CHAPTER 3. AFFECTED ENVIRONMENT

This chapter describes the existing environmental and socioeconomic characteristics of the Savannah River Site (SRS) and the nearby region that the proposed action or its alternatives (described in Chapter 2) could affect. It provides the environmental bases against which the U.S. Department of Energy (DOE) has assessed the environmental consequences described in Chapter 4.

The activities that DOE describes in this environmental impact statement (EIS) would occur on the SRS, primarily in industrialized areas (for example see Figure 2-13). The only exception would involve the transportation of spent nuclear fuel or waste between SRS areas.

The industrialized areas consist primarily of buildings, paved parking lots, and graveled areas. There are grassed areas around some buildings, and there is vegetation along drainage ditches, but most of the industrialized areas have little or no vegetation.

As discussed in Section 2.4.2, DOE has identified three candidate host sites for the potential construction of a Transfer and Storage Facility. These sites are the east side of L Area inside the facility fence (see Figure 2-8), the southeast side of C Area inside the facility fence (see Figure 2-13), and the northeast side of P Area (see Figure 2-14). DOE also could construct a new Transfer, Storage and Treatment Facility at any of these three sites or in F or H Area. Finally, facilities to implement the New Processing Technology options could be located inside a reactor building, such as Building 105-L.

3.1 Geologic Setting and Seismicity

The SRS is in west-central South Carolina, approximately 100 miles from the Atlantic coast (Figure 3.1-1). It is on the Aiken Plateau of the Upper Atlantic Coastal Plain about 25 miles (40 kilometers) southeast of the Fall Line which separates the Atlantic Coastal Plain from the Piedmont.

3.1.1 GENERAL GEOLOGY

In South Carolina, the Atlantic Coastal Plain Province consists of a wedge of seaward-dipping and thickening unconsolidated and semiconsolidated sediments that extend from the Fall Line to the Continental Shelf (Figure 3.1-1). The Aiken Plateau is the subdivision of the Coastal Plain that includes the location of the SRS. The plateau extends from the Fall Line to the oldest of several scarps incised in the Coastal Plain sediment. The Plateau surface is highly dissected and characterized by broad interfluvial areas with narrow steep-sided valleys. It is generally well drained, although poorly drained depressions (called Carolina bays) occur (DOE 1995a). At the Site, the plateau is underlain by 500 to 1,400 feet (150 to 420 meters) of sands, clays, and limestones of Tertiary and Cretaceous age. These sediments are underlain, in turn, by sandstones of Triassic age and older metamorphic and igneous rocks (Arnett and Mamatey 1996). Because of the proximity of the SRS to the Piedmont Province, it has more relief than areas that are nearer the coast, with onsite elevations ranging from 89 to 420 feet (27 to 128 meters) above mean sea level.

The sediments of the Atlantic Coastal Plain (Figure 3.1-2) dip gently seaward from the Fall Line and range in age from Late Cretaceous to Recent. The sedimentary sequence thickens from essentially 0 at the Fall Line to more than 4,000 feet (1,219 meters) at the coast. Regional dip is to the southeast. Coastal Plain sediments underlying the SRS consist of sandy clays and clayey sands, although occasional beds of clean sand, gravel, clay, or carbonate occur (DOE 1995a). The formations of interest in C, F, H, L, and P Areas are part of the shallow (Floridan) aquifer system (Figure 3.1-2 and Table 3.1-1). Any contaminants could migrate to these formations and be carried by them to SRS streams.

Figure 3.1-1. General location of Savannah River Site and its relationship to physiographic provinces of southeastern United States.

Figure 3.1-2. Generalized geologic and aquifer units in SRS region.

Table 3.1-1. Soil formations of the Floridan aquifer system.[a]

Aquifer Unit	Formation	Description
Upper Three Runs Aquifer	"Upland Unit"	Poorly sorted, clayey-to-silty sands, with lenses and layers of conglomerates, pebbly sands, and clays. Clay clasts are abundant, and cross-bedding and flecks of weathered feldspar are locally common.
	Tobacco Road Formation	Moderately to poorly sorted, variably colored, fine-to-coarse grained sand, pebbly sand, and minor clay beds
	Dry Branch Formation	Variably colored, poorly sorted to well sorted sand with interbedded tan to gray clay
	Clinchfield Formation	Light colored basal quartz sand and glauconitic, biomoldic limestone, calcareous sand and clay. Sand beds of the formation constitute Riggins Mill Member and consist of medium to coarse, poorly to well sorted, loose and slightly indurated, tan, gray, and green quartz. The carbonate sequence of the Clinchfield consists of Utley Member -- sandy, glauconitic limestone and calcareous sand with indurated biomoldic facies
	Tinker/Santee Formation	Unconsolidated, moderately sorted, subangular, lower coarse-to-medium grained, slightly gravely, immature yellow and tan quartz sand and clayey sand; calcareous sands and clays and limestone also occur in F- and H-Areas.
Gordon Confining Unit (green clay)	Blue Bluff Member of Santee Limestone	Micritic limestone
	Warley Hill Formation	Fine grained, glauconitic, clayey sand, and clay that thicken, thin, and pinch out abruptly
Gordon Aquifer	Congaree Formation	Yellow, orange, tan, gray, and greenish gray, well-sorted, fine-to-coarse-grained quartz sands. Thin clay laminae occur throughout the section, with pebbly layers, clay clasts, and glauconite in places. In some places on SRS, upper part of Congaree Formation is cemented with silica; in other places it is slightly calcareous. Glauconitic clay, encountered in some borings on SRS near the base of this formation, indicates that basal contact is unconformable
	Fourmile Formation	Tan, yellow-orange, brown, and white, moderately to well-sorted sand, with clay beds near middle and top of unit. The sand is very coarse to fine-grained, with pebbly zones common. Glauconite and dinoflagellate fossils occur.
	Snapp Formation	Silty, medium- to course-grained quartz sand interbedded with clay. Dark, micaceous, lignitic sand also occurs. In northwestern part of SRS, this Formation is less silty and better sorted, with thinner clay interbeds.

a. Source: Aadland, Gellici, and Thayer (1995).

3.1.2 SUBSURFACE FEATURES

EC TC There are several fault systems off the Site northwest of the Fall Line (DOE 1990a). A more recent study of geophysical evidence (Wike, Moore-Shedrow, and Shedrow 1996) and an earlier study (Stephenson and Stieve 1992) identified the faults indicated on Figure 3.1-3. The earlier study identified the following faults – Pen Branch, Steel Creek, Advanced Tactical Training Area (ATTA), Crackerneck, Ellenton, and Upper Three Runs – under SRS. The one closest to the areas under consideration is the Steel Creek Fault, which passes through L Area and is approximately 1 mile (1.6 kilometers) northwest of P Area. The Upper Three Runs Fault, which is a Paleozoic fault that does not cut Coastal Plain sediments, passes approximately 1 mile (1.6 kilometers) from F Area. The lines shown on Figure 3.1-3 represent the projection of faults to the ground surface. The actual faults do not reach the surface, but rather stop several hundred feet below.

Based on the available information, none of the faults discussed in this section is capable, which means that it has not moved at or near the ground surface within the past 35,000 years or is associated with another fault that had moved in the past 35,000 years. (10 CFR 100 contains a more detailed definition of a capable fault.)

3.1.3 SEISMICITY

Two major earthquakes have occurred within 186 miles (300 kilometers) of SRS.

- The Charleston, South Carolina, earthquake of 1886 had an estimated Richter scale magnitude of 6.8; it occurred approximately 90 miles (145 kilometers) from the SRS area, which experienced an estimated peak horizontal acceleration of 10 percent of gravity (0.10*g*) (URS/Blume 1982).

- The Union County, South Carolina, earthquake of 1913 had an estimated Richter scale magnitude of 6.0 and occurred about 99 miles (160 kilometers) from the Site (Bollinger 1973).

Because these earthquakes are not associated conclusively with a specific fault, researchers cannot determine the amount of displacement resulting from them.

In recent years, three earthquakes occurred inside the SRS boundary as reported by local print and media and cited in DOE (1999a). EC

- On May 17, 1997, with a Richter scale magnitude of 2.3 and a focal depth of 3.38 miles (5.44 kilometers); its epicenter was southeast of K Area.

- On August 5, 1988, with a local Richter scale magnitude of 2.0 and a focal depth of 1.66 miles (2.68 kilometers); its epicenter was northeast of K Area.

- On June 8, 1985, with a local Richter scale magnitude of 2.6 and a focal depth of 0.59 mile (0.96 kilometer); its epicenter was south of C Area and west of K Area.

Existing information does not relate these earthquakes conclusively with known faults under the Site. Figure 3.1-3 shows the locations of the epicenters of these earthquakes.

Outside the SRS boundary, an earthquake with a Richter scale magnitude of 3.2 occurred on August 8, 1993, approximately 10 miles (16 kilometers) east of the City of Aiken near Couchton, South Carolina. People reported feeling this earthquake in Aiken, New Ellenton (immediately north of SRS), North Augusta [approximately 25 miles (40 kilometers) northwest of the SRS], and on the Site (Aiken Standard 1993). EC

3.2 Water Resources

3.2.1 SURFACE WATER RESOURCES

This section describes the surface water, and the quality of that water, in the area potentially affected by the proposed action, including the Savannah River, Upper Three Runs, Fourmile Branch, and Steel Creek.

Figure 3.1-3. Savannah River Site, showing seismic fault lines and locations of onsite earthquakes and their year of occurrence.

3.2.1.1 Savannah River

The Savannah River bounds SRS on its southwestern border for about 20 miles (32 kilometers), approximately 160 river miles (260 river kilometers) from the Atlantic Ocean. Five upstream reservoirs -- Jocassee, Keowee, Hartwell, Richard B. Russell, and Strom Thurmond -- minimize the effects of droughts and the impacts of low flow on downstream water quality and fish and wildlife resources in the river. River flow averages about 10,000 cubic feet (283 cubic meters) per second at SRS (DOE 1995a).

The Savannah River, which forms the boundary between Georgia and South Carolina, supplies potable water to a number of users. Upstream of SRS, the river supplies domestic and industrial water for Augusta, Georgia, and North Augusta, South Carolina. Approximately 130 river miles (210 river kilometers) downstream of SRS, the river supplies domestic and industrial water for Savannah, Georgia, and Beaufort and Jasper Counties in South Carolina through intakes at about River Mile 29 and River Mile 39, respectively (DOE 1995b).

The Savannah River receives sewage treatment plant effluent from Augusta, Georgia; North Augusta, Aiken, and Horse Creek Valley, South Carolina; and from a number of SRS operations through discharges to onsite streams. In addition, the Georgia Power Company's Vogtle Electric Generating Plant withdraws an average of 46 cubic feet (1.3 cubic meters) per second for cooling and returns an average of 12 cubic feet (0.35 cubic meter) per second of cooling tower blowdown. The Urquhart Steam Generating Station at Beech Island, South Carolina, withdraws approximately 265 cubic feet (7.5 cubic meters) per second for once-through cooling water (DOE 1995a).

On SRS, a swamp occupies the floodplain along the Savannah River for approximately 10 miles (17 kilometers); the swamp is about 1.5 miles (2.5 kilometers) wide. A natural levee separates the river from the floodplain. Figure 3.2-1 shows the 100-year floodplain of the Savannah River in the SRS vicinity and the floodplains of major tributaries that drain the Site (DOE 1995a).

3.2.1.2 SRS Streams

Five tributaries of the Savannah River -- Upper Three Runs, Fourmile Branch, Pen Branch, Steel Creek, and Lower Three Runs -- drain almost all of the SRS (Figure 3.2-1). Each stream originates on the Aiken Plateau in the Coastal Plain and descends 50 to 200 feet (15 to 60 meters) before discharging into the river. The streams, which historically received varying amounts of effluent from SRS operations, are not commercial sources of water. Their natural flows range from less than 10 cubic feet (l cubic meter) per second in smaller streams such as Pen Branch to 240 cubic feet (6.8 cubic meters) per second in Upper Three Runs (DOE 1995a).

Upper Three Runs, Fourmile Branch, and Steel Creek are the streams closest to most SRS spent nuclear fuel management locations (see Figure 3.2-1). These streams also are closest to the areas where DOE is most likely to place new spent nuclear fuel facilities.

Upper Three Runs is a large, cool, blackwater stream in the northern part of SRS. It drains an area of approximately 210 square miles (545 square kilometers), and has an average discharge of 330 cubic feet (9.3 cubic meters) per second at its mouth. Upper Three Runs is approximately 25 miles (40 kilometers) long, with its lower 17 miles (28 kilometers) inside SRS boundaries. This creek receives more water from underground sources than other SRS streams and, therefore, has lower conductivity, hardness, and pH values. Upper Three Runs is the only major tributary on SRS that has never received thermal discharges from nuclear reactors (DOE 1995a).

Fourmile Branch is about 15 miles (24 kilometers) long and drains an area of approximately 22 square miles (57 square kilometers). At its headwaters, Fourmile Branch is a small blackwater stream that currently receives

Figure 3.2-1. Savannah River Site, showing 100-year floodplain and major stream systems.

impacts from SRS operations. The water chemistry in the headwater area is very similar to that of Upper Three Runs, with the exception of nitrate concentrations, which are an order of magnitude higher than those in Upper Three Runs (DOE 1995a). These elevated concentrations are probably the result of groundwater transport and outcropping from the F- and H-Area seepage basins. In its lower reaches, Fourmile Branch broadens and flows through a delta formed by the deposition of sediments. Although most of the flow through the delta is in one main channel, the delta has many standing dead trees, logs, stumps, and cypress trees that provide structure and reduce the water velocity in some areas. Downstream of the delta, the creek flows in one main channel and discharges primarily into the Savannah River at River Mile 152, while a small portion flows west and enters Beaver Dam Creek, a EC small onsite tributary of the Savannah River (DOE 1995a).

