4. DESCRIPTION OF THE AFFECTED ENVIRONMENT

The SPD EIS (DOE 1999c) provided an extensive discussion of the affected environment for SRS, including F Area. That discussion is included in this chapter with appropriate updated information. SRS developed the *Generic Safety Analysis Report* (GSAR) (WSRC 1999a) for all facilities located at SRS. The GSAR provides key site information including (but not limited to) geology, hydrology, meteorology, land use, and demographics for SRS. The GSAR is updated on a periodic basis. The GSAR is used in this ER to supplement the information provided in the SPD EIS. This ER also uses the SRS Environmental Reports for 1998 and 1999 (Arnett and Mamatey 1999, 2000a) to update information provided in the SPD EIS. Where more recent information is not available, the data provided in the SPD EIS were used. In some instances, more recent data were investigated, and it was determined that data presented in the SPD EIS provided a more conservative basis for projecting impacts on the affected environment.

4.1 SITE LOCATION AND LAYOUT

The site location is summarized in Section 4.1.1, and the site layout is described in Section 4.1.2.

4.1.1 Site Location

The MFFF is located in the Separations Area (F Area) of SRS in South Carolina (Figure 4-1). SRS, which is owned by the U.S. Government, was set aside in 1950 for the production of nuclear materials for national defense. SRS, as shown in Figure 4-1, is an approximately circular tract of land occupying 310 mi^2 (803 km^2) or 198,400 ac (80,292 ha) within Aiken, Barnwell, and Allendale Counties in southwestern South Carolina. Because public access to the SRS area is limited by DOE security regulations, DCS plans to use the DOE site boundary as the controlled area boundary for the MFFF (Figure 4-2). F Area and the MFFF are located in Aiken County near the center of SRS, east of SRS Road C and north of SRS Road E. F Area comprises approximately 395 ac (160 ha) of SRS. The nearest site boundary to F Area is approximately 5.8 mi (9.3 km) to the west. The center of F Area is approximately 25 mi (40 km) southeast of the city limits of Augusta, Georgia; 100 mi (161 km) from the Atlantic Coast; 6 mi (9.7 km) east of the Georgia border; and about 110 mi (177 km) south-southwest of the North Carolina border. The MFFF site is located adjacent to the north-northwest corner of F Area (Figure 4-3).

The location of SRS and F Area relative to towns, cities, and other political subdivisions within a 50-mi (80-km) radius is shown in Figure 4-4. The largest nearby population centers are Aiken, South Carolina, and Augusta, Georgia. The only towns within 15 mi (24 km) of the center of F Area are New Ellenton, Jackson, Barnwell, Snelling, and Williston, South Carolina.

Prominent geographical features within 50 mi (80 km) of SRS are Thurmond Lake (formerly called Clarks Hill Reservoir) and the Savannah River. Thurmond Lake is an impoundment of the Savannah River approximately 40 mi (64 km) northwest of the center of SRS. The Savannah River bounds 17 mi (27 km) of the southwest border of SRS.

Six principal tributaries to the Savannah River are located on SRS: Upper Three Runs, Beaver Dam Creek, Fourmile Branch, Pen Branch, Steel Creek, and Lower Three Runs. F Area is drained by several tributaries of Upper Three Runs and by Fourmile Branch as shown in Figure 4-1.

The PDCF and the Waste Solidification Building (WSB) are part of the DOE's surplus plutonium disposition program in addition to the MFFF. The PDCF and WPB will be located in F Area at SRS near the MFFF. The PDCF will supply plutonium feedstock to the MFFF, while the WPB will solidify the MFFF stripped uranium and high alpha waste streams and PDCF waste. R2

The main processing facility in F Area is F Canyon, which is composed of a chemical separations plant and associated waste storage facilities. During the SRS production years, F Canyon was used to chemically separate uranium, plutonium, and fission products from irradiated fuel and target assemblies. The separated uranium and plutonium were transferred to other DOE facilities for further processing and final use. F Canyon is presently used to process the remaining transplutonium solutions and other material onsite for eventual disposal in a geologic repository. F-Canyon waste is transferred to HLW tanks in the area for storage. The F-Area Tank Farm consists of 22 underground storage tanks that store aqueous radioactive HLW and saltcake.

Five reactor facilities are located within a 10-mi (16-km) radius of F Area; however, all five of these reactors have been placed in cold shutdown with no plans for restart.

Facilities in Z Area, which is located about 2.5 mi (4 km) from F Area, are used to process and dispose of decontaminated salt solution supernatants from waste tanks. The DWPF in nearby S Area vitrifies the F-Area waste tank HLW into borosilicate glass for disposal offsite.

H Area is located 2 mi (3.2 km) to the east of F Area. The H-Canyon Facility in H Area is used to convert highly enriched weapons-grade uranium to a low enriched form not usable for weapons production and to stabilize plutonium-242 solutions. In July 2000, work commenced R1 on the Tritium Extraction Facility, which will extract tritium from irradiated fuel rods from the Tennessee Valley Authority Sequoyah and Watts Bar nuclear plants.

Reactor material fabrication facilities in M Area are located approximately 5 mi (8 km) from F Area.

4.1.2 Site Layout

The MFFF is located adjacent to the north-northwest corner of F Area, as shown in Figure 4-3. The buildings and facilities of the MFFF, shown in Figure 4-5, are arranged to ensure safe, secure, and efficient performance of all MFFF functions. The site layout provides the characteristics necessary to satisfy the stringent security criteria for safeguarding the SNM and to support safe and efficient MFFF operations. The entire facility comprises an area of approximately 41 ac (16.6 ha). No highways, railroads, or waterways traverse the MFFF site, and the movement of material and personnel to and from the MFFF site takes place via the SRS internal road system.

A conventional PIDAS fence surrounds the protected area of the MFFF. The specific functions of the MFFF buildings and facilities are described in Section 3.1. The MOX Fuel Fabrication Building is located within the protected area and is comprised of three major functional areas: the MOX Processing Area, the Aqueous Polishing Area, and the Shipping and Receiving Area. The Diesel Generator Buildings, the Technical Support Building, and the Secured Warehouse Building are also located inside the protected area. The Administration Building and the Gas Storage Facility are located outside the PIDAS. The Secured Warehouse Building, which is located adjacent to the site access road, is an integral part of the outer PIDAS security barrier. The Technical Support Building, which serves as the sole personnel access point to the protected area, is located near the Administration Building and is accessed by a walkway between the two buildings.

