately 0.002 in the surrounding population of the storage sites were estimated. The annual collective dose to members of the public (i.e., those living and working within 80 km [50 mi] of the SRS) produced by routine operation of the proposed MOX facility would be expected to result in an LCF rate of approximately 0.0009/yr or less. Therefore, continued storage would result in higher annual impacts.

The national costs associated with the proposed action are the total life-cycle costs, which include research and development and pre-capital costs, design and construction costs, operating costs, deactivation costs, and contingency costs. Decommissioning costs are not included given the uncertainty surrounding their magnitude. The total cost of the proposed action is estimated to be $3,850 million (in 2001 dollars), with $2,155 million to cover the cost of the proposed MOX facility and $1,695 million for the PDCF and WSB (NNSA 2002). A significant item included in the estimated total cost of the proposed facilities is the credits associated with the value of the MOX and HEU fuel. These items amount to $964 million over the life of the project (NNSA 2002).

4.6.3 Regional Costs and Benefits

The various quantifiable costs and benefits of the proposed MOX facility in the REA are identified in Table 4.28. Costs and benefits are presented for construction and operation, including decommissioning, over a 20-year project life. On balance, the proposed MOX facility would provide a net benefit (total benefits minus total costs) to the REA. The net benefit of the proposed MOX facility would be approximately $1,840 million. Sections 4.6.3.1 and 4.6.3.2 provide a more detailed description of the costs and benefits of the proposed MOX facility.

4.6.3.1 Regional Costs

Both potential internal and external costs are included in the assessment. Potential external costs include both long-term and short-term costs. The most significant long-term external cost associated with the proposed action is the potential impact that an accident at the proposed MOX facility would produce. As set forth in Table 4.14, an explosion accident at the proposed MOX facility could cause up to 200 latent cancer fatalities (LCFs) in the area surrounding SRS. At the PDCF, the highest-consequence event there would be a major glovebox fire (tritium release), which could cause up to 100 LCFs in the area surrounding SRS.

Although the probability of occurrence of such accidents is very low, if those accidents did occur, the people living within 80 km (50 mi) of the SRS would likely be affected by these severe accidents at these proposed facilities. The extent to which the surrounding population would be affected would depend on the amount of material released and the direction and speed at which airborne material was dispersed by wind conditions at the time of the accident. While the overall risk to the surrounding population would be very low (since the probability of severe accidents occurring would be very low), the greatest short-term risk of exposure would be to population groups located to the west-northwest of SRS, while the greatest one-year risk would be to population groups located southwest of SRS.

Routine operation of the proposed facilities is expected to produce an annual latent cancer risk of about 1 in 250 million for the maximally exposed member of the public. The annual collective dose (associated with the facilities) to members of the public living and working within 80 km (50 mi) of SRS is expected to produce an LCF risk of approximately 0.0009 or less.

No adverse impacts from chemical exposure of workers at the proposed facilities are anticipated. Less than one fatality and approximately 410 worker injuries are expected during the 10-year operating period of the proposed facilities.

Routine proposed facilities operations are expected to produce insignificant impacts to air quality and would not exceed any ambient air quality standards for criteria pollutants at SRS. Maximum levels of $PM_{2.5}$ in the vicinity of SRS already exceed the applicable levels, and facility construction would create an additional 0.07% of the present standard; facility operations would contribute 0.009%.

Table 4.29. Unavoidable impacts of constructing and operating the proposed facilities

Resource	Unavoidable impacts
Geology and soils	• Construction excavation work may result in release of contaminated materials
Surface water	• Potential impacts to surface water quality by release of sediment, contaminated runoff, or accidental release of oil or construction equipment fuel
Air quality	• Incremental releases of $PM_{2.5}$ of 0.07% and 0.009% of proposed annual standard for construction and operations. The SRS currently exceeds proposed $PM_{2.5}$ standard level.
Ecology	• Initial loss of 50.0 ha (123.4 acres) of woodland and grassland habitat in F-Area. Over 30 ha (75 acres) would be landscaped following construction.
Land use	• A worst-case accident at the facility could result in minor land use impacts outside of the SRS
Cultural and paleontological resources	• Construction would directly affect two prehistoric archaeological sites that are eligible for listing on the *National Register of Historic Places*
Waste management	• Small impact to waste management system at the SRS • Volumes of TRU and hazardous waste produced by facilities would represent 3% of the WIPP disposal capacity and 20% of the SRS storage capacity, respectively. • Nonhazardous liquids produced would be about 35% of the capacity of the CSWTF
Human health risk	• Annual radiological impacts to SRS employees and the public from exposure to radioactive air pollutants are expected to be small at 3×10^{-5} and 9×10^{-4} latent cancer fatalities/yr, respectively. • 610 lost workday injuries during 5-year construction period • 410 lost workday injuries during 10-year operations period
Socioeconomics	• Increase in employment of 0.1 of a percentage point during construction • In-migrating workers during construction and operations would require 2% and <1% of vacant housing in ROI