Steel Creek is about 9 miles (15 kilometers) long and, with Meyers Branch, drains an area of approximately 35 square miles (90 square kilometers) (DOE 1996a). Its headwaters originate near P Reactor. The creek flows southwest about 2 miles (3 kilometers) before it enters the headwaters of L Lake. Flow from the outfall of the L-Lake dam travels about 3 miles (5 kilometers) before entering the Savannah River swamp and then another 2 miles (3 kilometers) before entering the river.

Meyers Branch, the main tributary of Steel Creek, flows approximately 6 miles (10 kilometers) before entering Steel Creek. Meyers Branch is a small blackwater stream that has remained relatively undisturbed by SRS operations. The confluence of Meyers Branch and Steel Creek is downstream from the L-Lake dam. Steel Creek received intermittent thermal effluent from P and L Reactors from 1954 to 1964, and from L Reactor only from 1964 to 1968 (Halverson et al. 1997). Effluents from L and P Areas flow to L Lake and subsequently to Steel Creek through the L-Lake dam outfall. During water year 1996, flows in Steel Creek (downstream of the confluence with Meyers Branch) averaged 59.2 cubic feet (1.7 cubic meters) per second (DOE 1996a).

3.2.1.3 <u>Surface-Water Quality</u>

In 1996, releases of radionuclides from the SRS to surface waters amounted to 8,550 curies of tritium, 0.214 curie of strontium-89 and -90, and TC 0.05 curie of plutonium-239 (Arnett and Mamatey 1998a). Table 3.2-1 lists radioactive liquid releases by source for 1997; Table 3.2-2 lists radioactive liquid releases by outfall or facility and compares annual average radionuclide concentrations to DOE concentration guides (Figure 3.2-2 shows outfall and facility locations for radioactive surveillance). The resulting doses to a downriver consumer of river water from radionuclides released from the Site were less than 2 percent of the U.S. Environmental Protection Agency (EPA) and DOE standards for public water supplies (40 CFR Part 141 and DOE Order 5400.5, respectively) and less than 0.2 percent of the DOE dose standard from all TC pathways (DOE 1990b; Arnett and Mamatey 1998).

The South Carolina Department of Health and Environmental Control (SCDHEC) regulates the physical properties and concentrations of chemicals and metals in SRS effluents under the National Pollutant Discharge Elimination System (NPDES) program. SCDHEC, which also regulates biological water quality standards for SRS waters, has classified the Savannah River and SRS streams as "Freshwaters." In 1997, 99.9 percent of the NPDES water quality analyses on SRS effluents were in compliance with the TC SRS NPDES permit; only 7 of 5,758 analyses exceeded permit limits (Arnett and Mamatey 1998a). A comparison of 1997 Savannah River water quality analysis upstream and downstream of SRS showed no significant differences, and a comparison with historical data indicates that coliform data are within normal fluctuation for river water in this area and the overall exceedances decreased in number from 1996 (Arnett TC and Mamatey 1998a). Table 3.2-3 summarizes the water quality of Fourmile Creek, Steel Creek, and Upper Three Runs for 1996.

Table 3.2-1. Annual liquid releases by source for 1997 (including direct and seepage basin migration releases).[a]

TC

		Curies					
Radionuclide[b]	Half-life (years)	Reactors	Separations[c]	Reactor materials	TNX	SRTC	Total
H-3 (oxide)	12.3	2.91×10^{3}	5.24×10^{-3}		4.02×10^{2}	1.82	8.55×10^{-3}
Sr-89,90[d]	29.1	6.46×10^{-2}	1.40×10^{-1}		5.09×10^{-3}	4.10×10^{-3}	2.14×10^{-1}
I-129[e]	1.6×10^{7}		7.82×10^{-2}[e]				7.82×10^{-2}[d]
Cs-137	30.2	2.86×10^{-3}	4.49×10^{-2}				4.78×10^{-2}
U-234	2.46×10^{5}	4.45×10^{-3}	2.30×10^{-2}	2.68×10^{-5}	1.52×10^{-6}	1.06×10^{-4}	2.76×10^{-2}
U-235	7.04×10^{8}	4.91×10^{-5}	7.23×10^{-4}		1.37×10^{-7}	3.44×10^{-6}	7.76×10^{-4}
U-238	4.47×10^{9}	3.83×10^{-3}	2.57×10^{-2}	5.71×10^{-5}	9.19×10^{-6}	1.11×10^{-4}	2.97×10^{-2}
Pu-238	87.7	4.24×10^{-5}	9.57×10^{-4}		7.68×10^{-7}	1.78×10^{-6}	1.00×10^{-3}
Pu-239[f]	24,100	1.10×10^{-2}	3.39×10^{-2}	1.14×10^{-3}	1.12×10^{-3}	3.38×10^{-3}	5.05×10^{-2}
Am-241	432.7		7.81×10^{-6}	2.11×10^{-6}			9.92×10^{-6}
Cm-244	18.1		2.93×10^{-6}	4.14×10^{-7}			3.34×10^{-6}

Notes: Blank spaces indicate no quantifiable activity.
a. Source: Arnett and Mamatey (1998a).
b. H = hydrogen (H-3 = tritium), Sr = strontium, I = iodine, Cs = cesium, U = uranium, Pu = plutonium, Am = americium, Cm = curium.
c. Includes separations, waste management, and tritium facilities.
d. Includes unidentified beta.
e. Measured I-129 doses were not available for 1997. The value for separations emissions is from 1996.
f. Includes unidentified alpha.
TNX = a technology development facility adjacent to the Savannah River.
SRTC = Savannah River Technology Center.

(Figure 3.2-3 shows stream water quality monitoring locations.)

Certain technologies, including those considered in this EIS, generate liquid byproducts that are transferred to the F- and H-Area Tank Farms. Evaporator overheads from these tanks are condensed and treated at the F- and H-Area Effluent Treatment Facility (ETF). Waste concentrate from the ETF is disposed of in the Z-Area Saltstone Manufacturing and Disposal Facility and the decontaminated wastewater is discharged to Upper Three Runs through NPDES outfall H-16. These existing facilities are described in the *Interim Management of Nuclear Materials EIS* (DOE 1995b) and the *Defense Waste Processing Facility Supplemental EIS* (DOE 1994). Requirements for spent nuclear fuel processing are included in these documents and, therefore, this EIS considers those facilities and processed waste amounts to be part of the SRS baseline.

3.2.2 GROUNDWATER RESOURCES

3.2.2.1 Groundwater Features

In the SRS region, the subsurface contains two hydrogeologic provinces. The uppermost, consisting of a wedge of unconsolidated Coastal Plain sediments of Late Cretaceous and Tertiary age, is the Atlantic Coastal Plain Hydrogeologic Province. Beneath the sediments of the Atlantic Coastal Plain Hydrogeologic Province are rocks of the Piedmont Hydrogeologic Province. These rocks consist of Paleozoic igneous and metamorphic basement rocks and lithified mudstone, sandstone, and conglomerates of the Dunbarton basin of the Upper Triassic. Sediments of the Atlantic Coastal Plain Hydrogeologic Province are divided into three main

Table 3.2-2. Liquid radioactive releases by outfall/facility and comparison of annual average radionuclide concentrations to DOE derived concentration guides.[a]

Outfall or Facility	Radionuclide[b]	Quantity of Radionuclides Released during 1997 (Ci)	Average Effluent Concentration during 1997 (µCi/mL)	DOE DCGs[c] (µCi/mL)
C Area (C Reactor)				
C Canal	H-3 (oxide)	1.20	1.75×10^{-6}	2.00×10^{-3}
	Sr-89,90	Below MDL	ND	1.00×10^{-6}
	Cs-137	Below MDL	1.02×10^{-9}	3.00×10^{-6}
F Area (Separations and Waste Management)				
F-01	H-3 (oxide)	5.03×10^{-2}	2.54×10^{-7}	2.00×10^{-3}
	Sr-89,90	Below MDL	ND	1.00×10^{-6}
	Cs-137	Below MDL	1.32×10^{-9}	3.00×10^{-6}
F-012 (281-8F Retention Basin)	H-3 (oxide)	7.67×10^{-1}	9.83×10^{-6}	2.00×10^{-3}
	Sr-89,90	Below MDL	3.01×10^{-9}	1.00×10^{-6}
	Cs-137	158×10^{-3}	2.07×10^{-8}	3.00×10^{-6}
	H-3 (oxide)	1.73×10^{-2}	1.63×10^{-6}	2.00×10^{-3}
	Sr-89,90	3.13×10^{-5}	4.39×10^{-9}	1.00×10^{-6}
	Cs-137	5.92×10^{-4}	2.30×10^{-8}	3.00×10^{-6}
Fourmile Branch-3 (F-Area Effluent)	H-3 (oxide)	1.32×10	7.80×10^{-7}	2.00×10^{-3}
	Sr-89,90	Below MDL	4.16×10^{-10}	1.00×10^{-6}
	Cs-137	Below MDL	8.97×10^{-10}	3.00×10^{-6}
Upper Three Runs-2 (F Storm Sewer)	H-3 (oxide)	1.66×10^{-1}	8.78×10^{-7}	2.00×10^{-3}
	Sr-89,90	Below MDL	8.56×10^{-11}	1.00×10^{-6}
	Cs-137	Below MDL	5.13×10^{-10}	3.00×10^{-6}
	U-234	6.86×10^{-5}	3.48×10^{-10}	6.00×10^{-7}
	U-235	5.15×10^{-6}	3.02×10^{-11}	6.00×10^{-7}
	U-238	1.90×10^{-4}	9.15×10^{-10}	6.00×10^{-7}
	Pu-238	1.54×10^{-5}	9.10×10^{-11}	4.00×10^{-8}
	Pu-239	7.73×10^{-6}	4.66×10^{-11}	3.00×10^{-8}
	Am-241	7.77×10^{-6}	3.98×10^{-11}	3.00×10^{-8}
	Cm-244	2.92×10^{-6}	1.74×10^{-11}	6.00×10^{-8}
Upper Three Runs F-3 (Naval Fuel Effluent)	H-3 (oxide)	3.45×10^{-2}	1.46×10^{-6}	2.00×10^{-3}
	Sr-89,90	Below MDL	1.16×10^{-10}	1.00×10^{-6}
	Cs-137	Below MDL	2.47×10^{-10}	3.00×10^{-6}
	U-234	1.62×10^{-5}	8.95×10^{-10}	6.00×10^{-7}
	U-235	5.86×10^{-6}	2.30×10^{-9}	6.00×10^{-7}
	U-238	3.04×10^{-6}	1.76×10^{-10}	6.00×10^{-7}
	Pu-238	1.61×10^{-7}	6.23×10^{-12}	4.00×10^{-8}
	Pu-239	2.60×10^{-8}	5.04×10^{-12}	3.00×10^{-8}
	Am-241	4.49×10^{-8}	7.07×10^{-13}	3.00×10^{-8}
	Cm-244	9.54×10^{-9}	-6.84×10^{-11}	6.00×10^{-8}

TC

Table 3.2-2. (continued).

