CHAPTER 5. CUMULATIVE IMPACTS

The Council on Environmental Quality (CEQ) regulations implementing the procedural provisions of the National Environmental Policy Act (NEPA) define cumulative impacts as the impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR 1508.7). The cumulative impacts analysis presented in this section is based on the incremental actions associated with the maximum impact alternative for spent nuclear fuel (SNF) management at the Savannah River Site (SRS), other actions associated with onsite activities, and offsite activities with the potential for related environmental impacts. Although it is unlikely that the maximum impact alternative would be implemented to manage SNF at SRS, it was used to estimate cumulative impacts to ensure a conservative analysis. In accordance with a handbook recently prepared by CEQ (1997), the U.S. Department of Energy (DOE) identified the resource areas in which SNF management could add to the impacts of past, present, and reasonably foreseeable actions within the project impact zones as defined by CEQ (1997).

Based on an examination of the environmental impacts of direct and indirect SNF management actions coupled with DOE and other agency actions, it was determined that cumulative impacts for the following areas need to be presented: (1) air resources; (2) water resources; (3) public and worker health; (4) waste generation; (5) utilities and energy consumption; and (6) socioeconomics. Discussion of cumulative EC impacts for the following resources is omitted because impacts from the proposed SNF management activities would be so small that their potential contribution to cumulative impacts would be negligible: geologic resources, ecological resources, aesthetic and scenic resources, cultural resources, and traffic.

For determining the impact to air, water, human health, waste generation, utilities and energy, and socioeconomic resources from commercial and Federal nuclear facilities, the 50-mile (80-kilometer) radius surrounding SRS was selected as the project impact zone. For aqueous releases, the downstream population that uses the Savannah River as its source of drinking water was included in the project impact zone.

Nuclear facilities within a 50-mile radius of SRS include Georgia Power's Plant Vogtle Electric Generating Plant across the river from SRS; Chem-Nuclear Inc., a commercial low-level waste burial site just east of SRS; and Starmet CMI, Inc. (formerly Carolina Metals), located southeast of SRS, which processes uranium-contaminated metals. Radiological impacts from the operation of the Vogtle Electric Generating Plant, a two-unit commercial nuclear power plant are minimal, but DOE has factored them into the analysis. The South Carolina Department of Health and Environmental Control Annual Report (SCDHEC 1995) indicates that operation of the Chem-Nuclear Services facility and the Starmet CMI facility do not noticeably impact radiation levels in air or liquid pathways in the vicinity of SRS. Therefore, they are not included in this assessment.

The counties surrounding SRS have numerous existing (e.g., textile mills, paper product mills, and manufacturing facilities) and planned (e.g., Bridgestone Tire) industrial facilities with TC permitted air emissions and discharges to surface waters. Because of the distances between SRS and the private industrial facilities, there is little opportunity for interactions of plant emissions, and no major cumulative impact on air or water quality. Construction and operation of Bridgestone Tire and Hankook Polyester facilities could affect the regional socioeconomic cumulative impacts.

Additional offsite facilities with the potential to affect the nonradiological environment include 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 32 river kilometers (20 river miles) north of SRS. Because of the distance between SRS and the Urquhart Station and the regional wind direction frequencies, there is little opportunity for any interaction of plant emissions, and no significant cumulative impact on air quality.

DOE also evaluated the impacts from its own proposed future actions by examining impacts to resources and the human environment as shown in NEPA documentation related to SRS (see Section 1.6). Additional NEPA documents related to SRS that are considered in the cumulative impacts section include the following:

Final Environmental Impact Statement - Interim Management of Nuclear Materials (DOE/EIS-0220) (DOE 1995a). DOE has begun implementation of the preferred alternatives for the nuclear materials discussed in the Interim Management of Nuclear Materials EIS. SRS baseline data in this chapter reflect projected impacts from implementation.

Final Environmental Impact Statement for the Accelerator Production of Tritium at Savannah River Site (DOE/EIS-0270) (DOE 1999a). DOE has proposed an accelerator design (using helium-3 target blanket material) and an alternate accelerator design (using lithium-6 target blanket material). If an accelerator is built, it would be located at SRS. However, since the Record of Decision states the preferred alternative as use of an existing commercial light-water reactor, data from this EIS are not used.