4.2 LAND USE

Information in this section was previously discussed in Section 3.5.10.1 of the SPD EIS (DOE 1999c). Land may be characterized by its potential for the location of human activities (i.e., land use). Natural resource attributes and other environmental characteristics could make a site more suitable for some land uses than for others. Changes in land use may have both beneficial and adverse effects on other resources (i.e., biological, cultural, geological, aquatic, and atmospheric).

4.2.1 General Site Description

The general site description was provided previously in Section 3.5.10.1.1 of the SPD EIS (DOE 1999c). Forest and agricultural land predominate in the areas bordering SRS. There are also significant open water and non-forested wetlands along the Savannah River Valley. Incorporated and industrial areas are the only other significant land uses. There is limited urban and residential development bordering SRS. The three counties in which SRS is located have not zoned any of the site land. The only adjacent area with any zoning is the town of New Ellenton, which has lands bordering SRS in two zoning categories: urban development and residential development. The closest residences are to the west, north, and northeast, within 200 ft (61 m) of the SRS boundary (DOE 1996b).

Various industrial, manufacturing, medical, and farming operations are conducted in areas around the site. Major industrial and manufacturing facilities in the area include textile mills, plants producing polystyrene foam and paper products, chemical processing plants, and a commercial nuclear power plant. Farming is diversified in the region; it includes such crops as peaches, watermelon, cotton, soybeans, corn, and small grains (DOE 1995a).

Outdoor public recreation facilities are plentiful and varied in the SRS region. Included are the Sumter National Forest, 47 mi (76 km) to the northwest; Santee National Wildlife Refuge, 50 mi

(80 km) to the east; and Clarks Hill/Strom Thurmond Reservoir, 43 mi (69 km) to the northwest. There are also a number of state, county, and local parks in the region, most notably Redcliffe Plantation, Rivers Bridge, Barnwell and Aiken County State Parks in South Carolina, and Mistletoe State Park in Georgia (DOE 1995a). The Crackerneck Wildlife Management Area, which extends over 4,770 ac (1,930 ha) of SRS adjacent to the Savannah River, is open to the public for hunting and fishing. Public hunts are allowed under DOE Order 4300.1C, which states that "all installations having suitable land and water areas will have programs for the harvesting of fish and wildlife by the public" (Noah 1995). SRS is a controlled area with public access limited to through traffic on South Carolina Highway 125 (SRS Road A), U.S. Highway 278, SRS Road 1, and the CSX railway line (DOE 1995a).

Land use at SRS can be classified into three major categories: forest/undeveloped, water/wetlands, and developed facilities. General land use at SRS and its vicinity is shown on Figure 4-6. Approximately 226 mi^2 (585 km^2) of SRS (i.e., 73% of the area) is undeveloped (DOE 1996b). Wetlands, streams, and lakes account for 70 mi^2 (181 km^2) or 22% of the site, while developed facilities including production and support areas, roads, and utility corridors only make up approximately 5% or 15 mi^2 (38.9 km^2) of SRS (DOE 1996b). The woodlands area is primarily in revenue-producing, managed timber production. The U.S. Forest Service, under an interagency agreement with DOE, harvests about 2.8 mi^2 (7.3 km^2) of timber from SRS each year (DOE 1997b). Soil map units that meet the requirements for prime farmland soils exist onsite. However, the U.S. Department of Agriculture, Natural Resources Conservation Service, does not identify these as prime farmlands because the land is not available for agricultural production (DOE 1996b).

In 1972, DOE designated all of SRS as a National Environmental Research Park. The National Environmental Research Park is used by the national scientific community to study the impacts of human activities on the cypress swamp and hardwood forest ecosystems (DOE 1996b). DOE has set aside approximately 22 mi^2 (57 km^2) of SRS exclusively for nondestructive environmental research (DOE 1997b).

Decisions on future land uses at SRS are made by DOE through the site development, land use, and future planning processes. SRS has established a Land Use Technical Committee composed of representatives from DOE, WSRC, and other SRS organizations. The discussion draft *SRS Long Range Comprehensive Plan* (DOE 2000a), issued in September 2000, includes the operation of the MFFF as part of the plan. In March 2000, DOE also issued a *Savannah River Site Strategic Plan* (DOE 2000c). Under the Nuclear Materials Stewardship Program, the NMS-1 Goal is to reduce the global nuclear danger by providing safe and secure storage, stabilization, and disposition of nuclear materials and spent nuclear fuel. The design, construction, and operation of the MFFF in F Area is one of the strategies that DOE plans to use to achieve this strategic goal. R1 R1

In addition to DOE planning, the state of South Carolina also conducts land use planning in the vicinity of SRS as discussed in Section 3.5.10.1.1 of the SPD EIS (DOE 1999c). The state of South Carolina requires local jurisdictions to undertake comprehensive planning. Regional-level planning also occurs within the state, which is divided into 10 planning districts guided by regional advisory councils (DOE 1996b). The counties of Aiken, Allendale, and Barnwell together constitute part of the Lower Savannah River Council of Governments. Private lands bordering SRS are subject to the planning regulations of these three counties.

No onsite areas are subject to Native American Treaty Rights. However, five Native American groups (the Yuchi Tribal Organization, the National Council of Muskogee Creek, the Indian Peoples Muskogee Tribal Town Confederacy, the Pee Dee Indian Association, and the Ma Chis Lower Alabama Creek Indian Tribe) have expressed concern over sites and items of religious significance on SRS. DOE routinely notifies these organizations about major planned actions at SRS and asks them to comment on SRS documents prepared in accordance with NEPA.

4.2.2 Proposed Facility Location

Land use in F Area is industrial, as described previously in Section 3.5.10.1.2 of the SPD EIS (DOE 1999c). Many buildings are situated within F Area. Included is Building 221-F, one of the canyons where plutonium was recovered from targets during DOE's plutonium production phase. Land use at Building 221-F in F Area is classified as heavy industrial.