4.7.1 Unavoidable Adverse Environmental Impacts

Geology and Soils. Impacts to geology and soils from construction and operation of the proposed MOX facility, PDCF, and WSB are expected to be insignificant. Restoration work, consisting of final grading and revegetation, would reclaim over half of the 41.9 ha (103.5 acres) of land in the F-Area that would be disturbed during construction. The 41.9-ha (103.5-acre) disturbed area is assumed to include 2 ha (4.9 acres) for laydown area for constructing the PDCF, and 9.7 ha (24 acres) for a laydown area for constructing the WSB. Some land in the area would be permanently altered because of constructing buildings, roads, and parking lots. The proposed MOX facility would permanently alter 6.9 ha (17 acres) of land, the PDCF would permanently alter 1.2 ha (3 acres), and the WSB would permanently alter exposure to air emissions from the proposed facilities are expected to be very small, approximately 3×10^{-5} and 9×10^{-4} LCF/yr, respectively.

Hydrazine is the only chemical, aside from the radionuclides, that would be used in MOX processing that is listed as a hazardous air pollutant under the Clean Air Act. During routine operations, off-gas treatment systems would be expected to keep hydrazine emissions to very low levels that would not cause adverse health impacts to the off-site public or noninvolved workers.

Socioeconomics. The potential socioeconomic impacts from constructing and operating the proposed facilities would be insignificant. The increase in the annual average employment growth rate would be less than 0.1 of a percentage point over the duration of construction; even less during the operation phase.

In-migration of 350 people during the peak construction year would have only a marginal effect on population growth requiring 2.0% of the available vacant rental housing units in the region of influence (ROI) for construction and less than 1% of the available vacant owner occupied housing units for facility operations.

There would be no significant impact on public finances or the need for additional local public service employees during construction or normal operation.

Minor impacts would occur to agriculture and commercial fishing as demand for their products increase during construction and normal operation. No significant impacts on agriculture and downstream fisheries are expected from facility operations.

Any impacts associated with the transportation of fresh MOX fuel, including impacts on property values, would be minimal.

Environmental Justice. There would be no unavoidable environmental justice impacts from routine operations.

Aesthetics. The addition of the proposed facilities would not adversely affect the overall aesthetics of the F-Area or the SRS. The size and appearance of facility structures would be similar to those of existing buildings adjacent to the F-Area and would maintain the industrial nature of the F-Area.

Cumulative Impacts. Cumulative impacts of normal operations of the proposed facilities at the SRS were evaluated for air quality, health and safety, waste generation, resource use, and employment. Cumulative impacts for water quality, geologic resources, ecological resources, aesthetic resources, and cultural and paleontological resources were not explicitly addressed because direct and indirect impacts to these resources are expected to be negligible.

Cumulative impacts to air quality from proposed facility operations are not expected to be significant. On the basis of conservative assumptions, facility operations are projected to contribute 2% or less to cumulative concentrations of criteria air pollutants.

During normal operations, the facilities' contribution to cumulative radiological doses to the off-site population would be low (5.8% of the total). A cumulative dose to a MEI would increase by 0.94%. No latent cancer fatalities are expected from the cumulative dose to the MEI or to the off-site population. Transportation of radioactive materials associated with facility operations would not contribute significantly to cumulative impacts (collective occupational dose, dose to the general public, and latent cancer fatalities).

For most types of waste, facility operations would contribute less than 10% to the cumulative waste volumes generated at the SRS; existing waste treatment facilities will be able to handle this cumulative total. The largest proportionate increase would be in the amount of TRU waste (9%).

The cumulative impacts of the proposed facilities to land development, electricity usage, and groundwater usage at the SRS would be quite small and well within existing SRS capacities.

Construction activities would result in a peak workforce of 1,000 in the peak construction year, or about 6% of the cumulative SRS employees. Facility operations would support 510 workers annually (3.7% of the total projected workforce for the SRS in 2007) and result in a cumulative total of 13,820 employees at the SRS in 2007.

4.7.2 Irreversible and Irretrievable Commitments of Resources

This section addresses the major irreversible and irretrievable commitments of resources associated with the no-action alternative and proposed action as described in Chapter 2. A commitment of a resource is irreversible when its primary or secondary impacts limit the future options for a resource. An irretrievable commitment refers to the use or consumption of resources neither renewable nor recoverable for use by future generations.