Environmental Assessment for the Tritium Facility Modernization and Consolidation Project at the Savannah River Site (DOE/EA-1222) (DOE 1997). This environmental assessment (EA) addresses the impacts of consolidating the tritium activities currently the new Building 233-H and Building 234-H. Tritium extraction functions would be transferred to Tritium Extraction Facility. The overall impact would be to reduce the tritium facility complex net tritium emissions by up to 50 percent. Another positive effect of this planned action would be to reduce the amount of low-level radioactive job-control waste. Effects on other resources would be negligible. Therefore, impacts from the environmental assessment have not been included in this cumulative impacts analysis.

Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement (DOE/EIS-0240) (DOE 1996). This cumulative impacts analysis incorporates the alternative of blending at SRS highly enriched uranium to 4 percent low-enriched uranium as uranyl nitrate hexahydrate as stated in the Record of Decision (61 FR 40619, August 5, 1996).

Final Environmental Impact Statement on Management of Certain Plutonium Residues and Scrub Alloy Stored at the Rocky Flats Environmental Technology Site (DOE/EIS-0277F) (DOE 1998). DOE proposes to process certain plutonium-bearing materials being stored at the Rocky Flats Environmental Technology Site. These materials are plutonium residues and scrub alloy remaining from nuclear weapons manufacturing operations formerly conducted by DOE at Rocky Flats. DOE has decided to remove the plutonium from certain residues that would be shipped from the Rocky Flats Environmental Technology Site to SRS for stabilization. The separated plutonium would be stored at SRS pending disposition decisions. Environmental impacts from using F Canyon to chemically separate the plutonium from the remaining materials at SRS are included in this section.

EC EC ***Final Environmental Impact Statement for the Construction and Operation of a Tritium Extraction Facility at the Savannah River Site (DOE/EIS-0271)*** (DOE 1999b). As stated in the Record of Decision (64 FR 26369; 5/14/99), DOE will construct and operate a Tritium Extraction Facility on SRS to provide the capability to extract tritium from commercial light water reactor targets and targets of similar design. The purpose of the proposed action and alternatives evaluated in the EIS is to provide tritium extraction capability to support either accelerator or reactor production. Environmental impacts from the maximum processing option in this EIS are included in this section.

EC TC ***Surplus Plutonium Disposition Final Environmental Impact Statement (DOE/EIS-0283)*** (DOE 1999c). This EIS analyzes the activities necessary to implement DOE's disposition strategy for surplus plutonium. In January 2000 DOE issued a Record of Decision selecting SRS as the site for all three disposition facilities: mixed-oxide fuel fabrication, plutonium immobilization, and plutonium pit disassembly and conversion. Impacts from these facilities are included in this section.

EC ***Defense Waste Processing Facility Supplemental Environmental Impact Statement (DOE/EIS-0082-S)*** (DOE 1994). The selected alternative in the Record of Decision (ROD) was the completion and operation of the Defense Waste Processing Facility to immobilize high-level radioactive waste at the SRS. The facility is currently processing sludge from SRS high-level waste tanks. However, SRS baseline data is not representative of full DWPF operational impacts, including processing of salt and supernate from these tanks. Therefore, the DWPF data is listed separately.

L2-16 EC ***Draft Environmental Impact Statement for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel (DOE/EIS-0306D) (DOE 1999d)***. DOE has published a draft environmental impact statement (64 FR 8553, 2/22/99) for treatment of sodium-bonded spent nuclear fuel. Two of the alternatives being evaluated in the Treatment and Management EIS are to process INEEL's sodium-bonded fuel inventory at SRS using the Plutonium-Uranium Extraction (PUREX) process and to use the Melt and Dilute facility being proposed in the EIS. Because processing at SRS is a reasonable alternative to processing at INEEL, it is being included in the Spent Nuclear Fuel Management EIS cumulative impact analysis. These methods could be used for the sodium-bonded spent nuclear fuel blanket assemblies currently in storage at INEEL. There are approximately 22.4 MTHM of Experimental Breeder Reactor-II (EBR-II) fuel blankets and 34.2 MTHM of Fermi-1 fuel blankets to be processed. This fuel would be declad before shipment to SRS. Because the decladding activities would occur at INEEL, the impacts of these decladding activities are not included in this chapter. L2-16 TC

This EIS includes cumulative impacts of sodium-bonded spent nuclear fuel processing at the SRS based on data from the Draft Electrometallurgical Treatment EIS. Data used in this EIS are based on Purex processing at SRS, which is more is conservative.