F Area occupies approximately 395 ac (160 ha) of SRS. The proposed MFFF will occupy a 41-ac (16.6-ha) area just north of the cancelled Actinide Packaging and Storage Facility (DOE 2002a). R2

4.3 GEOLOGY

Section 3.5.6 of the SPD EIS (DOE 1999c) describes the geology of the MFFF site. Section 1.4.3 of the SRS GSAR (WSRC 1999a) provides a comprehensive presentation of the regional and SRS site geology. This section presents an overview of the site geology as presented in these two references and based on a detailed geotechnical program conducted in calendar year 2000 to provide site-specific design information for the MFFF site (WSRC 2000). R1

4.3.1 Regional Geology

The southeastern continental margin, within a 200-mi (322-km) radius of SRS, contains portions of all the major divisions of the Appalachian orogen (mountain belt) in addition to the elements that represent the evolution to a passive margin.

Within the Appalachian orogen, several lithotectonic terranes that have been extensively documented include the foreland fold belt (Valley and Ridge) and western Blue Ridge Precambrian-Paleozoic continental margin; the eastern Blue Ridge-Chauga Belt-Inner Piedmont terrane; the volcanic-plutonic Carolina Terrane; and the geophysically defined basement terrane beneath the Atlantic Coastal Plain. These geological divisions record a series of compressional and extensional events that span the Paleozoic. The modern continental margin includes the Triassic-Jurassic rift basins that record the beginning of extension and continental rifting during the early to middle Mesozoic. The offshore Jurassic-Cretaceous clastic-carbonate bank sequence covered by younger Cretaceous and Tertiary marine sediments, and the onshore Cenozoic sediments represent a prograding shelf-slope and the final evolution to a passive margin. Other offshore continental margin elements include the Florida-Hatteras shelf and slope and the unusual Blake Plateau basin and escarpment.

The two predominant processes sculpting the landscape during this tectonically quiet period included erosion of the newly formed highlands and subsequent deposition of the sediments on the coastal plain to the east. The passive margin region consists of a wedge of Cretaceous and Cenozoic sediments that thickens from near zero at the Fall Line to about 1,100 ft (335 m) in the center of SRS, and to approximately 4,000 ft (1,219 m) at the South Carolina coast. The fluvial to marine sedimentary wedge consists of alternating sand and clay with tidal and shelf carbonates common in the downdip Tertiary section.

4.3.1.1 Coastal Plain Stratigraphy

The sediments of the Atlantic Coastal Plain in South Carolina are stratified sand, clay, limestone, and gravel that dip gently seaward and range in age from Late Cretaceous to Recent. The sedimentary sequence thickens from essentially zero at the Fall Line to more than 4,000 ft (1,219 m) at the coast. Regional dip is to the southeast, although beds dip and thicken locally in other directions because of locally variable depositional regimes and differential subsidence of basement features such as the Cape Fear Arch and the South Georgia Embayment.

The Coastal Plain sedimentary sequence near the center of the region (i.e., SRS) consists of about 700 ft (213 m) of Upper Cretaceous quartz sand, pebbly sand, and kaolinitic clay, overlain by about 60 ft (18 m) of Paleocene clayey and silty quartz sand, glauconitic sand, and silt. The Paleocene beds are in turn overlain by about 350 ft (107 m) of Eocene quartz sand, glauconitic quartz sand, clay, and limestone grading into calcareous sand, silt, and clay. The calcareous strata are common in the upper part of the Eocene section in downdip parts of the study area. In places, especially at higher elevations, the sequence is capped by deposits of pebbly, clayey sand, conglomerate, and clay of Miocene or Oligocene age. Lateral and vertical facies changes are characteristic of most of the Coastal Plain sequence.

4.3.1.2 Coastal Plain Sediments

Upper Cretaceous sediments overlie Paleozoic crystalline rocks or lower Mesozoic sedimentary rocks throughout most of the study area. The Upper Cretaceous sequence includes the basal Cape Fear Formation and the overlying Lumbee Group, which is divided into three formations (see Figure 4-7). The sediments in this region consist predominantly of poorly consolidated, clay-rich, fine- to medium-grained, micaceous sand, sandy clay, and gravel and are about 700 ft (213 m) thick near the center of the study area. Thin clay layers are common. In parts of the section, clay beds and lenses up to 70 ft (21 m) thick are present.

Tertiary sediments range in age from Early Paleocene to Miocene and were deposited in fluvial to marine shelf environments. The Tertiary sequence of sand, silt, and clay generally grades into highly permeable platform carbonates in the southern part of the study area and these continue southward to the coast. The Tertiary sequence is divided into three groups, the Black Mingo Group, Orangeburg Group, and Barnwell Group, which are further subdivided into formations and members (see Figure 4-7). These groups are overlain by the ubiquitous Upland unit.

The Orangeburg Group underlies SRS and the MFFF site and consists of the lower middle Eocene Congaree Formation (Tallahatta equivalent) and the upper middle Eocene Warley Hill Formation and Tinker/Santee Formation (Lisbon equivalent) (see Figure 4-7). Over most of the study area, these post-Paleocene sediments are more marine in character than the underlying Cretaceous and Paleocene sediments of the Black Mingo group; they consist of alternating layers of sand, limestone, marl, and clay.

The group crops out at lower elevations in many places within and near SRS. The sediments thicken from about 85 ft (26 m) at well P-30 near the northwestern SRS boundary to 200 ft (61 m) at well C-10 in the south. Dip of the upper surface is 12 ft/mi (2 m/km) to the southeast.

In the central part of the study area, the Orangeburg group includes, in ascending order, the Congaree, Warley Hill, and Tinker/Santee Formations (see Figure 4-7). The units consist of alternating layers of sand, limestone, marl, and clay that are indicative of deposition in shoreline to shallow shelf environments. From the base upward, the Orangeburg Group passes from clean shoreline sand, characteristic of the Congaree Formation, to shelf marl, clay, sand, and limestone, typical of the Warley Hill and Tinker/Santee Formations. Near the center of the study area, the Santee sediments consist of up to 30% carbonate by volume. The sequence is transgressive, with the middle Eocene Sea reaching its most northerly position during Tinker/Santee deposition.