Outfall or Facility	Radionuclide[b]	Quantity of Radionuclides Released during 1997 (Ci)	Average Effluent Concentration during 1997 (µCi/mL)	DOE DCGs[c] (µCi/mL)
H Area (Separations and Waste Management)				
Fourmile Branch-1C (H-Area Effluent)	H-3 (oxide)	3.85×10	9.22×10^{-6}	2.00×10^{-3}
	Sr-89,90	7.93×10^{-5}	7.05×10^{-10}	1.00×10^{-6}
	Cs-137	6.77×10^{-4}	3.27×10^{-9}	3.00×10^{-6}
	H-3 (oxide)	4.96×10^{-1}	1.23×10^{-5}	2.00×10^{-3}
	Sr-89,90	3.48×10^{-6}	5.40×10^{-10}	1.00×10^{-6}
	Cs-137	2.15×10^{-6}	7.15×10^{-10}	3.00×10^{-6}
	U-234	2.77×10^{-6}	8.54×10^{-11}	6.00×10^{-7}
	U-235	9.84×10^{-9}	8.61×10^{-12}	6.00×10^{-7}
	U-238	2.07×10^{-6}	6.58×10^{-11}	6.00×10^{-7}
	Pu-238	5.09×10^{-7}	2.45×10^{-11}	4.00×10^{-8}
	Pu-239	8.93×10^{-8}	6.37×10^{-12}	3.00×10^{-8}
H-017 (281-8H Retention Basin)	H-3	7.17×10^{-1}	1.02×10^{-5}	2.00×10^{-3}
	Sr-89,90	5.21×10^{-4}	7.91×10^{-9}	1.00×10^{-6}
	Cs-137	1.04×10^{-2}	1.11×10^{-7}	3.00×10^{-6}
H-018 (200-H Cooling Basin)	H-3 (oxide)	1.44×10^{-1}	2.27×10^{-5}	2.00×10^{-3}
	Sr-89,90	2.75×10^{-4}	4.58×10^{-8}	1.00×10^{-6}
	Cs-137	2.21×10^{-3}	3.71×10^{-7}	3.00×10^{-6}
HP-15 (Tritium Facility Outfall)	H-3 (oxide)	1.74×10	1.55×10^{-5}	2.00×10^{-3}
	Cs-137	Below MDL	7.75×10^{-11}	3.00×10^{-6}
HP-52 (H-Area Tank Farm)	H-3 (oxide)	2.43×10	1.30×10^{-6}	2.00×10^{-3}
	SR-89,90	Below MDL	7.67×10^{-11}	1.00×10^{-6}
	Cs-137	1.58×10^{-4}	1.92×10^{-9}	3.00×10^{-6}
TC McQueen's Branch at Rd F	H-3 (oxide)	120×10^{1}	1.05×10^{-5}	2.00×10^{-3}
	Cs-137	Below MDL	4.85×10^{-10}	3.00×10^{-6}
Upper Three Runs – 2A (ETF[e] Outfall at Rd C)	H-3 (oxide)	3.82×10^{2}	(f)	2.00×10^{-3}
	Sr-89,90	1.28×10^{-5}	2.24×10^{-9}	1.00×10^{-6}
	Cs-137	1.79×10^{-2}	2.16×10^{-7}	3.00×10^{-6}
L Area (L Reactor)				
L-007	H-3 (oxide)	6.02×10	3.38×10^{-7}	2.00×10^{-3}
	Sr-89,90	Below MDL	1.16×10^{-10}	1.00×10^{-6}
	Cs-137	Below MDL	4.53×10^{-10}	3.00×10^{-6}
P Area (P Reactor)				
P-013A	H-3 (oxide)	7.18×10^{-1}	2.96×10^{-4}	2.00×10^{-3}
	Sr-89,90	5.25×10^{-6}	3.47×10^{-9}	1.00×10^{-6}
	Cs-137	2.38×10^{-4}	9.86×10^{-8}	3.00×10^{-6}
P-019A (P-Area Canal Par Pond)	H-3 (oxide)	3.25×10^{-1}	5.41×10^{-7}	2.00×10^{-3}
	Sr-89,90	Below MDL	3.03×10^{-10}	1.00×10^{-6}
	Cs-137	Below MDL	ND	3.00×10^{-6}

a. Source: Arnett and Mamatey (1998a).
b. H = hydrogen (H-3 = tritium), Sr = strontium, I = iodine, Cs = cesium, U = uranium, Pu = plutonium, Am = americium, Cm = curium.
c. DCG = derived concentration guide. Source: DOE Order 5400.5. In cases where different chemical forms have different DCGs, the lowest DCG for the radionuclide is given. DCGs are defined as the concentration of that radionuclide that will give a 50-year committed effective dose equivalent of 100 mrem under conditions of continuous exposure for one year. DCGs are reference values only and are not considered release limits or standards.
d. MDL = minimum detectable level.
e. ETF = Effluent Treatment Facility.
f. Outfall concentrations for tritium exceed the DCG guidelines. DOE Order 5400.5 exempts tritium from "best available technology" requirements because there is no practical technology available for removing tritium from dilute liquid waste streams.
ND = not detected.

Figure 3.2-2. Radiological surface-water sampling locations.

Table 3.2-3. SRS stream water quality (onsite downstream locations).[a]

Parameter[b]	Units	Fourmile Branch (FM-6) average	Steel Creek (SC-4) average	Upper Three Runs (U3R-4) average	Water Quality Criterion[c], MCL[d], or DCG[e]
Aluminum	Mg/L	0.200[f]	0.018	0.274[f]	0.087
Cadmium	Mg/L	ND[g]	ND	ND	0.00066
Calcium	Mg/L	2.94	2.53	1.62	NA[h]
Cesium-137	PCi/L	NR[i]	NR	NR	120[e]
Chromium	mg/L	ND	ND	ND	0.011
Copper	mg/L	0.015[f]	0.028[f]	0.036[f]	0.0065
Dissolved oxygen	mg/L	7.9	8.73	8.2	≥5
Iron	mg/L	0.69	0.349	0.586	1
Lead	mg/L	ND	ND	ND	0.0013
Magnesium	mg/L	0.659[f]	0.854[f]	0.385[f]	0.3
Manganese	mg/L	0.055	0.048	0.026	1
Mercury	mg/L	ND	0.0002	ND	0.000012
Nickel	mg/L	0.01	0.01	0.012	0.088
Nitrate (as nitrogen)	mg/L	1.36	0.16	0.24	10[d]
pH	pH	6.31	6.32	6.3	6-8.5
Plutonium-238	pCi/L	NR	NR	NR	1.6[e]
Plutonium-239	pCi/L	NR	NR	NR	1.2[e]
Sodium	mg/L	6.8	1.89	1.58	NA
Strontium-89,90	pCi/L	NR	NR	NR	8[d]
Suspended solids	mg/L	8.08	5.2	14.1	NA
Temperature[j]	°C	18.1	18.6	17.3	32.2
Total dissolved solids	mg/L	355.6	48	36	500[k]
Tritium	pCi/L	NR	NR	NR	20,000[d]
Uranium-234	pCi/L	NR	NR	NR	20[e]
Uranium-235	pCi/L	NR	NR	NR	24[e]
Uranium-238	pCi/L	NR	NR	NR	24[e]
Zinc	mg/L	0.041	0.040	0.028	0.059

a. Source: Arnett and Mamatey (1997).
b. Parameters DOE routinely measures as a regulatory requirement or as part of ongoing monitoring programs.
c. Water Quality Criterion (WQC) is Aquatic Chronic Toxicity unless otherwise indicated.
d. MCL = Maximum Contaminant Level; State Primary Drinking Water Regulations.
e. DCG = DOE Derived Concentration Guides for Water (DOE Order 5400.5). DCG values are based on committed effective dose of 100 millirem per year; however, because drinking water MCL is based on 4 millirem per year, value listed is 4 percent of DCG.
f. Concentration exceeded WQC; however, these criteria are for comparison only. WQCs are not legally enforceable.
g. ND = Not Detected.
h. NA = Not Applicable.
i. NR = Not Reported.
j. Shall not be increased more than 2.8°C (5°F) above natural temperature conditions or exceed a maximum of 32.2°C (90°F) as a result of the discharge of heated liquids unless appropriate temperature criterion mixing zone has been established.
k. Secondary MCL; State Primary Drinking Water Regulations.

Figure 3.2-3. SRS streams and Savannah River water quality sampling locations.

aquifer systems, the Floridan Aquifer System, the Dublin Aquifer System, and the Midville Aquifer System as shown in Figure 3.1-2 (Aadland, Gellici, and Thayer 1995). Each aquifer system is divided from the others by two confining systems, the Meyers Branch Confining System and the Allendale Confining System, as shown in Figure 3.1-2. TC

Groundwater within the Floridan system (the shallow aquifer beneath the Site) flows slowly toward SRS streams and swamps and into the Savannah River at rates ranging from inches to several hundred feet per year. The depth to which onsite streams cut into soils and the orientation of the soil formations control the horizontal and vertical movement of the groundwater. The valleys of smaller perennial streams allow discharge from the shallow saturated geologic formations. The valleys of major tributaries of the Savannah River (e.g., Upper Three Runs) drain formations of intermediate depth, and the river valley drains deep formations. With the release of water to the streams, the hydraulic head of the aquifer unit releasing the water can become less than that of the underlying unit. If this occurs, groundwater has the potential to migrate from the lower unit to the overlying unit.

Groundwater flow in the shallow aquifer (Floridan) system is vertically downward in the divide areas between surface water drainages due to the decreasing hydraulic head with increasing depth. In areas along the lower reaches of most of the Site streams, groundwater moves vertically upward from deeper aquifers to the shallow aquifers. In these areas hydraulic heads increases with depth.

In the vicinity of these streams, the vertical upward flow occurs across the Crouch Branch Confining Unit/Gordon Confining Unit. At these locations any contaminants in the overlying aquifer system are prevented from migrating into deeper aquifers by the prevailing hydraulic gradient and the low permeability of the confining unit. Horizontal groundwater flow occurs at the M-Area metallurgical laboratory (to the west-northwest in the shallow aquifer and subsequent flow to the south toward Upper Three Runs in the intermediate aquifer), K-Area Disassembly Basin (toward Pen Branch and L Lake), P-Area Disassembly Basin (toward Steel Creek), F Canyon (toward Upper Three Runs and Fourmile Branch), and H Canyon (toward Upper Three Runs and its tributaries).

3.2.2.2 Groundwater Use

Groundwater is a domestic, municipal, and industrial water source throughout the Upper Coastal Plain. Domestic water supplies come primarily from the shallow aquifers including the Gordon Aquifer and the Upper Three Runs Aquifer (water-table aquifer). Most municipal and industrial water supplies in Aiken County are from the Cretaceous intermediate to deep aquifer units. In Barnwell and Allendale Counties some municipal water supplies are from the Gordon Aquifer and overlying units that thicken to the southeast. At SRS, most groundwater production for domestic and process water comes from the intermediate/deep aquifers (i.e., the Crouch Branch and McQueen Branch Aquifers), with a few lower-capacity process water wells pumping from the shallower Gordon Aquifer.

Every major operating area at SRS has groundwater wells; total groundwater production ranges from 9 to 12 million gallons (34,000 to 45,000 cubic meters) per day, similar to the volume pumped for industrial and municipal production within 10 miles (16 kilometers) of the Site (Arnett and Mamatey 1996).

From October 1995 to September 1996, the total groundwater withdrawal rate for C, F, H, P, and L Areas was approximately 4 million gallons (15,130 cubic meters) per day. Groundwater in C Area comes from two domestic wells that produced approximately 220,000 gallons (830 cubic meters) per day. Groundwater in F Area is pumped from four process production and two domestic wells. The total F-Area groundwater production rate from October 1995 to September 1996 was approximately 1.58 million gallons (5,981 cubic meters) per day. During the same period, wells in H, L, and P Areas produced ap- EC proximately 1.9 million gallons (7,190 cubic meters) per day, 140,000 gallons (530 cubic meters) per day, and 170,000 gallons (640 cubic meters) per day, respectively. H Area has two domestic wells and three process production wells; L Area has two domestic wells. Until recently, two P-Area groundwater wells were used for domestic purpose. At present, these wells are not being used for domestic or process production. SRS is implementing a consolidation program for domestic wells. When this program is complete, DOE might take the domestic wells in C, F, H, and L Areas out of service or use them only for process water (Wells 1997).

3.2.2.3 SRS Hydrogeology

The aquifers of interest for C, F, H, L, and P Areas are the Upper Three Runs and Gordon Aquifers. The Upper Three Runs (water table) Aquifer is defined by the hydrogeologic properties of the Tinker/Santee Formation, the Dry Branch Formation, and the Tobacco Road Formation (DOE 1996a). Table 3.1-1 lists these formations.

The Gordon Confining Unit (green clay), which separates the Upper Three Runs and Gordon Aquifers, consists of the Warley Hill Formation and the Blue Bluff Member of the Santee Limestone (Table 3.1-1). It is not a continuous clay unit, but consists of several lenses of green and gray clay that thicken, thin, and pinch out abruptly. Locally, beds of calcareous mud add to the thickness of the unit with minor interbeds of clayey sand or sand. The vertical hydraulic conductivity ranges from 1.1×10^{-6} foot (3.4×10^{-5} centimeter) to 0.16 foot (4.9 centimeters) per day and the horizontal conductivity ranges from 5.4×10^{-6} foot (1.6×10^{-5} centimeter) to 5.7×10^{-3} foot (0.17 centimeter) per day (Aadland, Gellici, and Thayer 1995). TC

The Gordon Aquifer consists of the Congaree, Fourmile, and Snapp Formations. Table 3.1-1 lists the soil descriptions for these formations. The Gordon Aquifer is partially eroded near the Savannah River and Upper Three Runs. This aquifer is recharged directly by precipitation in the outcrop area and at interstream drainage divides in and near the outcrop area, and by leak age from overlying and underlying aquifers. The northeast-to-southwest hydraulic gradient across SRS is consistent and averages 4.8 feet per mile (0.9 meter per kilometer). Based on pumping tests on 13 SRS wells, the average hydraulic conductivity is approximately 35 feet (10.7 meters) per day.

3.2.2.4 Groundwater Quality

Industrial solvents, metals, tritium, and other constituents used or generated on SRS have contaminated the shallow aquifers beneath 5 to 10 percent of the Site. In general, DOE does not use these aquifers for SRS operations or drinking water, although there are a few low-yield wells in the Gordon Aquifer. The shallow aquifer units discharge to SRS streams and eventually the Savannah River (Arnett and Mamatey 1997). TC

Most contaminated groundwater at SRS occurs beneath a few facilities; the contaminants reflect the operations and chemical processes performed at those facilities. At C Area, groundwater contaminants above regulatory or SRS guidelines include tritium and other radionuclides, bis (2-ethylhexyl) phthalate, carbon disulfide, lead, manganese, and chlorinated organics. At F and H Areas, contaminants above the guidelines include tritium and other radionuclides, metals, nitrates, sulfates, and chlorinated and volatile organics. At L Area, tritium, other radionuclides, carbon disulfide, chlorinated and volatile organics, and metals are in the groundwater at levels above the guidelines. Groundwater beneath the L-Area Disassembly Basin has been affected by metals, chlorinated organics, and tritium at levels above regulatory guidelines. Tables 3.2-4 through 3.2-8 list concentrations of individual analytes above regulatory or SRS guidelines for 1995 in C, F, H, L, and P Areas, respectively (WSRC 1995a). Figure 3.2-4 shows generalized groundwater contamination maximum values for analytes at or above regulatory or established SRS guidelines for the areas of concern.