DOE is currently evaluating nuclear material disposition needs. Other material discussed for processing at SRS under the PNA include single-pass reactor SNF at Hanford, a small amount of damaged SNF at Idaho National Engineering and Environmental Laboratory (INEEL), classified fissile material metal parts at the Rocky Flats Environmental Technology Site (RFETS), and plutonium scrap at Hanford. Currently, DOE has no plan or proposal to transfer the single-pass reactor SNF at Hanford or the damaged SNF at INEEL to SRS so that material was not considered for the cumulative impacts under this EIS. In an amended Record of Decision for the *Final Environmental Impact Statement on Storage and Disposition of Surplus Fissile Material,* DOE decided to transfer classified metal from RFETS to SRS for stabilization and storage. DOE is considering transferring the plutonium scrap from Hanford to SRS for stabilization and storage pending appropriate National Environmental Policy Act review. As a result, DOE has included processing that material as part of the cumulative impacts for this EIS.

L2-16 DOE is continuing to evaluate the inventory of nuclear material at facilities throughout the DOE complex. DOE's Nuclear Material Integration initiative is one such recent effort that has identified material which could be processed at SRS. Although there are no current plans to process these materials at SRS, DOE considers it appropriate to include a qualitative estimate of impacts as part of the cumulative impacts for this EIS because it is not unforeseen that processing at SRS could occur.

EC In addition, the cumulative impacts analysis includes the impacts from actions proposed in this SNF EIS. Risks to members of the public and site workers from radiological and nonradiological releases are based on operational impacts from the maximum impact alternative described in Section 4.1.2.

In addition, the cumulative impacts analysis accounts for other SRS operations. Most of the EC SRS baseline data are based on 1997 environmental report information (Arnett and Mamatey EC 1998), which are the most recent published data available.

Temporal limits were defined by examining the period of influence from both the proposed action and other Federal and non-Federal actions that have the potential for cumulative impacts. Ac- TC tions for SNF management are expected to begin in 2000 in preparation for ultimate offsite disposal, possibly in a monitored geologic repository which probably will not be available until at least 2010. Final offsite shipments of SNF from SRS for disposal would be completed by 2035.

The period of interest for the cumulative impacts analysis for this SNF EIS includes the potential construction and operation of the Tritium Extraction Facility and while actions for management of nuclear materials, highly enriched TC uranium, surplus plutonium disposition, and sodium-bonded nuclear fuel would be ongoing.

5.1 Air Resources

Table 5-1 compares the cumulative concentrations of nonradiological air pollutants from the SRS to Federal and state regulatory standards. The listed values are the maximum modeled concentrations that could occur at ground level at the Site boundary. The data demonstrate that total estimated concentrations of nonradiological air pollutants from SRS would in all cases be below the regulatory standards at the Site boundary. The highest percentages of the regulatory standards are for sulfur dioxide concentrations for the shorter time interval (approximately 97 percent of standard for the 24-hour averaging time), for particulate matter of less than 10 microns (ap- TC proximately 89 per- cent of standard for the 24-hour averaging time), and total suspended particulates (approximately 90 percent of standard on an annual basis). The remaining pollutant emissions would range from 1 to 69 percent of TC the applicable standards.

The majority of the impacts come from estimates of SRS baseline concentrations. It is unlikely that actual concentrations at ambient monitoring stations would be as high as that shown for the baseline values. The SRS baseline values are TC based on maximum potential emissions from the 1998 air emissions inventory and for all SRS sources, and observed concentrations from nearby ambient air monitoring stations.

Table 5-1. Estimated maximum cumulative ground-level concentrations of nonradiological pollutants (micrograms per cubic meter) at SRS boundary.[a,b]

Pollutant	Averaging time	SCDHEC ambient standard (µg/m^3)	SNF	SRS baseline (µg/m^3)	Other foreseeable planned SRS activities[c] (µg/m^3)	Cumulative concentration[d,e] (µg/m^3)	Percent of standard
Carbon monoxide	1 hour	40,000	9.760	10,000	36.63	10,046	25
	8 hours	10,000	1.31	6,900	5.15	6,906	69
Oxides of Nitrogen	Annual	100	3.36	26	4.38	33.7	34
Sulfur dioxide	3 hours	1,300	0.98	1,200	8.71	1,210	93
	24 hours	365	0.13	350	2.48	352.6	97
	Annual	80	0.02	34	0.17	34.2	43
Ozone[f]	1 hour	235	0.80	NA[g]	0.71	1.5	1
Lead	Max. quarter	1.5	NA	0.03	0.00	0.03	2
Particulate matter (≤10 microns aerodynamic diameter)[f]	24 hours	150	0.13	130	3.24	133.4	89
	Annual	50	0.02	25	0.13	25.2	50
Total suspended particulates (µg/m^3)	Annual	75	0.02	67	0.06	67.1	89