The late middle Eocene deposits overlying the Warley Hill Formation consist of moderately sorted yellow and tan sand, calcareous sand and clay, limestone, and marl. Calcareous sediments dominate downdip, are sporadic in the middle of the study area, and are missing in the northwest portion of SRS. The limestone represents the farthest advance to the northwest of the transgressing carbonate platform first developed in early Paleocene time near the South Carolina and Georgia coasts.

The Tinker/Santee interval is about 70 ft (21 m) thick near the center of SRS, and the sediments indicate deposition in shallow marine environments. Often found within the Tinker/Santee sediments, particularly in the upper third of the interval, are weak zones interspersed in stronger carbonate-rich matrix materials. The weak zones, which vary in apparent thickness and lateral extent, were noted where rod drops and/or lost circulation occurred during drilling, low blow counts occurred during soil penetration test pushes, etc. These weak zones have variously been termed in SRS reference documents as "soft zones," the "critical layer," "underconsolidated zones," "bad ground," and "void." The preferred term used to describe these zones is "soft zones." The soft zones can be in the form of irregular isolated pods, extended thin ribbons, or stacked thin ribbons separated by intervening unsilicified parent sediment. Soft zones encountered in one location could be absent at a location only a few feet away.

Upper Eocene sediments of the Barnwell Group (see Figure 4-7) represent the Upper Coastal Plain of western South Carolina and eastern Georgia. Sediments of the Barnwell Group are present at the MFFF site and overlie the Tinker/Santee Formation and consist mostly of shallow marine quartz sand containing sporadic clay layers. The group is about 70 ft (21 m) thick near the northwestern boundary of SRS and 170 ft (52 m) near its southeastern boundary. The regionally significant Santee Unconformity separates the Clinchfield Formation from the overlying Dry Branch Formation. The Santee Unconformity is a pronounced erosional surface observable throughout the SRS region.

In the northern part of the study area, the Barnwell Group consists of red or brown, fine to coarse-grained, well-sorted, massive sandy clay and clayey sand, calcareous sand and clay, as well as scattered thin layers of silicified fossiliferous limestone. All are suggestive of lower delta plain and/or shallow shelf environments.

4.3.1.3 Crustal Thickness

In general, the thickness of continental crust thins from west to east across the eastern United States continental margin. The zone of transition from continental crust to oceanic crust is thought to underlie the offshore Carolina Trough and the Blake Plateau basin. A cross-section through the continental margin offshore at South Carolina and North Carolina shows a geometry of thinning crust (see Figure 4-8). This is a typical Atlantic-type margin showing the geometry of oceanic crust to the east and continental crust to the west. The Moho deepens from east to west from about 9 mi (15 km) to about 25 mi (40 km), respectively. The continental crust along the margin has been extended and intruded during Mesozoic rifting and is described as rift stage crust. The data that support this interpretive model come largely from seismic reflection and refraction surveys and potential field surveys.

Further inland, the base of crust is discerned by following the configuration of the Moho on seismic refraction or reflection lines. From seismic reflection data collected at SRS, the Moho is interpreted at about 18.6 to 19.6 mi (30.0 to 31.5 km) depth. On the deep seismic profiles, a wide ban of reflections (200 to 300 milliseconds wide) at 10.5 to 11.05 seconds are interpreted to be the Moho. Luetgert et al. (1994) reports crustal thickness changes along a survey from SRS southeast to Walterboro, South Carolina.

4.3.1.4 Faulting

The most definitive evidence of crustal deformation in the Late Cretaceous through Cenozoic is the reverse sense faulting found in the Coastal Plain section of the eastern United States. Under the auspices of the Reactor Hazards Program of the late 1970s and early 1980s, the United States Geological Survey (USGS) conducted a field mapping effort to identify and compile data on all young tectonic faults in the Atlantic Coastal Plain. Consequently, many large, previously unrecognized Cretaceous and Cenozoic fault zones were found. Of 131 fault localities cited, 26 were within North Carolina and South Carolina. The identification of Cretaceous and younger faults in the eastern United States is greatly affected by distribution of geologic units of that age.

Prowell and Obermeier (1991) characterized the faults as mostly northeast trending reverse slip fault zones with up to 62 mi (100 km) lateral extent and up to 250 ft (76 m) vertical displacement in the Cretaceous. The faults dip 40° to 85°. Offsets were observed to be progressively smaller in younger sediments. This may be due to an extended movement history from Cretaceous through Cenozoic. Based on their similar characteristics, Prowell (1988) was able to associate Cretaceous and younger faulting in the Coastal Plain into several Fault Provinces. SRS falls into Prowell's (1988) Atlantic Coast Fault Province. A comparison of Cretaceous and younger faulting in SRS found that faulting on SRS shared similar characteristics with the faults in the Atlantic Coastal Fault Province including orientation and offset history. This comparison concluded that Cretaceous and younger faulting on SRS was not unique in comparison to the Atlantic Coast Fault Province in general and as a result shared the same seismic hazard.

Offset of Coastal Plain sediments at SRS includes all four Tertiary unconformities. Following deposition of the Late Paleocene Snapp Formation, some evidence indicates oblique-slip movement on the existing faults.

This faulting was followed by erosion and truncation of the Paleocene section at the Lang Syne/Sawdust Landing unconformity. Subsequent sediments were normal faulted following deposition of the Tinker/Santee Formation. Locally, however, offset of the overlying section indicates renewed movement on new or existing faults after deposition of Tobacco Road/Dry Branch sediments.

In conjunction with these observations of Coastal Plain faults, modern stress measurements provide an indication of the likelihood of Holocene movement. Moos and Zoback (1992, 1993) report a consistent northeast-southwest direction of maximum horizontal compressive stress (N 55-70°E) in the southeast United States. Their determination is based on direct in situ stress measurements, focal mechanisms of recent earthquakes, and young geologic indicators. Moos and Zoback (1992) conclude that the northeast directed stress would not induce damaging reverse and strike-slip faulting earthquakes on the Pen Branch fault, a northeast-striking Tertiary fault in the area. These same conclusions may be implied for the other northeast-trending faults.