Table 3.2-4. C-Area maximum reported groundwater parameters in excess of regulatory and SRS limits.[a]

Analyte	Concentration	Regulatory Limit
Aluminum[b]	6,430 μg/L	50 μg/L[c]
Bis (2-ethylhexyl) phthalate	23 μg/L	6 μg/L[d]
Iron[b]	10,500 μg/L	300 μg/L[d]
Lead[b]	301 μg/L	50 μg/L[e]
Manganese[b]	254 μg/L	50 μg/L[c]
Carbon disulfide	74 μg/L	10 μg/L[f]
Trichloroethylene	1,580 μg/L	5 μg/L[d]
Tetrachloroethylene	174 μg/L	5 μg/L[d]
Dichloromethane	8.7 μg/L	5 μg/L[d]
Total organic halogens	972 μg/L	50 μg/L[f]
Tritium	2.4×10^{-2} μCi/mL	2.0×10^{-5} μCi/mL[d]
Thallium	3.5 μg/L	2 μg/L[d]
Thorium-234	6.8×10^{-7} μCi/mL	4.01×10^{-7} μCi/mL[g]

a. μg/L = micrograms per liter; μCi/mL = microcuries per milliliter.
b. Total recoverable.
c. EPA National Secondary Drinking Water Standards (WSRC 1995a).
d. EPA Primary Drinking Water Standards (WSRC 1995a).
e. SCDHEC Final Primary Drinking Water Standards (WSRC 1995a).
f. Drinking Water Standards do not apply. Criterion 10 times a recently published 90th percentile detection limit was used (WSRC 1995a).
g. EPA Proposed Primary Drinking Water Standard (WSRC 1995a).

3.3 Air Resources

3.3.1 GENERAL METEOROLOGY

Based on data collected from SRS meteorological towers from 1987 through 1991 (the latest quality-assured 5-year data set), maximum wind direction frequencies at the Site are from the northeast and west-southwest and the average wind speed is 8.5 miles per hour (3.8 meters per second). The average annual temperature at the Site is 64°F (17.8°C). The atmosphere in the region is unstable approximately 56 percent of the time, neutral 23 percent of the time, and stable about 21 percent of the time (Shedrow 1993). In general, as the atmosphere becomes more unstable, atmospheric dispersion of airborne pollutants increases and ground-level pollutant concentrations decrease.

3.3.2 SEVERE WEATHER

The SRS area experiences an average of 55 thunderstorm days a year, 50 percent of which occur in June, July, and August (Shedrow 1993). On average, lightning strikes six times a year on a square-kilometer area (Hunter 1990). The highest windspeed recorded at Bush Field (Augusta, Georgia) between 1950 and 1993 was 62 miles (100 kilometers) per hour (NOAA 1994).

From 1954 to 1983, 37 reported tornadoes occurred in a 1-degree square of latitude and longitude that includes SRS (WSRC 1993). This frequency of occurrence is equivalent to an average of about one tornado per year. Tornado statistics indicate that the average frequency of a tornado striking any single point on the site is TC

Table 3.2-5. F-Area maximum reported groundwater parameters in excess of regulatory and SRS limits.[a]

Analyte	Concentration (µg/L for metals and organics; µCi/mL for radioisotopes unless otherwise noted)	Regulatory limit (µg/L for metals and organics; µCi/mL for radioisotopes)
Aluminum[b]	95,900	50[c]
Beryllium[b]	10	4[d]
Bis (2-ethylhexyl) phthalate	190	6[d]
Cadmium[b]	243	5[d]
Copper[b]	1,210	1,000[d]
Chromium[b]	185	100[d]
Iron[b]	261,000	300[d]
Lead[b]	6,500	50[e]
Lithium[b]	249	50[f]
Manganese[b]	15,000	50[c]
Mercury[b]	5.4	2[e]
Nickel[b]	176	100[d]
Carbon tetrachloride	23	5[d]
Trichloroethylene	96	5[d]
Trichlorofluoromethane	80	10[f]
Tetrachloroethylene	42	5[d]
Dichloromethane	65	5[d]
1,2-dichloroethane	162	5[d]
Total organic carbon	18,600	10,000
Total organic halogens	148	50[f]
Nitrate as nitrogen	71,300	1,000[d]
Nitrate-nitrite as nitrogen	384,000	10,000[d]
Americium-241	9.9×10^{-8}	6.34×10^{-9}[g]
Cesium-137	4.4×10^{-7}	2.0×10^{-7}[h]
Cobalt[b]	665	40[f]
Curium-243/244	1.6×10^{-7}	8.3×10^{-9}[g]
Curium-245/246	9.9×10^{-8}	6.23×10^{-9}[g]
Iodine-129	7.2×10^{-7}	1.0×10^{-9}[h]
Lithium[b]	56	50[f]
Tritium	2.2×10^{-2}	2.0×10^{-5}[d]
Plutonium-238	2.3×10^{-8}	7.02×10^{-9}[g]
Radium-226	1.1×10^{-7}	2.0×10^{-8}[g,I]
Radium-228	3.1×10^{-7}	2.0×10^{-8}[g,I]
Nonvolatile beta	2.5×10^{-5}	5.0×10^{-8}[h]
Total alpha-emitting radium	1.6×10^{-7}	2.0×10^{-8}[g]
Gross alpha	2.5×10^{-6}	1.5×10^{-8}[d]
Strontium-89	7.1×10^{-7}	2.0×10^{-8}[h]
Strontium-90	7.4×10^{-6}	8.0×10^{-9}[d]
Thallium[b]	4.3	2.0[d]
Thorium-234	9.5×10^{-7}	4.01×10^{-7}[g]
Uranium-233/234	4.8×10^{-7}	1.38×10^{-8}[g]
Uranium-235	5.0×10^{-8}	1.45×10^{-8}[g]
Uranium-238	1.3×10^{-6}	1.46×10^{-8}[g]

a. Abbreviations: µg/L = micrograms per liter; µCi/mL = microcuries per milliliter.
b. Total recoverable.
c. EPA National Secondary Drinking Water Standard (WSRC 1995a).
d. EPA Final Primary Drinking Water Standard (WSRC 1995a).
e. SCDHEC Final Primary Drinking Water Standard (WSRC 1995a).
f. Drinking Water Standards do not apply. Criterion 10 times a recently published 90th percentile detection limit was used (WSRC 1995a).
g. EPA Proposed Primary Drinking Water Standard (WSRC 1995a).
h. EPA Interim Final Primary Drinking Water Standards (WSRC 1995a).
i. Radium-226/228 combined proposed Maximum Contaminant Level of 5.0×10^{-8} microcuries per milliliter.

Table 3.2-6. H-Area maximum reported groundwater parameters in excess of regulatory and SRS limits.[a]

Analyte	Concentration (µg/L for metals and organics; µCi/mL for radioisotopes)	Regulatory limit (µg/L for metals and organics; µCi/mL for radioisotopes)
Aluminum[b]	2,800	50[c]
Bis (2-ethylhexyl) phthalate	23	6[d]
Iron[b]	7,990	300[d]
Lead[b]	301	50[e]
Manganese[b]	91	50[c]
Trichloroethylene	1,580	50[c]
Total Organic Halogens	972	50[d]
Thallium[b]	4.0	2.0[d]
Tritium	2.4×10^{-2}	2.0×10^{-5}[d]
Thorium-234	6.8×10^{-7}	4.01×10^{-7}[g]

a. Abbreviations: µg/L = micrograms per liter; µCi/mL = microcuries per milliliter.
b. Total recoverable.
c. EPA National Secondary Drinking Water Standard (WSRC 1995a).
d. EPA Final Primary Drinking Standard (WSRC 1995a).
e. SCDHEC Final Primary Drinking Water Standard (WSRC 1995a).
f. Drinking Water Standards do not apply. Criterion 10 times a recently published 90th percentile detection limit was used (WSRC 1995a). TC
g. EPA Proposed Primary Drinking Water Standards (WSRC 1995a).

Table 3.2-7. L-Area maximum reported groundwater parameters in excess of regulatory and SRS limits.[a]

Analyte	Concentration (µg/L for metals and organics; µCi/mL for radioisotopes)	Regulatory limit (µg/L for metals and organics; µCi/mL for radioisotopes)
Aluminum[b]	320	50[c]
Boron[b]	1,590	300[d]
Iron[b]	14,100	300[d]
Lead[b]	58	50[e]
Manganese[b]	771	50[c]
Tetrachloroethylene	17	5[d]
Total Organic Carbon	3.5×10^{-6}	10,000[f]
Nitrate-nitrite as Nitrogen	268,000	10,000[d]
Thallium[b]	7.4	2.0[d]
Tritium	5.4×10^{-4}	2.0×10^{-5}[d]
Non-volatile Beta	1.7×10^{-6}	5.0×10^{-8}[g]

a. Abbreviations: µg/L = micrograms per liter; µCi/mL = microcuries per milliliter.
b. Total recoverable.
c. EPA National Secondary Drinking Water Standard (WSRC 1995a).
d. EPA Final Primary Drinking Water Standard (WSRC 1995a).
e. SCDHEC Final Primary Drinking Water Standard (WSRC 1995a).
f. Drinking Water Standards do not apply. Criterion 10 times a recently published 90th percentile detection limit was used (WSRC 1995a).
g. EPA Interim Final Primary Drinking Water Standards (WSRC 1995a).

Table 3.2-8. P-Area maximum reported groundwater parameters in excess of regulatory and SRS limits.[a]

Analyte	Concentration (µg/L for metals and organics)	Regulatory limit (µg/L for metals and organics)
Aluminum[b]	19,900	50[c]
Iron[b]	22,200	300[d]
Manganese[b]	419	50[c]
Carbon tetrachloride	11	5[d]
Trichloroethylene	24	50[d]
Tetrachloroethylene	8.4	5[d]
Total organic halogens	79	50[e]
Tritium	7.7×10^{-2} Ci/mL	2.0×10^{-5}[d] µCi/mL
Strontium-90	1.7×10^{-6} Ci/mL	8.0×10^{-9}[d] µCi/mL

a. Abbreviations: µg/L = micrograms per liter; µCi/mL = microcuries per milliliter.
b. Total recoverable.
c. EPA National Secondary Drinking Water Standard (WSRC 1995a).
d. EPA Final Primary Drinking Water Standard (WSRC 1995a).
e. Drinking Water Standards do not apply. Criterion 10 times a recently published 90th percentile detection limit was used (WSRC 1995a).

2×10^{-4} per year or about once every 5,000 years (Weber et al. 1998). Since operations began in 1953, nine confirmed tornadoes have occurred on or near the Site. Nothing more than light damage occurred, with the exception of a tornado in October 1989 that caused considerable damage to forest resources in an undeveloped southeastern sector of the SRS (Shedrow 1993). From 1700 to 1992, 36 hurricanes crossed South Carolina, which resulted in a frequency of about one every 8 years (WSRC 1993). Because the SRS is about 100 miles (160 kilometers) inland, the winds associated with hurricanes have usually diminished below hurricane force [i.e., equal to or greater than a sustained wind speed of 75 miles per hour (33.5 meters per second)] before reaching the Site. Winds exceeding hurricane force have been observed only once at the SRS (Hurricane Gracie in 1959) (Shedrow 1993).

3.3.3 RADIOLOGICAL AIR QUALITY

DOE provides detailed summaries of radiological releases to the atmosphere from SRS operations, along with resulting concentrations and doses, in a series of annual environmental data reports. This section references several of those documents, which contain additional information. The information enables comparisons of current data with potential releases, concentrations, and doses associated with each alternative.

In the SRS region, airborne radionuclides originate from natural sources (terrestrial and cosmic), worldwide fallout, and Site operations. DOE maintains a network of air monitoring stations on and around the Site to determine concentrations of radioactive particulates and aerosols in the air (Arnett and Mamatey 1998b).

Table 3.3-1 lists average and maximum atmospheric radionuclide concentrations at the SRS boundary and at background monitoring locations [100-mile (160-kilometer) radius] during 1997. Tritium is the only radionuclide from the SRS detected routinely in offsite air samples above background (control) concentrations (Cummins, Martin, and Todd 1990, 1991; Arnett et al. 1992; Arnett, Karapatakis, and Mamatey 1993, 1994; Arnett and Mamatey 1996; Arnett and Mamatey 1997; Arnett and Mamatey 1998b). Table 3.3-2 lists 1997 radionuclide releases from each major operational group of SRS facilities. All radiological impacts are within regulatory requirements.

Figure 3.2-4. Maximum reported groundwater contamination at Savannah River Site.