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TC

a. DOE (1994; 1996; 1998; 1999b,c,d) and Hunter (1999) for baseline values.
b. Hydrochloric acid, formaldehyde, hexane, and nickel are not listed in Table 5-1 because operation of SNF or other foreseeable, planned SRS activities would not result in any change to the SRS baseline concentrations of these toxic pollutants.
c. Includes Highly Enriched Uranium, Tritium Extraction Facility, Management of Certain Plutonium Residues and Scrub Alloy Concentrations, Defense Waste Processing Facility, and Disposition of Surplus Plutonium, Sodium-Bonded Spent Nuclear Fuel, and components from throughout the DOE complex.
d. SCDHEC (1976).
e. Includes SNF concentrations.
f. New NAAQS for ozone (1 hr replaced by 8 hr standard = 0.08 ppm) and particulate matter ≤ 2.5 microns (24 hr standard = 65 µg/m^3) and annual standard of 15 µg/m^3 will become enforceable during the stated temporal range of the cumulative impacts analyses.
g. Not available.

TC

DOE also evaluated the cumulative impacts of airborne radioactive releases in terms of dose to a maximally exposed individual at the SRS boundary. DOE included the impacts of Plant Vogtle (NRC 1996) in this cumulative total. The radiological emissions from the operation of the Chem-Nuclear low-level waste disposal facility just east of SRS are very low (SCDHEC 1992) and are not included.

TC Table 5-2 lists the results of this analysis, using 1997 emissions (1992 for Plant Vogtle) for the SRS baseline. The cumulative dose to the maximally exposed member of the public would be 1 x 10^{-4} rem (or 0.1 millirem) per year, well below the regulatory standard of 10 millirem per year (40 CFR Part 61). TC Summing the doses to maximally exposed individual for the nine actions and baseline SRS operations listed in Table 5-2 is an extremely conservative approach because in order to get the calculated dose, the maximally exposed individual would have to occupy different physical locations at the same time, which is impossible.

Table 5-2. Estimated average annual cumulative radiological doses and resulting health effects to the maximally exposed offsite individual and population in the 50-mile radius from airborne releases.

Activity	Offsite Population: Maximally exposed individual – Dose (rem)	Offsite Population: Maximally exposed individual – Probability of fatal cancer risk	Offsite Population: 50-mile population – Collective dose (person-rem)	Offsite Population: 50-mile population – Excess latent cancer fatalities
SRS Baseline[a]	5.0×10^{-5}	2.5×10^{-8}	2.2	1.1×10^{-3}
Management of Spent Nuclear Fuel[b]	1.5×10^{-5}	7.5×10^{-9}	0.56	2.8×10^{-4}
Surplus HEU Disposition[c]	2.5×10^{-6}	1.3×10^{-9}	0.16	8.0×10^{-5}
Tritium Extraction Facility[d]	2.0×10^{-5}	1.0×10^{-8}	0.77	3.9×10^{-4}
Surplus Plutonium Disposition[e]	7.4×10^{-6}	3.7×10^{-9}	1.8	9.0×10^{-4}
Management of Plutonium Residues/ Scrub Alloy[f]	5.7×10^{-7}	2.9×10^{-10}	$6.2\text{x}10^{-3}$	3.1×10^{-6}
Defense Waste Processing Facility[g]	1.0×10^{-6}	5.0×10^{-10}	0.071	3.6×10^{-5}
DOE complex miscellaneous components[h]	4.4×10^{-6}	2.2×10^{-9}	7.0×10^{-3}	3.5×10^{-6}
Sodium-Bonded Spent Nuclear Fuel[i]	3.9×10^{-7}	2.0×10^{-10}	1.9×10^{-2}	9.5×10^{-6}
Plant Vogtle[j]	5.4×10^{-7}	2.7×10^{-10}	0.042	$2.1\text{x}10^{-5}$
Total	1.0×10^{-4}	5.1×10^{-8}	5.6	2.8×10^{-3}

a. Arnett and Mamatey (1998) for 1997 data for MEI and population.
b. Maximum-impact alternative.
c. DOE (1996); HEU = highly enriched uranium.
d. DOE (1999b).
e. DOE (1999c).
f. DOE (1998).
g. DOE (1994).
h. Derive from impacts from conventional processing of Group A fuel.
i. DOE (1999d).
j. NRC (1996).