4.3.1.5 SRS Geological Conditions

As discussed in this section, many SRS investigations and an extensive literature review support the conclusion that there are no geologic threats affecting the MFFF site, except the Charleston Seismic Zone and minor random Piedmont earthquakes. In the immediate region of SRS, there are no known capable faults. A capable fault is one that has had movement at or near the ground surface at least once within the past 35,000 years or recurrent movement within the past 500,000 years. Several faults have been identified from subsurface mapping and seismic surveys within the Paleozoic and Triassic basement beneath SRS. The largest of these is the Pen Branch Fault. There is no evidence of movement within the last 38 million years along this fault (DOE 1996b).

Three earthquakes of Intensity III or less occurred during recent years with epicenters inside the SRS boundary. On June 9, 1985, an earthquake with a local magnitude of III and a focal depth of about 0.6 mi (1 km) occurred at SRS. Its epicenter was west of C and K Areas. The acceleration produced by the earthquake did not activate seismic monitoring instruments in the reactor areas. (These instruments have detection limits of 0.002g.) On August 5, 1988, another earthquake with a local magnitude of I-II, a local duration magnitude of 2.0, and a focal depth of about 1.7 mi (2.7 km) occurred at SRS. Its epicenter was northwest of K Area. The seismic alarms in SRS facilities were not triggered. Existing information does not conclusively correlate the two earthquakes with any of the known faults on the site. Earthquakes capable of producing structural damage are not likely to occur in the vicinity of SRS (WSRC 2000c).

On May 17, 1997, an earthquake with a duration magnitude of 2.3 occurred. It was felt by workers in K Area and by nearby guards. An accelerograph, located 3 mi (4.8 km) east of the epicenter, was not triggered. Another more sensitive machine, located about 10 mi (16 km) away, was also not triggered. These events are small and appear to be shallow events associated with strain release near small-scale faults, intrusions, or edges of metamorphic belts. No damage has been reported (WSRC 2000c). On October 7, 2001, a minor earthquake with a duration magnitude of 2.5 lasting about 2 minutes occurred, producing audible rumbling, but no damage to any buildings in the area has been reported. Its epicenter was just north of the F and H Areas of SRS (Schneider and Chavis 2001). R1

Historically, two large earthquakes have occurred within 186 mi (300 km) of SRS. The largest of these, the Charleston earthquake of 1886, had an estimated Richter scale magnitude ranging from 6.5 to 7.5. The SRS area experienced an estimated peak horizontal acceleration of 0.10g during this earthquake.

There are no volcanic hazards at SRS. The area has not experienced volcanic activity within the last 230 million years. Future volcanism is not expected because SRS is along the passive continental margin of North America.

The soils at SRS are primarily sands and sandy loams. The somewhat excessively drained soils have a thick, sandy surface layer that extends to a depth of 6.6 ft (2 m) or more in some areas. Soil units that meet the soil requirements for prime farmland soils exist on SRS. However, the U.S. Department of Agriculture, Natural Resources Conservation Service, does not identify these lands as prime farmland due to the nature of site use; that is, the lands are not available for the production of food or fiber. The soils at SRS are considered acceptable for standard construction techniques. Detailed descriptions of the geology and the soil conditions at SRS are included in the S&D PEIS and the *Savannah River Site Waste Management Final Environmental Impact Statement* (DOE 1995b).

4.3.2 MFFF Site-Specific Geology

Soils in F Area are predominantly of the Fuquay-Blanton-Dothan association, consisting of nearly level to sloping, well-drained soils. Other soils include the Troup-Pickney-Lucy association, consisting of nearly level soils formed along, and parallel to, the floodplains of streams.

In 2000, 13 exploration borings and 63 cone penetration test (CPT) holes were used to define subsurface conditions at the MFFF site. Additional site geotechnical programs previously performed by others adjacent to and on this site were also used to evaluate site subsurface geologic and groundwater conditions. Actual conditions encountered at the MFFF site were evaluated with known geologic and groundwater hydrology conditions (described in Section 4.4.3), and no unusual conditions were encountered.

The CPT holes extended from approximately 64 ft (19.5 m) to 140 ft (42.7 m) below existing site grade. Each CPT hole provided a continuous profile of the soil conditions encountered at each test location. Seismic, resistivity, and piezometric measurements were obtained in many of the CPT holes. Some soft soil zones related to past solution and deposition activity were identified at depth on the MFFF site. The soft zones encountered were typical of those that have been described in previous F-Area investigations. The CPT holes were used to define limits of the soft zones. The planned locations of heavily loaded structures, such as the MOX Building and Diesel Generator Building, were adjusted on the MFFF site to minimize the potential impact of the underlying soft zones. This adjustment was necessitated by the potential of the soil to liquefy under certain conditions, forcing foundations to fail.The soil exploration borings extended from approximately 131 ft (40 m) to 181 ft (55.2 m) below existing site grade. The exploration borings were used to correlate with the CPT holes and to obtain soil samples for laboratory testing. Three cased holes for the exploration program were used for downhole seismic testing.

A comprehensive laboratory testing program was conducted to establish both static and dynamic design parameters for use in analysis. Laboratory results indicate that conditions at the MFFF site are consistent with those encountered in previous investigations in F Area and other studies in the same geologic units described at SRS.

The upper geologic units at the MFFF site are composed of the Barnwell Group described in Section 4.3.1.2. The exploration borings also extended through the Tinker/Santee Formation, Warley Hill Formation, and into the Congaree Formation of the Orangeburg Group.

The unconfined water table is within the Upper Three Runs aquifer, as described in Section 4.4.3.1. Based on the results of pore water pressure dissipation testing, the groundwater level at the MFFF site was generally encountered at a depth of 60 ft (18.3 m) or more below grade, at the time of site exploration. As indicated in WSRC (2002), the Upper Three Runs aquifer water table is generally at 210 ft (63.6 m) (msl). In the past ten years, during wetter seasons, it has reached 220 ft (67 m) (msl), well below the deepest MFFF construction excavation level of 242 ft (73.8 m) (msl). The water table and gradient at the MFFF site are consistent with Figure 4-9. R1

The subsurface conditions encountered at the MFFF site are considered suitable to support the proposed structures for the MFFF.

4.4 HYDROLOGY

This section addresses the baseline hydrology in the vicinity of the MFFF site. Hydrology was discussed in Section 3.5.7 of the SPD EIS (DOE 1999c). Some updated information is provided in the following sections. Section 4.4.1 discusses water use in the region, Section 4.4.2 discusses the surface water hydrology, and Section 4.4.3 discusses the groundwater hydrology.