The 23.6 ha (58.3 acres) within which the proposed MOX facility, PDCF, and WSB would be built and the estimated 15.5 ha (38.3 acres) needed for infrastructure upgrades (e.g., pipeline and powerline rights-of-way, storm-water basin, batch plant, and roads) would be precluded from other uses until the NRC license to operate the facility was terminated (i.e., about 20 years into the future). About 3.6 ha (8.9 acres) of mostly woodland vegetation surrounding the proposed MOX facility site border would require grading for facility construction. Existing habitats would be eliminated, and ecological succession that would typically lead to progression from grassland to woodland vegetation would not occur. Although ultimate decommissioning of the facility could result in removal of all structures and paved surfaces, it is unlikely that woodland habitat comparable in quality to that north and west of the F-Area could become reestablished in less than 50 to 70 years.

Construction and operation activities would involve use of materials that could not be recovered or recycled. Soil excavated to produce the cement used in concrete would be irretrievably lost. Concrete and steel represent the bulk of construction materials. Other major construction materials that would be irretrievably lost or difficult to recycle include aluminum, lumber, piping materials, and electric wires and cables (DCS 2002a).

Table E.7. Joint frequency distribution used for calculation of receptor dose from facility air emissions

Wind speed (m/s)	Stability class	Wind direction															
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE
	A	0.25	0.20	0.24	0.24	0.21	0.18	0.15	0.18	0.17	0.17	0.21	0.22	0.18	0.18	0.16	0.21
	B	0	0.03	0.03	0.03	0.01	0.00	0.00	0.01	0.01	0.01	0.03	0.03	0.00	0.03	0.03	0.02
	C	0.02	0.01	0.01	0.02	0.01	0.01	0.02	0.03	0.03	0.01	0.01	0.01	0.01	0.02	0.01	0.01
0.89	D	0.01	0.02	0.00	0.02	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.03
	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0	0	0.00	0.00	0.00
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00
	A	0.88	0.73	0.92	1.04	1.06	0.79	0.70	0.55	0.74	0.78	1.12	1.37	1.19	0.82	0.56	0.57
	B	0.24	0.36	0.43	0.44	0.35	0.25	0.19	0.21	0.26	0.24	0.34	0.38	0.29	0.25	0.16	0.16
	C	0.15	0.39	0.73	0.50	0.39	0.24	0.24	0.29	0.33	0.36	0.43	0.49	0.34	0.28	0.23	0.18
2.46	D	0.09	0.25	0.59	0.34	0.31	0.27	0.34	0.37	0.42	0.39	0.38	0.33	0.30	0.22	0.26	0.21
	E	0.01	0.09	0.28	0.11	0.08	0.16	0.17	0.18	0.26	0.22	0.19	0.20	0.13	0.13	0.11	0.13
	F	0.01	0.02	0.02	0.01	0.00	0.03	0.02	0.03	0.03	0.03	0.02	0.05	0.00	0.01	0.02	0.04
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	A	1.03	0.66	0.53	0.50	0.44	0.30	0.26	0.20	0.37	0.43	0.60	0.70	0.71	0.48	0.24	0.36
	B	0.21	0.57	0.65	0.67	0.32	0.23	0.16	0.19	0.31	0.33	0.55	0.75	0.55	0.36	0.16	0.18
	C	0.16	0.69	1.49	0.86	0.67	0.44	0.42	0.42	0.52	0.58	0.74	0.78	0.78	0.57	0.27	0.14
4.47	D	0.12	0.52	1.64	0.95	0.81	0.70	0.84	1.12	1.48	1.05	1.26	1.27	1.01	0.88	0.50	0.20
	E	0.06	0.64	1.08	0.81	0.62	0.62	0.82	0.98	1.20	1.10	1.06	1.12	0.63	0.47	0.42	0.24
	F	0.02	0.22	0.19	0.07	0.10	0.16	0.18	0.17	0.22	0.16	0.21	0.27	0.07	0.06	0.05	0.06
	G	0.00	0.02	0.01	0.00	0.00	0.01	0.01	0.01	0.02	0.01	0.01	0.02	0.00	0.00	0.00	0.00
	A	0.21	0.18	0.03	0.03	0.01	0.02	0.02	0.01	0.02	0.04	0.05	0.10	0.09	0.11	0.03	0.09
	B	0.02	0.17	0.12	0.04	0.04	0.03	0.05	0.04	0.04	0.09	0.18	0.31	0.46	0.34	0.09	0.03
	C	0.00	0.18	0.46	0.21	0.08	0.09	0.16	0.22	0.20	0.29	0.41	0.46	0.73	0.62	0.13	0.01
6.93	D	0.00	0.09	0.19	0.08	0.05	0.06	0.13	0.46	0.43	0.24	0.24	0.12	0.13	0.11	0.07	0.00
	E	0.00	0.09	0.06	0.09	0.07	0.05	0.05	0.09	0.13	0.10	0.19	0.07	0.02	0.02	0.01	0.00
	F	0.00	0.04	0.02	0.03	0.01	0.03	0.02	0.01	0.01	0.01	0.03	0.02	0.01	0.00	0.00	0.00
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	A	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.00	0.01
	B	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.08	0.06	0.01	0.00
	C	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.04	0.04	0.05	0.05	0.08	0.18	0.10	0.02	0.00
9.61	D	0.00	0.00	0.00	0	0.00	0.00	0.00	0.03	0.02	0.02	0.01	0.00	0.02	0.00	0.00	0.00
	E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
	F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table E.7. Continued