Adding the population doses from current and projected activities at SRS, Plant Vogtle, and management of SNF could yield a total annual cumulative dose of 5.6 person-rem from airborne sources. The total annual cumulative dose translates into $2.8\text{x}10^{-3}$ latent cancer fatality for each year of exposure for the population living within a 50-mile (80-kilometer) radius of the SRS. For comparison, 143,863 deaths from cancer due to all causes would be likely in the same population over their lifetimes.

5.2 Water Resources

At present, a number of SRS facilities discharge treated wastewater to Upper Three Runs and its tributaries and Fourmile Branch via National Pollutant Discharge Elimination System (NPDES)–permitted outfalls. These include the F and H Area Effluent Treatment Facility (ETF) and the M-Area Liquid Effluent Treatment Facility. As stated in Section 4.1.1.1, SNF operations are not expected to result in any discharges to groundwater. The only technology that would result in discharges of radioactive and nonradioactive effluents to surface water would be Conventional Processing. The major sources of liquid effluents from facilities associated with Conventional Processing would be process cooling water and steam condensate systems that could contain small quantities of radionuclides and chemicals. This process wastewater would be treated at ETF and then discharged to Upper Three Runs. Studies of water quality and biota downstream of the ETF outfall suggest that discharges from it have not degraded the water quality of Upper Three Runs. Other potential sources of contaminants into Upper Three Runs during the SNF management period include the accelerator production of tritium, the tritium extraction facility, environmental restoration, and decontamination and decommissioning activities, as well as modifications to existing SRS facilities. Discharges associated with the accelerator production of tritium and tritium extraction facility activities would not add significant amounts of nonradiological contaminants to Upper three Runs. The amount of discharge associated with environmental restoration and decontamination and decommissioning activities would vary based on the level of activity. All the potential activities that could result in wastewater discharges would be required to comply with the NPDES permit limits that ensure protection of water quality. Studies of water quality and biota in Upper Three Runs suggest that discharges from facilities outfalls have not degraded the stream (Halverson et al. 1997).

Table 5-3 summarizes the estimated cumulative radiological doses from waterborne sources to human receptors downstream from SRS. Liquid effluents would be released to SRS streams that are tributaries of the Savannah River could contain small quantities of radionuclides. The exposure pathways considered in this analysis included drinking water, fish ingestion, shoreline exposure, swimming, and boating. The estimated TC cumulative dose to the maximally exposed member of the public from liquid releases would be $2.4x10^{-4}$ rem (or 0.24 millirem) per year, well below the regulatory standard of 4 millirem per year (40 CFR Part 141). Adding the population doses associated with current and projected SRS activities would yield a cumulative annual dose TC of 2.6 person-rem from liquid sources. This translates into 0.0013 latent cancer fatality for each year of exposure of the population living within a 50-mile (80-kilometer) radius of the SRS. For comparison, 15,300 deaths from cancer due to all causes would be likely in the population of 70,000 downstream residents over their lifetimes. TC

5.3 Public and Worker Health

Table 5-4 summarizes the cumulative radiological health effects of routine SRS operations, proposed DOE actions, and non-Federal nuclear facility operations (Plant Vogtle Electric Generating Facility). Impacts resulting from proposed DOE actions are described in the EISs listed previously in this chapter. In addition to estimated radiological doses to the hypothetical maximally exposed offsite individual, the offsite population, and involved workers, Table 5-4 also lists the potential number of latent cancer fatalities for the public and workers due to exposure to radiation. The radiation dose to the maximally exposed offsite individual from air and liquid pathways would be $3.4x10^{-4}$ rem (0.34 mrem) per year, TC which is well below the applicable DOE regulatory limits (10 mrem per year from the air pathway, 4 mrem per year from the liquid pathway, and 100 mrem per year for all pathways). The total annual population dose for current and projected activities of 8.2 person-rem translates into TC 0.004 latent cancer fatality for each year of exposure for the population living within a 50-mile (80-kilometer) radius of the SRS. As stated in Section 5.1, for comparison, 143,863 deaths TC from cancer due to all causes would be likely in the same population over their lifetimes.

The annual radiation dose to the involved worker population would be 859 person-rem. In addi- TC tion, doses to individual workers would be kept below the regulatory limit of 5,000 mrem per year (10 CFR 835). Furthermore, as low as reasonably achievable principles would be exercised to maintain individual worker doses below the DOE Administrative Control Level of 2,000 mrem per year.

Table 5-3. Estimated average annual cumulative radiological doses and resulting health effects to offsite population in the 50-mile radius from aqueous releases.