Table 3.3-1. Radioactivity in air at SRS boundary and at 100-mile (160-kilometer) radius during 1997 (picocuries per cubic meter).[a]

Location	Tritium	Gross alpha	Gross beta	Cobalt-60	Cesium-137	Strontium-89,90	Plutonium-238	Plutonium-239
Site boundary								
Average[b]	11	9.8×10^{-4}	0.015	5.7×10^{-4}	1.5×10^{-4}	8.0×10^{-5}	(c)	(c)
Maximum[d]	65	0.0033	0.032	0.024	0.0073	3.6×10^{-4}	4.1×10^{-6}	7.0×10^{-6}
Background (100-mile radius)								
Average	3.2	0.0011	0.011	(c)	(c)	8.9×10^{-4}	6.9×10^{-6}	(c)
Maximum	5.4	0.0030	0.018	0.0073	0.0055	0.0019	4.2×10^{-5}	2.6×10^{-5}

a. Source: Arnett and Mamatey (1998a).
b. The average value is the average value of the arithmetic means reported for the site perimeter sampling locations.
c. Below background levels.
d. The maximum value is the highest value of the maximums reported for the site perimeter sampling locations.

TC

3.3.4 NONRADIOLOGICAL AIR QUALITY

The SRS is in the Augusta (Georgia) - Aiken (South Carolina) Interstate Air Quality Control Region. This region, which is designated a Class II area, is in compliance with National Ambient Air Quality Standards for criteria pollutants. Class II is the initial designation of any area that is not pristine; pristine areas include national parks or national wilderness areas. Criteria pollutants include sulfur dioxide, nitrogen oxides (reported as nitrogen dioxide), particulate matter (less than or equal to 10 microns in diameter), carbon monoxide, ozone, and lead (40 CFR 50).

DOE used the comprehensive emissions inventory data for 1996, which is the most recent available, to establish the baseline year for showing compliance with national and state air quality standards by calculating actual emission rates for existing sources of criteria pollutants. DOE based these emission rates on process knowledge, source testing, material balance, and EPA's Industrial Source Complex Air Dispersion Model.

SCDHEC has air quality regulatory authority over SRS. SCDHEC determines ambient air quality compliance based on air pollutant emissions and estimates of concentrations at the Site boundary based on atmospheric dispersion modeling. The SRS is in compliance with National Ambient Air Quality Standards for criteria pollutants and gaseous fluoride and with total suspended particulate standards, as required by SCDHEC Regulation R.61-62.5, Standard 2, “Ambient Air Quality Standards.” Table 3.3-3 lists these standards and the results of the atmospheric dispersion modeling for baseline year 1996.

The SRS is in compliance with SCDHEC Regulation R.61-62.5, Standard 8, “Toxic Air Pollutants,” which regulates the emission of 257 toxic air pollutants (WSRC 1994). DOE has identified emission sources for 139 of the 257 regulated air toxics; the modeled results indicate that the Site is in compliance with SCDHEC air quality standards. Table 3.3-4 lists toxic air pollutants that are the same as those the alternative actions described in this EIS would emit, and compares maximum downwind concentrations at the Site boundary for baseline year 1990, which is the most recent data available, to SCDHEC standards for toxic air pollutants.

Table 3.3-2. Radiological atmospheric releases by operational group for 1997.[a]

Radionuclide[b]	Half-life	Reactors	Separations[c]	Reactor materials	Heavy water	SRTC[d]	Diffuse and fugitive[e]	Total
		Curies released						
Gases and vapors								
H-3 (oxide)	12.3 years	5.2×10^{3}	3.3×10^{4}		350		150	3.9×10^{4}
H-3 (elem)	12.3 years		1.9×10^{4}					1.9×10^{4}
H-3 Total	12.3 years	5.2×10^{3}	5.2×10^{4}		350		150	5.8×10^{4}
C-14	5.73×10^{3} years		3.1×10^{-2}				1.9×10^{-8}	3.1×10^{-2}
Kr-85	10.73 years		9.6×10^{3}					9.6×10^{3}
I-129	1.57×10^{7} years		7.1×10^{-3}				1.2×10^{-7}	7.1×10^{-3}
I-131	8.040 days		2.9×10^{-5}			2.98×10^{-5}		5.9×10^{-5}
I-133	20.8 hours					4.92×10^{-4}		4.9×10^{-4}
Particulates								
Na-22	2.605 years						1.1×10^{-9}	1.1×10^{-9}
Mn-54	312.2 days						4.8×10^{-12}	4.8×10^{-12}
Co-57	271.8 days		2.2×10^{-7}				1.0×10^{-9}	2.1×10^{-7}
Co-58	70.88 days						1.7×10^{-12}	1.7×10^{-12} TC
Co-60	5.271 years		3.5×10^{-7}				9.1×10^{-7}	1.3×10^{-6}
Ni-59	7.6×10^{4} years						3.2×10^{-10}	3.2×10^{-10}
Ni-63	100 years						2.3×10^{-9}	2.3×10^{-9}
Zn-65	243.8 days						3.7×10^{-12}	3.7×10^{-12}
Se-79	6.5×10^{4} years						2.2×10^{-10}	2.2×10^{-10}
Sr-89,90[f]	29.1 years	1.8×10^{-3}	2.2×10^{-4}	4.2×10^{-5}	1.8×10^{-4}		8.2×10^{-5}	2.3×10^{-3}
Zr-95	64.02 days						2.1×10^{-5}	2.1×10^{-5}
Nb-95	34.97 days						1.6×10^{-15}	1.6×10^{-15}
Tc-99	2.13×10^{5} years						3.6×10^{-8}	3.6×10^{-8}
Ru-106	1.020 years						0.070	0.070
Sn-126	1×10^{5} years						3.4×10^{-15}	3.4×10^{-15}
Sb-124	60.2 days						3.4×10^{-12}	3.4×10^{-12}
Sb-125	2.758 years						5.9×10^{-7}	5.9×10^{-7}
Cs-134	2.065 years		1.4×10^{-6}				1.2×10^{-9}	1.4×10^{-6}
Cs-137	30.17 years	2.5×10^{-4}	4.2×10^{-4}		2.9×10^{-6}		4.2×10^{-3}	4.9×10^{-3}
Ba-133	10.53 years						3.0×10^{-12}	3.0×10^{-12}
Ce-144	284.6 days		4.2×10^{-6}				6.1×10^{-6}	1.0×10^{-5}
Pm-144	360 days						1.3×10^{-12}	1.3×10^{-12}

Table 3.3-2. (Continued).

Radionuclide[b]	Half-life	Reactors	Separations[c]	Reactor materials	Heavy water	SRTC[d]	Diffuse and fugitive[e]	Total
		Curies released						
Particulates (continued)								
Pm-147	2.6234 years						1.0×10^{-8}	1.0×10^{-8}
Eu-152	13.48 years						5.3×10^{-9}	5.3×10^{-9}
Eu-154	8.59 years		1.5×10^{-7}				6.4×10^{-6}	6.6×10^{-6}
Eu-155	4.71 years		4.9×10^{-6}				1.7×10^{-6}	6.6×10^{-6}
Ra-226	1.6×10^{3} years						1.2×10^{-8}	1.2×10^{-8}
Ra-228	5.76 years						1.8×10^{-10}	1.8×10^{-10}
Th-228	1.913 years						2.2×10^{-10}	2.2×10^{-10}
Th-230	7.54×10^{4} years						2.0×10^{-10}	2.0×10^{-10}
Th-232	1.40×10^{10} years						1.4×10^{-10}	1.4×10^{-10}
Th-234	24.10 days						2.3×10^{-10}	2.3×10^{-10}
Pa-231	3.28×10^{4} years						1.0×10^{-9}	1.0×10^{-9}
Pa-234	6.69 hours						2.3×10^{-10}	2.3×10^{-10}
U-233	1.592×10^{5} years						2.1×10^{-8}	2.1×10^{-8}
U-234	2.46×10^{5} years		8.0×10^{-6}	4.0×10^{-6}			1.5×10^{-5}	2.7×10^{-5}
U-235	7.04×10^{8} years		6.3×10^{-7}	6.4×10^{-7}			4.8×10^{-7}	1.8×10^{-6}
U-236	2.342×10^{7} years						4.8×10^{-7}	4.8×10^{-7}
U-238	4.47×10^{9} years		1.9×10^{-5}	1.7×10^{-6}			3.5×10^{-5}	5.6×10^{-5}
Np-237	2.14×10^{6} years						1.4×10^{-9}	1.4×10^{-9}
Np-239	2.35 days						2.2×10^{-7}	2.2×10^{-7}
Pu-238	87.7 years		3.3×10^{-5}	4.4×10^{-9}			3.6×10^{-4}	3.9×10^{-4}
Pu-239[g]	2.410×10^{4} years	2.9×10^{-4}	5.1×10^{-5}	6.9×10^{-6}	2.3×10^{-5}	2.5×10^{-6}	6.9×10^{-6}	3.8×10^{-4}
Pu-240	6.56×10^{3} years						1.1×10^{-6}	1.1×10^{-6}
Pu-241	14.4 years						5.2×10^{-5}	5.2×10^{-5}
Pu-242	3.75×10^{5} years						3.7×10^{-11}	3.7×10^{-11}
Am-241	432.7 years		1.4×10^{-5}	1.2×10^{-8}			8.7×10^{-7}	1.5×10^{-5}
Am-243	7.37×10^{3}yr						1.8×10^{-5}	1.8×10^{-5}
Cm-242	162.8 days						8.2×10^{-12}	8.2×10^{-12}

TC

Table 3.3-2. (Continued).

Radionuclide[b]	Half-life	Reactors	Separations[c]	Reactor materials	Heavy water	SRTC[d]	Diffuse and fugitive[e]	Total
		Curies released						
Particulates (continued)								
Cm-244	18.1 years		2.5×10^{-5}	2.0×10^{-10}			1.3×10^{-4}	1.5×10^{-4}
Cm-245	8.5×10^{3} years						1.9×10^{-12}	1.9×10^{-12}

a. Source: Arnett and Mamatey (1998a).
b. H = hydrogen (H-3 = tritium), C = carbon, Kr = krypton, I = iodine, Na = sodium, Mn = manganese, Co = cobalt, Ni = nickel, Zn = zinc, Se = selenium, Sr = strontium, Zr = zirconium, Nb = niobium, Tc = technetium, Ru = ruthenium, Sn = tin, Sb = antimony, Cs = cesium, Ba = barium, Ce = cerium, Pm = promethium, Eu = europium, Ra = radium, Th = thorium, Pa = protactinium, U = uranium, Np = neptunium, Pu = plutonium, Am = americium, Cm = curium. TC
c. Includes F- and H-Area releases.
d. SRTC = Savannah River Technology Center.
e. Estimated releases from minor unmonitored diffuse and fugitive sources.
f. Includes unidentified beta emissions.
g. Includes unidentified alpha emissions.

Table 3.3-3. SRS baseline air quality for maximum potential emissions and observed ambient concentrations.

Pollutant	Averaging time	SCDHEC ambient standard (µg/m^3)[a]	Estimated SRS baseline concentration (µg/m^3)[b]
Criteria pollutants			
Sulfur dioxide (as SO_x)[c]	3-hr	1,300	1,200
	24-hr	365	350
	Annual	80	34
Total suspended particulates	Annual	75	67
Particulate matter (≤10 µm)[d]	24-hr	150	133
	Annual	50	25
Carbon monoxide	1-hr	40,000	10,000
	8-hr	10,000	6,900
Nitrogen dioxides (as NO_x)[e]	Annual	100	26
Lead	Calendar Quarterly mean	1.5	0.03
Ozone (as total VOCs)[f]	1-hr	235	NA[g]
Toxic/hazardous air pollutants			
Benzene	24-hr	150	3.9
Beryllium	24-hr	0.01	0.009
Biphenyl	24-hr	6	0.02
Mercury	24-hr	0.25	0.03
Methyl alcohol (methanol)	24-hr	1,310	0.9

TC

SO_x = oxides of sulfur; NO_x = oxides of nitrogen: VOCs = volatile organic compounds; NA = not available.

a. Source: SCDHEC Standard 2, “Ambient Air Quality Standards,” and Standard 8, “Toxic Air Pollutants” (SCDHEC 1976).

b. Source: Hunter (1999). Concentration is the sum of modeled air concentrations using the permitted maximum potential emissions from the 1998 air emissions inventory for all SRS sources not exempted by Clean Air Act Title V requirements and observed concentrations from nearby ambient air monitoring stations.

c. Based on emissions for all oxides of sulfur (SO_x).

d. New NAAQS for particulate matter ≤2.5 microns (24-hour limit of 65 µg/m^3 and an annual average limit of 15 µg/m^3) will become enforceable during the life of this project.

e. Based on emissions for all oxides of nitrogen (NO_x).

f. New NAAQS for ozone (8 hours limit of 0.08 parts per million) will become enforceable during the life of this project.

g. Ambient concentrations of VOCs, which are precursors to ozone, can be used to provide a highly conservative bounding estimate for ozone but should not be used for explicit assessments of compliance with the ozone standard. Not all the VOCs emitted will result in the formation of ozone, and there is no method to directly correlate the two quantities. For purposes of estimating ozone concentrations from all SRS operations, no value for total VOCs is provided since the estimate would be overly conservative.

Table 3.3-4. Estimated 24-hour average ambient concentrations at SRS boundary - toxic air pollutants regulated by South Carolina from SRS sources.[a]

Pollutant[b]	Concentration ($\mu g/m^3$)[c]	Regulatory standard ($\mu g/m^3$)	Concentration as a percent of standard (%)
Benzene	31	150	20.70
Hexane	0.07	200	0.04
Nitric acid	6.70	125	5.40
Sodium hydroxide	0.01	20	0.05
Toluene	1.60	2,000	0.08
Xylene	3.80	4,350	0.09

$\mu g/m^3$ = micrograms per cubic meter.

a. Source: WSRC (1994).

b. Pollutants listed include air toxics of interest in relation to spent nuclear fuel management alternatives. (Section 5.2 addresses the effects of all air toxics.)

c. Based on actual emissions from existing SRS sources plus maximum potential emissions for sources permitted for construction through December 1992.