Wind speed (m/s)	Stability class	Wind direction															
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE
11.2	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	G	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: DCS (2002a).

Table E.13. Radionuclide quantities (Ci)[a] released to the atmosphere for each accident type

	Proposed MOX facility				WSB		
Isotope	Internal fire	Load handling	Explosion	Criticality	Fire	Explosion	Loss of confinement
Pu-238	2.3×10^{-3}	9.2×10^{-5}	4.5×10^{-2}	6.0×10^{-13}	2.83×10^{-5}	1.55×10^{-5}	2.70×10^{-6}
Pu-239	2.0×10^{-2}	7.7×10^{-4}	3.8×10^{-1}	5.0×10^{-12}	1.84×10^{-4}	1.01×10^{-4}	1.76×10^{-5}
Pu-240	4.8×10^{-3}	1.9×10^{-4}	9.2×10^{-2}	1.3×10^{-12}	6.74×10^{-5}	3.69×10^{-5}	6.44×10^{-6}
Pu-241	3.5×10^{-1}	1.4×10^{-2}	6.8	9.0×10^{-11}	3.40×10^{-3}	1.87×10^{-3}	3.25×10^{-4}
Pu-242	1.3×10^{-6}	5.3×10^{-8}	2.6×10^{-5}	3.5×10^{-16}	1.30×10^{-8}	7.12×10^{-9}	1.24×10^{-9}
Am-241	NA[b]	NA	2.0×10^{-1}	2.1×10^{-12}	0.00	1.03×10^{-1}	4.39×10^{-2}
U-232	NA	NA	NA	NA	9.89×10^{-4}	3.51×10^{-9}	4.69×10^{-10}
U-233	NA	NA	NA	NA	4.26×10^{-3}	1.51×10^{-8}	2.02×10^{-9}
U-234	NA	NA	NA	NA	5.52×10^{-2}	1.95×10^{-7}	2.62×10^{-8}
U-235	NA	NA	NA	NA	5.54×10^{-4}	1.96×10^{-9}	2.62×10^{-10}
U-236	NA	NA	NA	NA	1.14×10^{-2}	4.04×10^{-8}	5.30×10^{-9}
Kr-83m	NA	NA	NA	1.1×10^{2}	NA	NA	NA
Kr-85m	NA	NA	NA	7.1×10^{1}	NA	NA	NA
Kr-85	NA	NA	NA	8.4×10^{-4}	NA	NA	NA
Kr-87	NA	NA	NA	4.3×10^{2}	NA	NA	NA
Kr-88	NA	NA	NA	2.3×10^{2}	NA	NA	NA
Kr-89	NA	NA	NA	1.3×10^{4}	NA	NA	NA
Xe-131m	NA	NA	NA	1.0×10^{-1}	NA	NA	NA
Xe-133m	NA	NA	NA	2.2	NA	NA	NA
Xe-133	NA	NA	NA	2.7×10^{1}	NA	NA	NA
Xe-135m	NA	NA	NA	3.3×10^{3}	NA	NA	NA
Xe-135	NA	NA	NA	4.1×10^{2}	NA	NA	NA
Xe-137	NA	NA	NA	4.9×10^{4}	NA	NA	NA
Xe-138	NA	NA	NA	1.1×10^{4}	NA	NA	NA
Te-134	NA	NA	NA	NA	NA	NA	NA
I-131	NA	NA	NA	2.8	NA	NA	NA
I-132	NA	NA	NA	2.9×10^{2}	NA	NA	NA
I-133	NA	NA	NA	4.1×10^{1}	NA	NA	NA
I-134	NA	NA	NA	1.1×10^{3}	NA	NA	NA
I-135	NA	NA	NA	1.1×10^{2}	NA	NA	NA
H-3	NA	NA	NA	NA	NA	NA	NA