TC EC

	Offsite Population			
	Maximally exposed individual		50-mile population	
Activity	Dose (rem)	Probability of fatal cancer risk	Collective dose (person-rem)	Excess latent cancer fatalities
SRS Baseline[a]	1.3×10^{-4}	6.5×10^{-8}	2.4	1.1×10^{-3}
Management of Spent Nuclear Fuel[b]	5.7×10^{-5}	2.9×10^{-8}	0.19	9.5×10^{-5}
Surplus HEU Disposition[c]	(d)	(d)	(d)	(d)
Tritium Extraction Facility[e]	(d)	(d)	(d)	(d)
Defense Waste Processing Facility[f]	(d)	(d)	(d)	(d)
Surplus Plutonium Disposition[g]	(d)	(d)	(d)	(d)
Management Plutonium Residues/Scrub Alloy[h]	(d)	(d)	(d)	(d)
DOE complex miscellaneous components[i]	4.2×10^{-8}	2.1×10^{-11}	2.4×10^{-4}	1.2×10^{-7}
Sodium-Bonded Spent Nuclear Fuel[j]	1.2×10^{-7}	6.0×10^{-11}	6.8×10^{-4}	3.4×10^{-7}
Plant Vogtle[k]	5.4×10^{-5}	2.7×10^{-8}	2.5×10^{-3}	1.3×10^{-6}
Total	2.4×10^{-4}	1.2×10^{-7}	2.6	1.3×10^{-3}

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a. Arnett and Mamatey (1998) for 1997 data for MEI and population. Worker dose is based on 1997 data (WSRC 1998).
b. Maximum-impact alternative.
c. DOE (1996); HEU = highly enriched uranium.
d. Less than minimum reportable levels.
e. DOE (1999b).
f. DOE (1994).
g. DOE (1999c).
h. DOE (1998).
i. Derived from impacts from conventional processing. EC
j. DOE (1999d).
k. NRC (1996).

5.4 Waste Generation

TC

As stated in Section 4.1.1.4, high-level waste, transuranic waste, and low-level waste would be generated from SNF management activities. Smaller amounts of mixed and hazardous waste would also be generated from SNF processing activities. The largest volume of high-level and transuranic waste would be generated with the Conventional Processing alternative. However, as stated in Section 4.1.1.4, the projected high-level waste and transuranic waste generation rates would not require additional treatment and storage capacities beyond the current and planned SRS capacities. In general, the waste generation rate varies with each phase of SNF handling and the type of fuel group. The total radioactive/hazardous waste volume associated with SNF activities could range from 20,700 cubic meters (27,076 cubic yards) for the minimum impact option to 154,967 cubic meters (202,681 cubic yards) for the maximum impact (conventional processing) option.

Table 5-4. Estimated average annual cumulative radiological doses and resulting health effects to offsite population and facility workers.

	Maximally exposed individual				Offsite population[a]				Workers	
Activity	Dose from airborne releases (rem)	Dose from liquid releases (rem)	Total dose (rem)	Probability of fatal cancer risk	Collective dose from airborne releases (person-rem)	Collective dose from liquid releases (person-rem)	Total collective dose (person-rem)	Excess latent cancer fatalities	Collective dose	Excess latent cancer fatalities
SRS Baseline[b]	5.0×10^{-5}	1.3×10^{-4}	1.8×10^{-4}	9.0×10^{-8}	2.2	2.4	4.6	2.3×10^{-3}	165	0.066
Management of Spent Nuclear Fuel[c]	1.5×10^{-5}	5.7×10^{-5}	7.2×10^{-5}	3.6×10^{-8}	0.56	0.19	0.75	3.8×10^{-4}	55	0.022
Surplus HEU Disposition[d]	2.5×10^{-6}	(e)	2.5×10^{-6}	1.3×10^{-8}	0.16	(e)	0.16	8.0×10^{-5}	11	4.4×10^{-3}
Tritium Extraction Facility[f]	2.0×10^{-5}	(e)	2.0×10^{-5}	1.0×10^{-8}	0.77	(e)	0.77	3.9×10^{-4}	4	1.6×10^{-3}
Defense Waste Processing Facility[g]	1.0×10^{-6}	(e)	1.0×10^{-6}	5.0×10^{-10}	0.071	(e)	0.071	3.6×10^{-5}	120	0.048
Surplus Plutonium Disposition[h]	7.4×10^{-6}	(e)	7.4×10^{-6}	3.7×10^{-9}	1.8	(e)	1.8	9.0×10^{-4}	456	0.18
Management Plutonium Residues/ Scrub Alloy[i]	5.7×10^{-7}	(e)	5.7×10^{-7}	2.9×10^{-10}	$6.2\text{x}10^{-3}$	(e)	$6.2\text{x}10^{-3}$	3.1×10^{-6}	7.6	$3\text{x}10^{-3}$
DOE complex miscellaneous components[j]	4.4×10^{-6}	4.2×10^{-8}	4.4×10^{-6}	2.2×10^{-9}	7.0×10^{-3}	2.4×10^{-4}	7.2×10^{-3}	3.6×10^{-6}	2	0.001
Sodium-Bonded Spent Nuclear Fuel[k]	3.9×10^{-7}	1.2×10^{-7}	5.1×10^{-7}	2.6×10^{-10}	1.9×10^{-2}	6.8×10^{-4}	2.0×10^{-2}	9.8×10^{-6}	38	0.015
Plant Vogtle[l]	5.4×10^{-7}	5.4×10^{-5}	5.5×10^{-5}	2.7×10^{-8}	0.042	2.5×10^{-3}	0.045	2.2×10^{-5}	NA	NA
Total	1.0×10^{-4}	2.4×10^{-4}	3.4×10^{-4}	1.7×10^{-7}	5.6	2.6	8.2	4.1×10^{-3}	859	0.34