DOE measures nonradiological air emissions from SRS facilities at their points of discharge by direct measurement, sample extraction and measurement, or calculation of the emissions using process knowledge. Using monitoring data and meteorological information, DOE estimates the concentration of certain pollutants at the Site boundary. The Site is in compliance with National Ambient Air Quality Standards.

TC

The Environmental Protection Agency approved revisions to the national ambient air quality standards for ozone and particulate matter that became effective on September 16, 1997. However, on May 14, 1999, in response to challenges filed by industry and others, the U.S. Court of Appeals for the District of Columbia Circuit issued a split opinion (2 to 1) directing EPA to develop a new particulate matter standard (meanwhile reverting back to the previous PM_{10} standard) and ruling that the new ozone standard "cannot be enforced" (EPA 1999). The EPA has asked the U.S. Department of Justice to appeal this decision and take all judicial steps necessary to overturn the decision. Therefore, it is uncertain at this time when new ozone and particulate matter standards will become enforceable.

TC

3.4 Ecological Resources

The U.S. Government acquired the land that became SRS in 1951. At that time, the Site was approximately two-thirds forested and one-third cropland and pastures. An extensive forest management program conducted by the Savannah River Natural Resources Management and Research Institute (SRI), which is part of the U.S. Forest Service, has converted many croplands and pastures to pine plantations. At present, more than 90 percent of the SRS is forested.

The Site provides more than 181,000 acres (734 square kilometers) of contiguous forested cover broken only by unpaved secondary roads, transmission line corridors in various stages of succession, a few paved primary roads, and scattered industrial facilities. Carolina bays, the Savannah River Swamp, and several relatively intact longleaf pine-wiregrass communities contribute to the biodiversity of the SRS and the entire region.

Under some of the alternatives described in Chapter 2, DOE proposes to construct and operate a Transfer and Storage Facility or a Transfer, Storage, and Treatment Facility at SRS to receive, characterize, condition, treat, package, and dry-store spent nuclear fuel before shipping it to a geologic repository. If not located in an existing reactor building, the site for either of these facilities would cover approximately 15 acres (0.061 square kilometer), including the building footprint(s), construction area needs, and security requirements (WSRC 1996a).

As described in Chapter 2, this Transfer and Storage Facility or Transfer, Storage, and Treatment Facility would be in L Area (preferred site), C Area, or P Area. Facilities to implement the New Processing Technology Alternative also could be located inside a reactor building, such as Building 105-L.

The proposed site for any new facility in L Area is a ridge that runs southwest-to-northeast approximately 0.5 mile (0.8 kilometer) from the Steel Creek floodplain. The site, which is wholly within the developed portion of L Area, is bounded by L Reactor to the west, a rail spur (L Line) to the north, and paved access roads to the east and south. The area consists of buildings, paved areas, graveled areas, and mowed turf grasses. The site is inside 6-foot (1.8-meter) security fences and has negligible value as wildlife habitat.

An upland pine stand is immediately east of the proposed site, adjacent to the fenced area. The stand is primarily slash pines (*Pinus elliotti*) that the Forest Service planted in the mid-1950s, with small areas of long-leaf (*P. palustris*) and loblolly pine (*P. taeda*) planted in the 1940s (SRFS 1997). Understory species include black cherry (*Prunus serotina*), wax myrtle (*Myrica cerifera*) and yellow jessamine (*Gelsemium sempervirens*). SRI manages forested areas such as this for timber production and wildlife.

Wildlife characteristically found in SRS pine plantations include toads (i.e., the southern toad, [*Bufo terrestris*]), lizards (e.g., the eastern fence lizard, [*Sceloporus undulatus*]), snakes (e.g., the black racer, [*Coluber constrictor*]), songbirds (e.g., the brown-headed nuthatch [*Sitta pusilla*], and the pine warbler [*Dendroica pinus*]), birds of prey (e.g., the sharp-shinned hawk [*Accipiter striatus*]), and a number of mammal species (e.g., the cotton mouse [*Peromyscus gossypinus*]), the gray squirrel [*Sciurus carolinensis*], the opossum [*Didelphis virginiana*], and the white-tailed deer [*Odocoileus virginianus*]) (Sprunt and Chamberlain 1970; Cothran et al. 1991; Gibbons and Semlitsch 1991; Halverson et al. 1997).

The proposed site for a new facility in C Area is on a plateau that rises between the floodplains of Fourmile Branch to the north and Castor Creek to the south. The entire site is inside the developed portion of C Area, surrounded by security fencing. The area consists of buildings, paved areas, graveled areas, and mowed turf grasses. A paved access road, a railroad spur, and two transmission lines cross the site. It provides little or no wildlife habitat. The areas immediately north and south of the site are forested, primarily with long-leaf and loblolly pine planted in the 1950s. The shrub layer contains young oaks (*Quercus* spp.) black cherry, hawthorne (*Crataegus* sp.), wax myrtle, and bear-grass (*Yucca filamentosa*). The wildlife species listed for L Area occur in these woods as well.

The proposed facility site in P Area is a broad hilltop above the headwaters of Steel Creek (to the west), Meyers Branch (to the south), and Lower Three Runs/Par Pond (to the east). The western two-thirds of the area (adjacent to the P-Area fence) is meadow-like, comprised mostly of lawn grasses and a few common forbs, such as low hop clover (*Trifolium dubium*) and smooth vetch (*Vicia dasycarpa*). The remainder of the area is wooded, with trees that appear to have regenerated since P Area was developed in the early 1950s. The canopy layer is dominated by laurel oak (*Quercus laurifolia*), water oak (*Q. nigra*), blackjack oak (*Q. marilandica*), mockernut hickory (*Carya alba*), and long-leaf pine. In the sub-canopy and shrub layer, species such as *Q. laevis* (turkey oak), huckleberry (*Vaccinium stamineum*), and hawthorne are well represented. Wooded areas to the north and east of the site are predominantly slash pines that were planted in the 1950s and loblolly pines that were planted in the 1980s (SRFS 1997). Because it is regularly mowed, the grassy area provides limited wildlife habitat. The wooded areas presumably provide habitat for many of the wildlife species mentioned above.

Under the Endangered Species Act of 1973 the Federal government provides protection to six species that occur on the SRS: American alligator (*Alligator mississippiensis*; threatened due to similarity of appearance to the endangered American crocodile), short-nosed sturgeon (*Acipenser brevirostrum*; endangered), bald eagle (*Haliaeetus leucocephalus*; threatened), wood stork (*Mycteria americana*; endangered), red-cockaded woodpecker (*Picoides borealis*; endangered), and smooth purple coneflower (*Echinacea laevigata*; endangered) (SRFS 1994). None of these species is known to occur on or near the proposed facility sites in L, C, P, F, or H Areas, which are located on previously disturbed areas (SRFS 1996).

3.5 Socioeconomics

Approximately 90 percent of the 1995 SRS workforce lived in the SRS region of influence which includes Aiken, Allendale, Bamberg, and Barnwell Counties in South Carolina, and Columbia and Richmond Counties in Georgia. *Socioeconomic Characteristics of Selected Counties and Communities Adjacent to the Savannah River Site* (HNUS 1997) contains additional information on the economic and demographic characteristics of the six-county region.

3.5.1 EMPLOYMENT

Between 1980 and 1990, total employment in the six-county region increased from 181,072 to 241,409, an average annual growth rate of approximately 2.9 percent. The unemployment rates for 1980 and 1990 were 7.3 percent and 4.7 percent, respectively (HNUS 1997). In 1994, regional employment was 243,854, an increase of only 1 percent since 1990. Over the next 10-year period, employment in the region is projected to increase at an average rate of slightly less than 1 percent per year, reaching approximately 264,000 by 2004 (HNUS 1997).

The increase in employment in the 1980s was spurred in part by the buildup in employment at the SRS during the middle and late years of the decade, and in part by the improved national economy. The flat increases in regional employment since 1990 are the result of the mild national recession from 1990 to 1992, followed by the decreases in SRS employment, discussed below.

At the beginning of fiscal year 1996, employment at SRS was 16,625, approximately 7 percent of regional employment, with an associated annual payroll of approximately $634 million. This represents a decrease of 6,726 in SRS employment since 1992 and an associated payroll reduction of $466 million from more than $1.1 billion. Site employment declined through attrition by approximately 950 jobs between the fall of 1995 and the fall of 1996 and by another approximately 850 jobs in early 1997 through involuntary separations. By March 1998, the SRS workforce was reported at 14,014 persons (DOE 1998).

3.5.2 POPULATION

Based on state and Federal agency surveys and trends, the estimated 1998 population in the region of influence was 466,222. About 90 percent lived in Aiken (29 percent), Columbia (20 percent), and Richmond (41 percent) counties. The population in the region grew at an annual growth rate of about 6.5 percent between 1990 and 1998 (U.S. Bureau of the Census 1999). Columbia County, and to a lesser extent Aiken County, contributed to most of the growth due to in-migration from other region of influence counties and other states. Over the same period Bamberg and Barnwell counties experienced net out-migration. In 2000, the population in the six-county region is expected to be approximately 498,900. Over the next 10-year period, the regional population should grow at a projected rate of 1 to 2 percent per year, reaching approximately 533,400 by 2010. According to census data, in 1990 the estimated average number of persons per household in the six-county region was 2.72, and the median age of the population was 31.8 years (HNUS 1997).

3.5.3 COMMUNITY CHARACTERISTICS

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (February 11, 1994), directs Federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. Executive Order 12898 also directs the Administrator of EPA to convene an interagency Federal Working Group on Environmental Justice.

The Working Group has provided guidance to Federal agencies on criteria for identifying disproportionately high and adverse human health or environmental effects on minority and low-income populations (EPA 1998). In addition, the Council on Environmental Quality, in consultation with EPA and other Federal agencies, has developed guidance for identifying and addressing environmental justice concerns during the National Environmental Policy Act (NEPA) process (CEQ 1998). DOE has based the environmental justice analysis in this document on those guidance documents. Further, in coordination with the Working Group, DOE is developing internal guidance for implementing the Executive Order.

Potential offsite health impacts from the proposed action would result from releases to the air and to the Savannah River downstream of the SRS. For air releases, DOE performed standard population dose analyses on a 50-mile (80-kilometer) radius because reasonably foreseeable dose levels beyond that distance would be negligible. For liquid releases, the region of interest includes areas that draw drinking water from the river (Beaufort and Jasper Counties in South Carolina and Effingham and Chatham Counties in Georgia).

The analysis included data (U.S. Bureau of the Census 1990a,b) for populations in census tracts with at least 20 percent of their area in the 50-mile radius and all tracts from Beaufort and

Jasper Counties and Effingham and Chatham Counties, which are downstream of the Site. DOE used data from each census tract in this combined region to identify the racial composition of communities and the number of persons characterized by the U.S. Bureau of the Census as living in poverty. The combined region contains 247 census tracts, 99 in South Carolina and 148 in Georgia.

Tables 3.5-1 and 3.5-2 list racial and poverty characteristics, respectively, of the population in the combined region. Table 3.5-1 indicates a total population of more than 993,000 in the area. Of that population, approximately 618,000 (62.2 percent) are white. In the minority population, approximately 94 percent are African American; the remainder are small percentages of Asian, Hispanic, and Native American persons. Figure 3.5-1 shows the distribution of minorities by census tract areas in the SRS region.

Executive Order 12898 does not define minority populations. One approach to a definition is to identify communities that contain a simple majority of minorities (greater than or equal to 50 percent of the total community population). A second approach, proposed by EPA for environmental justice purposes, defines minority communities as those that have higher-than-average (over the region of interest) percentages of minority persons (EPA 1994). The shading patterns in Figure 3.5-1 indicate census tracts where (1) minorities constitute 50 percent or more of the total population, or (2) minorities constitute between 35 percent and 50 percent of the total population. For this analysis, DOE has adopted the second, more expansive, approach to identify minority communities.

The combined region has 80 tracts (32.4 percent) where minority populations constitute 50 percent or more of the total population. In an additional 50 tracts (13.5 percent), minorities constitute between 35 and 50 percent of the population. These tracts are distributed throughout the region, although there are more toward the south and in the immediate vicinities of Augusta and Savannah, Georgia.

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Table 3.5-1. General racial characteristics of population in SRS region of interest.[a]

State	Total population	White	African American	Hispanic	Asian	Native American	Other	Minority	Percent minority[b]
South Carolina	418,685	267,639	144,147	3,899	1,734	911	355	151,046	36.08
Georgia	574,982	350,233	208,017	7,245	7,463	1,546	478	224,749	39.09
Total	993,667	617,872	352,164	11,144	9,197	2,457	833	375,795	37.82

a. Source: U.S. Bureau of the Census (1990a).
b. People of color population divided by total population.

Table 3.5-2. General poverty characteristics of population in SRS region of interest.[a]

Area	Total population	Persons living in poverty[b]	Percent living in poverty
South Carolina	418,685	72,345	17.28
Georgia	574,982	96,672	16.81
Total	993,667	169,017	17.01

a. Source: U.S. Bureau of the Census (1990b).
b. Families with income less than the statistical poverty threshold, which in 1990 was 1989 income of $8,076 for a family of two.