4.4.1 Water Use

Water has historically been withdrawn from the Savannah River for use mainly as cooling water; however, some has been used for domestic purposes (DOE 1996b). Total water usage from the Savannah River in 2000 was 13.1 billion gal (49.7 billion L). Most of this water is returned to the river through discharges to various tributaries (DOE 1996b). R1

The average flow of the Savannah River is 10,000 ft^3/sec (283 m^3/sec). Three large upstream reservoirs (Hartwell, Richard B. Russell, and Strom Thurmond/Clarks Hill) regulate the flow in the Savannah River, thereby lessening the impacts of drought and flooding on users downstream (DOE 1995b).

Several communities in the area use the Savannah River as a source of domestic water. The nearest downstream water intake is the Beaufort-Jasper Water Authority in South Carolina, which withdraws about 8.1 ft^3/sec (0.23 m^3/sec) to service about 51,000 people. Treated effluent is discharged to the Savannah River from upstream communities and from treatment facilities at SRS. The average annual volume of flow discharged by the sewage treatment facilities at SRS is about 185 million gal (700 million L) (DOE 1996b).

Groundwater aquifers are classified by federal and state authorities according to use and quality. The federal classifications include Class I, II, and III groundwater. Class I groundwater either is the sole source of drinking water or is ecologically vital. Class IIA and IIB are current or potential sources of drinking water (or other beneficial use), respectively. Class III is not considered a potential source of drinking water and is of limited beneficial use. The state of South Carolina classifies groundwater as "GA" (exceptional quality), "GB" (suitable for domestic drinking water), or "GC" (little potential as an underground source of drinking water). All groundwater in the vicinity of SRS is classified as GB by South Carolina and as Class IIA by EPA.

Groundwater in the area is used extensively for domestic and industrial purposes. Most municipal and industrial water supplies are withdrawn from the Crouch Branch and McQueen Branch aquifers, while small domestic supplies are withdrawn from the Gordon aquifer. It is estimated that about 2.1 billion gal/yr (8 billion L/yr) are withdrawn from the aquifers within a R1
10-mi (16-km) radius of the site, which is similar to the volume used by SRS (DOE 1996b). The Crouch Branch and McQueen Branch aquifers are an important water resource for the SRS

region. The water is generally soft, slightly acidic, and low in dissolved and suspended solids (DOE 1995b).

Groundwater is the only source of domestic water at SRS (DOE 1995b). Depth to groundwater ranges from near the surface to about 150 ft (46 m) below ground surface (bgs). In 1993, SRS withdrew about 3.4 billion gal/yr (13 billion L/yr) of groundwater to support site operations (DOE 1996b). There are no designated sole source aquifers in the area (DOE 1999b).

Groundwater ranges in quality across the site; in some areas it meets drinking water quality standards, while in areas near some waste sites it does not. The Crouch Branch and McQueen Branch aquifers are generally unaffected except for an area near A Area, where trichloroethylene (TCE) has been reported. TCE has also been reported in A and M Areas in the Crouch Branch and McQueen Branch aquifers. Tritium has been reported in the Gordon aquifer in the Separations Area. The water table aquifer is contaminated with solvents, metals, and low levels of radionuclides at several SRS sites and facilities. Groundwater eventually discharges into onsite streams or the Savannah River (DOE 1996b), but groundwater contamination has not been detected beyond SRS boundaries (DOE 1995b).

Groundwater rights in South Carolina are associated with the absolute ownership rule. Owners of land overlying a groundwater source are allowed to withdraw as much water as they desire; however, the state requires users who withdraw more than 100,000 gal/day (379,000 L/day) to report their withdrawals. DOE is required to report because its usage is above the reporting level (DOE 1996b).

4.4.2 Surface Water Hydrology

Surface water includes marine or freshwater bodies that occur above the ground surface, including rivers, streams, lakes, ponds, rainwater catchments, embayments, and oceans.

4.4.2.1 General Site Description

The largest river in the area of SRS is the Savannah River, which borders the site on the southwest. Six streams flow through SRS and discharge into the Savannah River: Upper Three Runs, Beaver Dam Creek, Fourmile Branch, Pen Branch, Steel Creek, and Lower Three Runs. Upper Three Runs has two tributaries, Tims Branch and Tinker Creek; Pen Branch has one tributary, Indian Grave Branch; and Steel Creek has one tributary, Meyers Branch (DOE 1996b).

There are two manmade lakes at SRS: L Lake, which discharges to Steel Creek, and Par Pond, which discharges to Lower Three Runs. Also, about 299 Carolina bays (i.e., closed depressions capable of holding water) occur throughout the site. While these bays receive no direct effluent discharges, they do receive stormwater runoff (DOE 1996b; WSRC 1997a).

It is clear that the surplus plutonium disposition facilities would not be located within a 100-year floodplain, but there is no information concerning 500-year floodplains (DOE 1996b). No federally designated Wild and Scenic Rivers occur within the site (DOE 1996b). A map showing the 100-year floodplain is presented as Figure 4-10.

The Savannah River is classified as a freshwater source that is suitable for primary and secondary contact recreation; drinking, after appropriate treatment; fishing; balanced indigenous aquatic community development and propagation; and industrial and agricultural uses. A comparison of Savannah River water quality upstream (river-mi 160 [river-km 257]) and downstream (river-mi 120 [river-km 193]) of SRS showed no significant differences for non-radiological parameters (Arnett and Mamatey 1996). A comparison of current and historical data shows that the coliform data are within normal fluctuations for river water in this area. For the different river locations, however, there has been an increase in the number of analyses in which standards were not met. The data for the river's monitoring locations generally met the freshwater standards set by the state; a comparison of the 1995 and earlier measurements for river samples showed no abnormal deviations. As for radiological constituents, tritium is the only radionuclide detected above background levels in the Savannah River (Arnett and Mamatey 1996).