N/A = not available

a. A collective dose to the 50-mile (80-kilometer) population for atmospheric releases and to the downstream users of the Savannah River for aqueous releases.
b. Arnett and Mamatey (1998) for 1997 data for MEI and population. Worker dose is based on 1997 data (WSRC 1998).
c. Maximum-impacts alternative.
d. DOE (1996); HEU = highly enriched uranium.
e. Less than minimum reportable levels.
f. DOE (1999b).
g. DOE (1994).
h. DOE (1999c).
i. DOE (1998).
j. Derived from impacts from conventional processing of Group A fuel.
k. DOE (1999d).
NRC (1996).

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Table 5-5 lists cumulative volumes of high-level, low-level, transuranic, and hazardous and mixed wastes that SRS would generate. The table includes data from the SRS 30-year expected waste forecast (WSRC 1994). The 30-year expected waste forecast is based on operations, environmental restoration, and decontamination and decommissioning waste forecasts from existing generators and the following assumptions: secondary waste from the Defense Waste Processing Facility, In-Tank Precipitation, and Extended Sludge Processing operations are addressed in the DWPF EIS; high-level waste volumes are based on the selected option for the F-Canyon Plutonium Solutions EIS; some investigation-derived wastes are handled as hazardous waste per Resource Conservation and Recovery Act (RCRA) regulations; purge water from well samplings is handled as hazardous waste; and the continued receipt of small amounts of low-level waste from other DOE facilities and nuclear naval operations. The estimated quantity of radioactive/hazardous waste from operations in this forecast during the next 30 years would be 142,666 cubic meters. In addition, radioactive/hazardous waste associated with environmental restoration and decontamination and decommissioning activities would have a 30-year expected forecast of 67,808 cubic meters (Halverson 1999). Waste generated from the conventional processing option would add a total of 154,970 cubic meters. During this same time period, other reasonably foreseeable activities that were not included in the 30-year forecast would add an additional 192,915 cubic. The major contributor to the other waste volumes would be from weapons components from various DOE sites that could be processed in SRS canyons. Therefore, the potential cumulative amount of waste generated from SRS activities during the period of interest would be 558,359 cubic meters. It is important to note that the quantities of waste generated are not equivalent to the amounts that will require disposal. As discussed in Section 4.1.1.4 for example, high-level waste is evaporated and concentrated to a smaller volume for final disposal. Combustible low-level waste is volume reduced on site in the Consolidated Incineration Facility.

The Three Rivers Solid Waste Authority Regional Waste Management Center at the Savannah River Site accepts non-hazardous and non-radioactive solid wastes from SRS and eight surrounding South Carolina counties. This municipal solid waste landfill provides state of the art Subtitle D (non-hazardous) facilities for landfilling solid wastes while reducing the environmental consequences associated with construction and operation of multiple county-level facilities (DOE 1995b). It was designed to accommodate combined SRS and county solid waste disposal needs for at least 20 years, with a projected maximum operational life of 45 to 60 years (DOE 1995b). The landfill is designed to handle an average of 1,000 tons per day and a maximum of 2,000 tons per day of municipal solid wastes. The SRS and eight cooperating counties had a combined generation rate of 900 tons per day in 1995. The Three Rivers Solid Waste Authority Regional Waste Management Center opened in mid-1998.