Low-income communities are those in which 25 percent or more of the population is characterized as living in poverty (EPA 1993). The U.S. Bureau of the Census defines persons in poverty as those whose income is less than a "statistical poverty threshold." This threshold is a weighted average based on family size and the age of the persons in the family. The baseline threshold for the 1990 census was a 1989 income of $8,076 for a family of two.

Table 3.5-2 indicates that in the SRS region, more than 169,000 persons (17 percent of the population) are characterized as living in poverty. In Figure 3.5-2, shaded census tracts identify low-income communities. In the region, 72 tracts (29.1 percent) are low-income communities. These tracts are distributed throughout the region of analysis, but primarily to the south and west of SRS.

3.6 Cultural Resources

Through a cooperative agreement, DOE and the South Carolina Institute of Archaeology and Anthropology, University of South Carolina, conduct the Savannah River Archaeological Research Program to provide on the SRS services required by Federal law for the protection and management of archaeological resources. Ongoing research programs work in conjunction with the South Carolina State Historic Preservation Officer. They provide theoretical, methodological, and empirical bases for assessing site significance using the compliance process specified by law. Archaeological investigations usually begin through the Site Use Program, which requires a permit for clearing land on the SRS.

The archaeological research has provided considerable information about the distribution and content of archaeological and historic sites on SRS. Savannah River archaeologists have examined SRS land since 1974. To date they have examined 60 percent of the 300-square-mile (800-square kilometer) area and recorded more than 1,200 archaeological sites (HNUS 1997). Most (approximately 75 percent) of these sites are prehistoric.

The activities associated with the proposed action and alternatives for spent nuclear fuel management at SRS that could affect cultural

Figure 3.5-1. Distribution of minorities by census tract in SRS region of analysis.

Figure 3.5-2. Low-income census tracts in the SRS region of analysis.

resources are the use of one of the three sites for the proposed Transfer and Storage Facility or Transfer, Storage, and Treatment Facility.

The sites are in reactor areas (L, C, and P) within 100 to 400 yards (91 to 366 meters) of the reactor buildings. The Savannah River Archaeological Research Program has not examined any areas in and immediately around the reactors. Construction of these facilities took place before the enactment of Federal regulations to protect historic resources. Archaeological resources in the footprints of the three preferred sites would be unlikely to have survived reactor construction, although 1951 aerial photographs show that the C- and L-Area sites had homeplaces before the development of the SRS in the early 1950s (Sassaman 1997a,b).

The potential for prehistoric sites in the preferred locations is limited. The P-Area site is in archaeology site density Zone 2, which has moderate potential for prehistoric archaeological sites of significance. The L-Area site is in archaeological site density Zone 3, which has the least potential for prehistoric sites of significance. C Area is divided between Zones 2 and 3. However, in all cases, reactor construction activities probably destroyed or severely damaged any prehistoric deposits (Sassaman 1997a,b).

3.7 Public and Worker Health

3.7.1 PUBLIC RADIOLOGICAL HEALTH

Because there are many sources of radiation in the human environment, evaluations of radioactive releases from nuclear facilities must consider all ionizing radiation to which people are routinely exposed.

Doses of radiation are expressed as millirem (mrem), rem (1,000 millirem), and person-rem (which is the average individual doses times the population).

An individual's radiation exposure in the vicinity of SRS amounts to approximately 357 millirem per year, which is comprised of natural background radiation from cosmic, terrestrial, and internal body sources, radiation from medical diagnostic and therapeutic practices, weapons test fallout, consumer and industrial products, and nuclear facilities. Figure 3.7-1 shows the relative contributions of each source to people living near SRS. All radiation doses mentioned in this EIS are effective dose equivalents; internal exposures are committed effective dose equivalents.

Releases of radioactivity to the environment from SRS account for less than 0.1 percent of the total annual average environmental radiation dose to individuals within 50 miles (80 kilo-meters) of the Site. Natural background radiation contributes about 293 millirem per year, or 82 percent of the annual dose of 357 millirem received by an average member of the population within 50 miles of the Site. Based on national averages, medical exposure accounts for an additional 14.8 percent of the annual dose, and combined doses from weapons test fallout, consumer and industrial products, and air travel account for about 3 percent (NCRP 1987a).

Other nuclear facilities within 50 miles (80 kilometers) of SRS include a low-level waste disposal site operated by Chem-Nuclear Systems, Inc., near the eastern Site boundary and Georgia Power Company's Vogtle Electric Generating Plant, directly across the Savannah River from the Site. In addition, Carolina Metals, Inc., which is northwest of Boiling Springs in Barnwell County, processes depleted uranium.

South Carolina Nuclear Facility Monitoring - Annual Report 1992 (SCDHEC 1992) documents that the Chem-Nuclear and Carolina Metals facilities do not influence radioactivity levels in the air, precipitation, groundwater, soil, or vegetation. Plant Vogtle began commercial operation in 1987: 1992 releases produced an annual dose of 0.17 millirem to the maximally exposed individual at the plant boundary and a total population dose within a 50-mile (80-kilometer) radius of 0.057 person-rem (NRC 1996).

Figure 3.7-1. Major sources of radiation exposure in the vicinity of the Savannah River Site.

In 1997, releases of radioactive material to the environment from SRS operations resulted in a maximum individual dose of 0.05 millirem per year in the west-southwest sector of the Site boundary from atmospheric releases, and a maximum dose from liquid releases of 0.13 millirem per year, for a maximum total annual dose at the boundary of 0.18 millirem (Arnett and Mamatey 1998b). The maximum dose to downstream consumers of Savannah River water – 0.07 millirem per year – occurred to users of the Port Wentworth and the Beaufort-Jasper public water supplies (Arnent amd Mamatey 1998b).

In 1990 the population within 50 miles (80 kilometers) of the Site was approximately 620,100. The collective effective dose equivalent to that population in 1997 was 2.2 person-rem from atmospheric releases. The 1990 population of 65,000 people using water from the Cherokee Hill Water Treatment Plant near Port Wentworth, Georgia, and the Beaufort-Jasper Water Treatment Plant near Beaufort, South Carolina, received a collective dose equivalent of 2.4 person-rem in 1997 (Arnett and Mamatey 1998b). Population statistics indicate that cancer caused 23.2 percent of the deaths in the United States in 1994 (CDC 1998). If this percentage of deaths from cancer continues, 23.2 percent of the U.S. population will contract a fatal cancer from all causes. Thus, in the population of 620,100 within 50 miles of SRS, 143,863 persons will be likely to contract fatal cancers from all causes. The total population dose from SRS of 4.6 person-rem (2.2 person-rem from atmospheric pathways plus 2.4 person-rem from water pathways) could result in 0.0023 additional latent cancer death in the same population [based on 0.0005 cancer death per person-rem (NCRP 1993)].

3.7.2 PUBLIC NONRADIOLOGICAL HEALTH

The hazards associated with the alternatives described in this EIS include exposure to nonradiological chemicals in the form of water and air pollution (see Sections 3.2 and 3.3). Table 3.3-3 lists ambient air quality standards and concentrations for selected pollutants. The purpose of these standards is to protect the public health and welfare. The concentrations of pollutants from SRS sources, listed in Table 3.3-2, are lower than the standards. Section 3.2 discusses water quality in the SRS vicinity.

3.7.3 WORKER RADIOLOGICAL HEALTH

One of the major goals of the SRS Health Protection Program is to keep worker exposures to radiation and radioactive material as low as reasonably achievable (ALARA). Such a program must evaluate both external and internal exposures with the goal to minimize the total effective dose equivalent. An effective ALARA program must also balance minimizing individual worker doses with minimizing the collective dose of workers in a group. For example, using many workers to perform small portions of a task would reduce the individual worker dose to low levels. However, frequent worker changes would make the work inefficient, resulting in a significantly higher collective dose to all the workers than if fewer had received slightly higher individual doses.

SRS worker doses have typically been well below DOE worker exposure limits. DOE set administrative exposure guidelines at a fraction of the exposure limits to help enforce doses that are as low as reasonably achievable. For example, the current DOE worker exposure limit is 5,000 millirem per year, and the 1997 SRS ALARA administrative control level for the whole body is 500 millirem per year. Every year DOE evaluates the SRS ALARA administrative control levels and adjusts them as needed.

Table 3.7-1 lists maximum and average individual doses and SRS collective doses from 1989 to 1998.

Table 3.7-1. SRS annual individual and collective radiation doses.[a]

Year	Number with measurable dose	Average individual worker dose (rem)[b]	Site worker collective dose (person-rem)
1989	12,363	0.070	863
1990	11,659	0.065	753
1991	8,391	0.055	459
1992	6,510	0.054	352
1993	5,202	0.051	264
1994	6,284	0.050	315
1995	4,846	0.053	256
1996	4,736	0.053	252
1997	3,327	0.050	165
1998	3,163	0.052	166

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a. Adapted from: DOE (1996b); WSRC (1997, 1998, 1999a).
b. The average dose includes only workers who received a measurable dose during the year.

3.7.4 WORKER NONRADIOLOGICAL HEALTH

Industrial hygiene and occupational health programs at the SRS deal with all aspects of worker health and relationship with the work environment. The objective of an effective occupational health program is to protect employees from hazards in their work environment. To evaluate these hazards, DOE uses routine monitoring to determine employee exposure levels to hazardous chemicals.

Exposure limit values are the basis of most occupational health codes and standards. If an overexposure to a harmful agent does not exist, that agent generally does not create a health problem.

The Occupational Safety and Health Administration (OSHA) has established Permissible Exposure Limits to regulate worker exposure to hazardous chemicals. These limits refer to airborne concentrations of substances and represent conditions under which nearly all workers could receive repeated exposures day after day without adverse health effects.

Table 3.7-2 lists the estimated maximum and average annual concentrations of existing OSHA-regulated workplace pollutants modeled in and around existing SRS facilities. Estimated concentration levels for existing OSHA-regulated workplace pollutants are less than the OSHA Permissible Exposure Limits for all contaminants, with the exception of nitrogen dioxide (as nitrogen oxide) and nitric acid. The large nitrogen dioxide exceedance (a 15-minute average of 406 mg/m^3 compared to the OSHA Permissible Exposure Limit of 9 mg/m^{-3}) is based on modeling assumptions with maximum potential emissions for diesel units including back-up units operating at ground-level for limited periods (Stewart 1997). The nitric acid value also is based on maximum potential emissions related to conventional processing activities. Actual emissions are expected to be below regulatory limits.

DOE has established industrial hygiene and occupational health programs for the processes covered by this EIS and across the SRS to protect the health of workers from nonradiological hazards.

3.8 Waste and Materials

3.8.1 WASTE MANAGEMENT

This section describes the waste generation baseline that DOE uses in Chapter 4 to gauge the relative impact of each SNF management alternative on the overall production of waste at SRS and on DOE's capability to manage such waste.

Table 3.7-2. Estimated maximum annual concentrations (milligrams per cubic meter) of workplace pollutants regulated by Occupational Safety and Health Administration.[a]

Pollutant	OSHA PEL[b] (mg/m^3)	Time period	Concentrations (mg/m^3) Maximum 8-hour average	Annual average
Carbon monoxide	55	8 hours	10	0.53
Nitrogen dioxide (as NO_x)	9	Ceiling limit[c]	406[d]	2.3
Total particulates	15	8 hours	0.95	0.06
Sulfur dioxide (as SO_x)	13	8 hours	0.63	0.05
Hexane	1,800	8 hours	1.5	0.08
Nitric acid	5	8 hours	11	0.34
Sodium hydroxide	2	8 hours	<0.01	<0.01
Xylene	435	8 hours	136	14.5

a. Source: Stewart (1997).
b. OSHA Permissible Exposure Limits (PEL).
c. Ceiling limits are permissible exposure limits that a facility cannot exceed at any time.
d. 15-minute average.

SRS generates six basic classes of waste – low-level radioactive, high-level radioactive, hazardous, mixed (low-level radioactive and hazardous), transuranic and alpha, and sanitary (nonhazardous, nonradioactive) – which this EIS considers because they are possible byproducts of SNF management. The following sections describe the waste classes. Table 3.8-1 lists projected total waste generation volumes for fiscal years 1999 through 2029 (a 30-year time period encompassing most of the time period of the scenarios addressed in this EIS). TC

Tables 3.8-2 through 3.8-4 provide an overview of the existing and planned facilities that DOE expects to use in the storage, treatment, and disposal of the various waste classes.

3.8.1.1 Low-Level Radioactive Waste

EC DOE Order 435.1 (Radioactive Waste Management) defines low-level radioactive waste as radioactive waste that cannot be classified as high-level waste, spent nuclear fuel, transuranic waste, or byproduct material, and that does not have any constituents that are regulated under the Resource Conservation and Recovery Act (RCRA).

At present, DOE uses a number of methods for treating and disposing of low-level waste at SRS, depending on the waste form and activity. Approximately 41 percent of this waste is low in activity and can be treated at the Consolidated Incineration Facility. In addition, DOE could volume-reduce these wastes by compaction, supercompaction, smelting, or repackaging (DOE 1995c). After volume reduction, DOE would package the remaining low-activity waste and place it in either shallow land disposal or vault disposal in E Area.

DOE places low-level wastes of intermediate activity and some tritiated low-level wastes in E Area intermediate activity vaults, and will store long-lived low-level waste (e.g., spent deionizer resins) in the long-lived waste storage buildings in E Area, where they will remain until DOE determines their final disposition.