Surface water rights for SRS are determined by the Doctrine of Riparian Rights, which allows owners of land adjacent to or under the water to use the water beneficially (DOE 1996b). SRS has four NPDES permits, one (SC0000175) for industrial wastewater discharges, two (SCR000000 and SCR100000) for general stormwater discharges, and one (ND0072125) for land application. Permit SC0000175 regulates 31 outfalls. The compliance rate for these outfalls was 99.7% since 1999. The 46 stormwater-only outfalls regulated by the stormwater permits are monitored as required. A stormwater pollution prevention plan has been developed to identify where best available technology and best management practices must be used. For stormwater runoff from construction activities extending over 5 ac (2 ha), a sediment reduction and erosion plan is required (Arnett and Mamatey 1996). Presently, only Permit SC0000175 is active at SRS for industrial wastewater discharges. The other active permits are related to stormwater discharges. R1 R1

4.4.2.2 Proposed Facility Location

The land around F Area drains to Upper Three Runs and Fourmile Branch. Upper Three Runs is a large, cool blackwater stream that flows into the Savannah River. It drains about 210 mi^2 (544 km^2) and, during water year 1995, had a mean discharge of 245 ft^3/sec (6.9 m^3/sec) near its mouth. The 7-day, 10-year low flow over the period of record (water years 1974 to 1995) at SRS Road A is about 100 ft^3/sec (2.8 m^3/sec). The stream is about 25 mi (40 km) long, and only its lower reaches extend through SRS. It receives more water from underground sources (Dublin-Midville aquifer system) than any other SRS stream and therefore has lower dissolved solids, hardness, and pH values. It is the only major stream onsite that has not received thermal discharges. It receives permitted discharges from several areas at SRS, including F Area, S Area, the S-Area sewage treatment plant, and treated industrial wastewater from the Chemical Waste Treatment Facility steam condensate. Flow from the sanitary wastewater discharge averages less than 0.035 ft^3/sec (0.001 m^3/sec) or 16 gal/min (61 L/min). A comparison with the 7-day, 10-year low flow of 100 ft^3/sec (2.8 m^3/sec) in Upper Three Runs shows that the present discharges are very small. The analytical results for the active outfalls show the constituents of concern are maintained within permit limitations (Arnett and Mamatey 2000a, 2000b).

Fourmile Branch is a blackwater stream (freshwater, dark color resulting from organic debris) affected by past operational practices at SRS. Its headwaters are near the center of the site, and it flows southwesterly before discharging into the Savannah River. The watershed is about 21 mi^2 (54 km^2) and receives permitted effluent discharges from F and H Areas. This stream received cooling water discharges from C Reactor while it was operating. Since those discharges ceased in 1985, the maximum recorded temperature in the stream has been 90°F (32°C). The average flow in the stream since 1985 is about 64 ft^3/sec (1.8 m^3/sec) (DOE 1995b). In water year 1995, the mean flow of Fourmile Branch at SRS Road A-13.2 was 37.3 ft^3/sec (1.1 m^3/sec). The 7-day, 10-year low flow over the period of record (water years 1977 to 1995) at SRS Road A-13.2 was 8.2 ft^3/sec (0.23 m^3/sec) (WSRC 1997a). In its lower reaches, this stream widens and flows via braided channels through a delta. Downstream of this delta area, it re-forms into one main channel, and most of the flow discharges into the Savannah River at river-mi 152.1 (river-km 245). When the Savannah River floods, water from Fourmile Branch flows along the northern boundary of the floodplain and joins with other site streams to exit the swamp via Steel Creek instead of flowing directly into the Savannah River (DOE 1995b).

Prior to 1996, Fourmile Branch received effluents from 16 National Pollutant Discharge Elimination System (NPDES) outfalls in C, F, and H Areas, and Central Shops, as well as groundwater from beneath F and H Areas due to outcropping. With the new NPDES permit (SC0000175) issued in 1996, outfalls were reduced from 16 to 5 due to deletions of waste streams and the consolidation of the outfalls. Effluent from the new 1.05 million gal/day (4.0 million L/day) CSWTF began discharging to Fourmile Branch in 1995 (WSRC 1997a).

Fourmile Branch, either directly or via tributaries, receives the following NPDES-permitted discharges: 186 basin overflows, cooling water, floor drains, steam condensate, process wastewater, laundry effluent, stormwater, sanitary treatment wastewater, ash basin runoff, and lab drains (WSRC 1997a).

Table 4-1 (WSRC 1999a) presents the annual instantaneous discharges of the Savannah River at Augusta, Georgia.

4.4.2.3 Summary of Potential for Flooding

There is no evidence that the selected site has experienced flooding in the past. Storm-induced runoff will provide sheet flow toward the site, which will be controlled by construction of short diversion berms near the site. The potential for flooding is discussed in the SRS GSAR (WSRC 1999a) and presented in this section.

The annual instantaneous maximum flows for Upper Three Runs gauging stations at Highway 278 near SRS Road C and at SRS Road A are listed in Table 4-2 (WSRC 1999a). The station at Highway 278 has the longest historical record.

For Upper Three Runs at Highway 278, the maximum flood recorded was 820 ft^3/sec (23 m^3/sec) on October 23, 1991, and the corresponding flood stage elevation was 174 ft (53 m) above msl. Similarly, the maximum flow at SRS Road C was 2,040 ft^3/sec (58 m^3/sec) (132.9 ft [40.5 m] above msl) on October 12, 1991, and at SRS Road A was more than 2,000 ft^3/sec (57 m^3/sec) (98 ft [29.9 m] above msl) on October 12, 1990. No dams are located in Upper Three Runs.

The site grade will be set at a mean elevation of 272 ft (83 m) above msl to ensure that there will be no flooding at the site due to the hydrological activity of these two streams.

The calculated probable maximum flood (PMF) for Upper Three Runs, downstream from the point where it is joined by Tinker Creek, is 150,000 ft^3/sec (4,248 m^3/sec). The watershed area at this point is 163 mi^2 (422 km^2), based on the drainage area at the nearest upstream gauging station (Station 02197300) and the planimetered additional drainage area. The maximum stage corresponding to this flow is 173.5 ft (52.9 m) above msl.

The estimated PMF for Upper Three Runs results in a water level of about 175 ft (53 m) above msl near F, H, and S Areas. The PMF for a small, unnamed tributary of Upper Three Runs, located about 0.4 mi (0.6 km) northwest of F Canyon, corresponds to a peak stage of approximately 225 ft (69 m) above msl.