The SNF management activities and other planned SRS activities would not generate larger volumes of radioactive, hazardous, or solid wastes beyond current and projected capacities of SRS waste storage and/or management facilities.

5.5 Utilities and Energy

Table 5-6 lists the cumulative consumption of electricity from activities at SRS. The values are based on annual consumption estimates. Among the SNF management technologies, Conventional Processing would place the largest annual demand on electricity and water re sources. The SNF management values are based on the maximum impact analysis (Section 4.1.1.5).

The overall SRS activities occurring concurrently with SNF management activities would not place an unreasonable demand on electricity resources.

Table 5-5. Estimated cumulative waste generation from SRS concurrent activities (cubic meters).[a,b,c]

Waste Type	SNF Management[a]	SRS Operations[b,c]	ER/D&D[b,c,d]	Other Waste Volume[e]	Total
High-level	11,000	14,129	0	69,552	94,681
Low-level	140,000	118,669	61,630	110,102	430,401
Hazardous/mixed	270	3,856	6,178	4,441	14,745
Transuranic	3,700	6,012	0	8,820	18,532
Total	154,970	142,666	67,808	192,915	558,359

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a. Maximum-impact alternative.
b. Halverson (1999).
c. Based on a total 30-year expected waste generation forecast, which includes previously generated waste.
d. ER/D&D = environmental restoration/decontamination & decommissioning.
e. Life-cycle waste associated with reasonably foreseeable future activities such as TEF, plutonium residues, surplus plutonium disposition, highly-enriched uranium, commercial light water reactor waste, sodium-bonded spent nuclear fuel, and weapons components that could be processed in SRS canyons. Impacts for the last group is based on conventional processing impacts for SNF Fuel Group A.

TC
EC

Table 5-6. Estimated average annual cumulative utility consumption.

Activity	Electricity (megawatt-hours)	Water usage (liters)
SRS baseline[a]	4.11×10^5	1.70×10^{10}
SNF management[b]	1.58×10^4	2.11×10^8
Other SRS foreseeable activities	1.51×10^5	6.73×10^8
Total	5.77×10^5	1.79×10^{10}

TC

a. Halverson (1999) for electricity usage and Arnett and Mamatey (1996) for water usage.
b. Based on the maximum impact alternative.
c. Includes utility consumption associated with reasonable foreseeable future actions such as tritium extraction, facility, plutonium residues, surplus plutonium disposition, highly-enriched uranium, sodium-bonded spent nuclear fuel, and weapons components that could be processes at SRS canyons. Impacts for last group are based on conventional processing impacts of spent nuclear fuel "Group A." See EISs referenced at end of chapter. Sodium-bonded spent nuclear fuel electricity usage based on "Group A" conventional processing; water usage from EIS.

DOE has also evaluated the SRS water needs during the SNF management activities period. At present, the SRS rate of groundwater with-drawl is estimated to be up to 17 billion liters annually. The estimated amount of groundwater needed for SNF management activities from 1998 to 2035 is 211 million liters per year, depending on the management option chosen. Operation of other foreseeable activities would require approximately 673 million liters of groundwater per year. Thus, sitewide groundwater withdrawals would increase minimally over the projected SNF management period.

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Surface water usage during the SNF management period is not projected to approach capacity levels.

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5.6 Socioeconomic Impacts

Cumulative regional economic and population changes from construction and operation of the Transfer and Storage Facility or the Transfer, Storage and Treatment Facility consider the impacts of other coincident economic development projects such as DOE's Accelerator for the Production of Tritium, Bridgestone-Firestone, and Hankook Synthetics.

Bridgestone-Firestone is building a $435 million tire manufacturing plant in Aiken County that will employ 800 workers. The Bridgestone-Firestone project is expected to complete construction and be in operation by the year 2000. Thus, this project should not impact the construction workforce for the Transfer and Storage Facility or Transfer, Storage and Treatment Facility which are not scheduled to be constructed until after the year 2000. Competition for construction workers should not overlap.

TC

Construction of the Transfer and Storage Facility or the transfer and storage phase of the Transfer, Storage and Treatment Facility would begin sometime after the year 2000, employ 500 workers (375 construction and 125 professional), and require 2 years to complete. The treatment phase would begin construction at the completion of the transfer and storage phases and also could employ as many as 500 workers and take as long as 2 years to complete. No additional workers would be required during operations since existing SRS employees would assume those positions.

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There would be no significant cumulative socioeconomic impacts from construction or operation of the Transfer and Storage Facility or the Transfer, Storage and Treatment Facility.

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