3.8.1.2 Low-Level Mixed Waste

DOE Order 435.1 defines low-level mixed waste as low-level radioactive waste that contains material listed as hazardous under RCRA or that exhibits one or more of the following hazardous waste characteristics: ignitability, corrosivity, TC reactivity, or toxicity. It includes such materials

Table 3.8-1. Total waste generation forecast for SRS (cubic meters).[a,b]

	Waste Class				
Inclusive Dates	Low-level	High-level	Hazardous	Mixed low-level	Transuranic and alpha
1999 to 2029	180,299	14,129	6,315	3,720	6,012

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Source: Derived from Halverson (1999).

as tritiated mercury, tritiated oil contaminated with mercury, other mercury-contaminated compounds, radioactively contaminated lead shielding, equipment from the tritium facilities in H Area, and filter paper takeup rolls from the M-Area Liquid Effluent Treatment Facility.

As described in the *Approved Site Treatment Plan* (DOE 1996c), storage facilities for low-level mixed waste are in several different SRS areas. These facilities are dedicated to solid, containerized, or bulk liquid waste and all are approved for this storage under RCRA as interim status or permitted facilities or as Clean Water Act-permitted tank systems. Several treatment processes described in the *Approved Site Treatment Plan* (DOE 1996c) exist or are planned for low-level mixed waste. These facilities, which are listed in Table 3.8-3, include the Consolidated Incineration Facility, the M-Area Vendor Treatment Process, and the Hazardous Waste/Mixed Waste Containment Building.

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Depending on the nature of the waste remaining after treatment, DOE plans to use either shallow land disposal or RCRA-permitted hazardous waste/mixed waste vaults for disposal.

3.8.1.3 High-Level Waste

High-level radioactive waste is highly radioactive material from the processing of SNF that contains a combination of transuranic waste and fission products in concentrations that require permanent isolation. It includes both liquid waste produced by processing and solid waste derived from that liquid (DOE 1988).

At present, DOE stores high-level waste in carbon steel and reinforced concrete underground tanks in the F- and H-Area tank farms. The high-level waste undergoes volume reduction by evaporation, and the resulting high activity precipitate is incorporated in borosilicate glass at the Defense Waste Processing Facility Vitrification Facility. The remaining low-activity salt solution is treated and disposed of at the Saltstone Manufacturing and Disposal Facility. Both processes are described in the *Final Supplemental Environmental Impact Statement, Defense Waste Processing Facility* (DOE 1994).

DOE has committed to complete closure by 2022 of the 24 HLW tank systems that do not meet the secondary containment requirements in the Federal Facility Agreement (WSRC 1999a). During waste removal, DOE will retrieve as much of the stored HLW as can be removed using the existing waste transfer equipment. The sludge portion of the retrieved waste will be treated in treatment facilities and vitrified at DWPF. The salt portion of the retrieved waste (processed and treated) will be treated at one of the salt disposition facilities being evaluated in the High-Level Waste Salt Disposition Alternatives EIS (DOE 1999b) and either vitrified at DWPF or disposed as grout in Z Area.

3.8.1.4 Sanitary Waste

Sanitary waste is solid waste that is neither hazardous, as defined by RCRA, nor radioactive. It consists of salvageable material and material that is suitable for disposition in a municipal sanitary landfill. Sanitary waste streams include

Table 3.8-2. Planned and existing waste storage facilities.[a]

Storage facility	Location	Capacity	Original waste stream[b]						Status
			Low-level	High-level	Transuranic	Alpha[c]	Hazardous	Mixed Low-level	
Long-lived waste storage buildings	E Area	140 m^3/ bldg	X						One exists.
Containerized mixed waste storage	Buildings 645-2N, 643-29E, 643-43E, 316-M, and Pad 315-4M	4754 m^3						X	DOE plans to construct additional storage buildings, similar to 643-43E, as necessary.
Liquid mixed waste storage	DWPF Organic Waste Tank (S Area) SRTC Mixed Waste Tanks Liquid Waste Solvent Tanks (H Area) Burial Ground Solvent Tanks (E Area)	9531 m^3						X	The Burial Ground Solvent Tanks are currently undergoing closure. The H-Area Liquid Waste Solvent Tanks were constructed as a replacement.
High-level waste tank farms	F and H Area	(d)		X					50 underground tanks are currently used for storage[e].
Failed equipment storage vaults	Defense Waste Processing Facility (S Area)	300 m^3		X					Two exist; DOE plans approximately 12 additional vaults.
Glass waste storage buildings	Defense Waste Processing Facility (S Area)	2,286 canisters		X					One exists; a second is planned for construction in 2007.
Hazardous waste storage facility	Building 710-B Building 645-N Building 645-4N Waste Pad 1 (between 645-2N and 645-4N) Waste Pad 2 (between 645-4N and 645-N) Waste Pad 3 (east of 645-N)	2,501 m^3					X		Currently in use. No additional facilities are planned, as existing space is expected to adequately support the short-term storage of hazardous wastes awaiting treatment and disposal.
Building 316-M	Building 316-M	117 m^3					X		Currently in use. No additional facilities are planned.
Transuranic waste storage pads	E Area	(f)			X	X		X	19 pads exist; 10 additional pads may be constructed by 2006.

DWPF = Defense Waste Processing Facility.
SRTC = Savannah River Technology Center.
a. Sources: DOE (1994, 1995a, 1995b, 1996a).
b. Sanitary waste is not stored at SRS, thus it is not addressed in this table.
c. Currently, alpha waste is handled and stored as transuranic waste.
d. Currently the High-level Waste Tanks contain approximately 130,600 m^3 of high-level waste. This is almost 90 percent of the usable capacity.
e. Twenty-three of these tanks do not meet secondary containment requirements and have been scheduled for waste removal.
f. Transuranic Pad storage capacities depends on the packaging of the waste and the configuration of packages on the pads.

Table 3.8-3. Planned and existing waste treatment processes and facilities.[a]

		Waste type							
Waste Treatment Facility	Waste Treatment Process	Low-level	High-level	Transuranic	Alpha[b]	Hazardous	Mixed low-level	Sanitary	Status
Consolidated Incineration Facility	Incineration	X				X	X		Began treating waste summer 1997
Offsite facility	Smelting	X							Currently ongoing
Defense Waste Processing Facility	Vitrification		X						Currently operational
Defense Waste Processing Facility	Stabilization						X		Currently operational
Replacement high-level waste evaporator[c]	Volume Reduction		X						Radioactive operation anticipated in March 2000
M-Area Vendor Treatment Facility	Vitrification						X		Undergoing Closure
Treatment at point of waste stream origin	Macroencapsulation						X		As feasible based on waste and location
Non-Alpha Vitrification Facility	Vitrification	X				X	X		Plan to begin operations in 2006
INEEL[d] Waste Engineering Development Facility	Amalgamation/ Stabilization						X		Developing shipping/ treatment schedules
Offsite facility	Offsite Treatment and Disposal					X			Currently ongoing
TC Offsite facility	Decontamination						X		Plan to begin shipment in FY2000
Various onsite and offsite facilities[e]	Recycle/Reuse	X				X	X	X	Currently ongoing
Alpha Vitrification Facility	Vitrification				X				Under evaluation as a potential process
Existing DOE facilities	Repackaging/ Treatment			X					Transuranic waste strategies are still being finalized
M-Area Air Stripper	Air Stripping					X			Currently operational
F- and H-Area Effluent Treatment Facility	Effluent Treatment	X							Currently operational

a. Sources: DOE (1994, 1995a, 1995b, 1996a); WSRC (1995a, 1995b, 1996b); and Odum (1995).
b. Currently, alpha waste is handled as transuranic waste. After it is assayed and separated, most will be treated and disposed of as low-level or mixed low-level waste.
c. Evaporation precedes treatment at the Defense Waste Processing Facility and is used to maximize high-level waste storage capacity.
d. Idaho National Engineering and Environmental Laboratory.
e. Various waste streams have components (e.g., silver, lead, freon, paper) that might be recycled or reused. Some recycling activities might occur onsite, while other waste streams are directed offsite for recycling. Some of the recycled products are released for public sale, while others are reused onsite.

Table 3.8-4. Planned and existing waste disposal facilities.[a]

			Original waste stream[b]						
Disposal facility	Location	Capacity (m^3)	Low-level	High-level	Transuranic	Hazardous	Mixed Low-level	Sanitary	Status
Shallow land disposal trenches	E Area	(c)	X						Four have been filled; up to 58 more may be constructed.
Low-activity vaults	E Area	30,500/vault	X						One vault exists and one additional is planned.
Intermediate-activity vaults	E Area	5,300/vault	X						Two vaults exist and five more may be constructed.
Hazardous waste/mixed waste vaults	NE of F Area	2,300/vault				X	X		RCRA permit application submitted for 10 vaults. At least 11 additional vaults may be needed.
Saltstone Disposal Facility	Z Area	80,000/vault[d]	X						Two vaults exist and approximately 13 more are planned.
Three Rivers Landfill	SRS Intersection of SC 125 and Rd. 2	NA						X	Current destination for SRS sanitary waste.
Burma Road Cellulosic and Construction Waste Landfill	SRS Intersection of C Rd. and Burma Rd	NA						X	Current destination for demolition/construction debris. DOE expects to reach permit capacity in 2008.
TC Waste Isolation Pilot Plant (WIPP)	New Mexico	175,600			X				EPA certification of WIPP completed in April 1998. EC RCRA certification finalized in 1999.[e] TC
Federal repository	See Status	NA		X					Proposed Yucca Mountain, Nevada site is currently under investigation.

RCRA = Resource Conservation and Recovery Act.

NA = Not Available.

a. Sources: DOE (1994, 1995a, 1995b, 1995c, 1996a, 1996c); WSRC (1995a and 1996b).

b. After alpha waste is assayed and separated from the transuranic waste, DOE plans to dispose of it as low-level or mixed low-level waste so it is not addressed separately here.

c. Various types of trenches exist including engineered low-level trenches, greater confinement disposal boreholes and engineered trenches, and slit trenches. The different trenches are designed for different waste types, are constructed differently, and have different capacities.

d. This is the approximate capacity of a double vault. One single vault and one double vault have been constructed. Future vaults are currently planned as double vaults.

TC e. SRS is scheduled for WIPP certification audit in 2000, after which WIPP could begin receiving SRS waste.

such items as paper, glass, discarded office material, and construction debris (DOE 1994).

Sanitary waste volumes have declined due to recycling and the decreasing SRS workforce. DOE sends sanitary waste that is not recycled or reused to the Three Rivers Landfill on SRS. The SRS also continues to operate the Burma Road Cellulosic and Construction Waste Landfill to dispose of demolition and construction debris.

3.8.1.5 Hazardous Waste

Hazardous waste is nonradioactive waste that SCDHEC regulates under RCRA and corresponding state regulations. Waste is hazardous if the EPA lists it is as such or if it exhibits the characteristic(s) of ignitability, corrosivity, reactivity, or toxicity. SRS hazardous waste streams consist of a variety of materials, including mercury, chromate, lead, paint solvents, and various laboratory chemicals.

At present, DOE stores hazardous wastes in three buildings and on three solid waste storage pads that have RCRA permits. Hazardous waste is sent to offsite treatment and disposal facilities, and could be treated at the Consolidated Incineration Facility in the future. DOE also plans to continue to recycle, reuse, or recover certain hazardous wastes, including metals, excess chemicals, solvents, and chlorofluorocarbons. Wastes remaining after treatment might be suitable for either shallow land disposal or disposal in the Hazardous/Mixed Waste Disposal Vaults (DOE 1995c).

3.8.1.6 Transuranic and Alpha Waste

Transuranic waste contains alpha-emitting transuranic radionuclides (those with atomic weights greater than 92) that have half-lives greater than 20 years at activities exceeding 100 nanocuries per gram (DOE 1988). At present, DOE manages low-level alpha-emitting waste with activities between 10 and 100 nanocuries per gram, referred to as alpha waste, as transuranic waste at SRS.

The SRS Waste Management EIS (DOE 1995c) describes the handling and storage of transuranic and alpha waste at the SRS. This consists primarily of providing continued safe storage until treatment and disposal facilities are available.

The *Strategic Plan for Savannah River Site Transuranic Waste* (WSRC 1996b) defines the future handling, treatment and disposal of the SRS transuranic and alpha waste stream. Eventually, DOE plans to ship the transuranic and mixed transuranic waste to the Waste Isolation Pilot Plant in New Mexico for disposal.

Before disposition, DOE plans to assay the wastes stored on the pads and segregate the alpha waste. Vitrification is an option for at least part of the mixed alpha waste (DOE 1996b). Following assay, DOE could dispose of much of the alpha waste as either mixed low-level or low-level waste.

3.8.2 HAZARDOUS MATERIALS

The *Savannah River Site Tier Two Emergency and Hazardous Chemical Inventory Report* for 1998 (WSRC 1999b) lists more than 79 hazardous chemicals that were present at SRS at some time during the year in amounts that exceeded the minimum reporting thresholds [10,000 pounds (4,536 kilograms) for hazardous chemicals and 500 pounds (227 kilograms) or less for extremely hazardous substances]. Four of the 79 are extremely hazardous substances under the Emergency Planning and Community Right-to-Know Act of 1986. The actual number and quantity of hazardous chemicals present on the Site and at individual facilities changes daily as a function of use and demand.

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