In F and E Areas, the 6-hr, 10-mi^2 (26-km^2) probable maximum precipitation (PMP) is 31 in (78.7 cm), as indicated in *Probable Maximum Precipitation Estimates, United States East of the 105th Meridian* (Schreiner and Reidel 1978), with a maximum intensity of 15.1 in (38.4 cm) in 1 hr. This rainfall was adjusted to a point PMP of 19 in (48.3 cm) in 1 hr, as shown by Hanson et al. (1993) and used to generate the PMF for the small watershed of the unnamed tributary near SRS. Incremental rainfall for 1-hr periods adjacent to the PMP was also determined as shown in Table 4-3 (WSRC 1999a). A synthetic hydrograph was used to determine peak flow. The peak stage corresponding to the PMF is 224.5 ft (68.4 m) above msl. Because F Area lies near a watershed divide, incident rainfall naturally drains away from the facilities.

The PMF flood peak for Upper Three Runs was calculated using the simplified method in Regulatory Guide 1.59. The PMF was plotted using the figures in Appendix B of Regulatory Guide 1.59 (NRC 1977b) for drainage areas ranging from 100 to 20,000 mi^2 (260 to 52,000 km^2); then interpolation of the logarithmic plot provided the PMF for the 163-mi^2 (423.8-km^2) watershed of Upper Three Runs (WSRC 1999a).

Unusual short-duration heavy rainfall occurred in F and E Areas in August 1990 and October 1990. Total rainfall measured in F Area was reported in the GSAR (WSRC 1999a) as follows:

- On August 22, 1990, 6.1 in (15.5 cm) of rainwater was collected.
- On October 11 and 12, 1990, about 10 in (25.4 cm) of rainfall was collected.

4.4.3 Groundwater Hydrology

Groundwater in the vicinity of the MFFF site is discussed in Section 3.5.7.2 of the SPD EIS (DOE 1999c). The following sections update that discussion using additional information from the SRS GSAR (WSRC 1999a).

4.4.3.1 General Site Description

The Southeastern Coastal Plain hydrogeologic province underlies 120,000 mi^2 (312,000 km^2) of the Coastal Plain of South Carolina, Georgia, Alabama, Mississippi, and Florida and a small contiguous area of southeastern North Carolina. This hydrogeologic province comprises a multi-layered hydraulic complex in which retarding beds composed of clay and marl are interspersed with beds of sand and limestone that transmit water more readily. Groundwater flow paths and flow velocity for each of these units are governed by the unit's hydraulic properties, the geometry of the particular unit, and the distribution of recharge and discharge areas. Miller and Renken (1988) divided the Southeastern Coastal Plain hydrogeologic province into seven regional hydrologic units: four regional aquifer units separated by three regional confining units. Six of the seven hydrologic units are recognized in the SRS area and are referred to as hydrogeologic systems. These systems have been grouped into three aquifer systems divided by two confining systems, all of which are underlain by the Appleton confining system. The Appleton confining system separates the Southeastern Coastal Plain hydrogeologic province from the underlying Piedmont hydrogeologic province. The regional aquifer/confining systems at SRS are presented in Figures 4-7 and 4-11 (WSRC 1999a).

In descending order, the aquifer systems beneath SRS are the Floridan aquifer system, the Dublin aquifer system, and the Midville aquifer system (see Figure 4-7). In descending order, the confining systems are the Meyers Branch confining system, the Allendale confining system, and the Appleton confining system. Beneath SRS, the Midville and Dublin aquifer systems each consists of a single aquifer, the McQueen Branch aquifer and Crouch Branch aquifer, respectively. Downdip, beyond SRS, aquifer systems are subdivided into several aquifers and confining units.

Beneath the MFFF site, the Floridan aquifer system consists of two aquifers – the Upper Three Runs aquifer and the underlying Gordon aquifer, which are separated by the Gordon confining unit. Northward, the Gordon and Upper Three Runs aquifer units coalesce to form the Steed Pond aquifer.

4.4.3.2 Proposed Facility Location

[Text Deleted]

Beneath the MFFF site, the Upper Three Runs aquifer is divided into upper and lower aquifer zones by the Tan Clay confining zone of the Dry Branch Formation. In the area near the MFFF site, the topography drops sharply to the north toward Upper Three Runs, and the water table R1 occurs not in the upper aquifer zone, but in the lower aquifer zone beneath the Tan Clay confining zone.

The Upper Three Runs aquifer is underlain and separated from the Gordon aquifer by clay-rich, Eocene age marine sediments. Hydrostratigraphically, this formation is the Gordon confining unit. Owing to the glauconitic sands and greenish clay beds in this unit, it has been referred to informally as the "green clay" in many previous SRS reports. The Gordon aquifer underlies and is confined by the Gordon confining unit at the MFFF site. R1

Groundwater quality in F Area is not significantly different from that for the site as a whole. It is abundant, usually soft, slightly acidic, and low in dissolved solids. High dissolved iron concentrations occur in some aquifers. Where needed, groundwater is treated to raise the pH and remove iron. Recently (September 2000), three wells (FNB-13, FNB-14, and FNB-15) at the Old F-Area Seepage Basin (OFASB) (see location on Figure 4.3) compliance boundary exceeded allowable standards for one nonradioactive constituent (nitrate) and several radioactive constituents (tritium, iodine-129, and strontium-90) (WSRC 2001). R1

F-Area groundwater quality can exceed drinking water standards for several contaminants. Near the F-Area seepage basins and inactive process sewer line, radionuclide contamination is widespread. Most of these wells contain tritium above drinking water standards. Other wells exhibit gross alpha, gross beta, iodine-129, and strontium-90 above their standards. Other radionuclides found above proposed standards in several wells include americium-241; curium-243 and -244; radium-226 and -228; strontium-90; total alpha-emitting radium; and uranium-233, -234, -235, and -238. Cesium-137, curium-245 and -246, and plutonium-238 were also found (Arnett and Mamatey 1996).

Near the F-Area Tank Farm, cadmium, gross alpha, lead, mercury, nitrate-nitrite as nitrogen, and tritium were detected above drinking water standards in one or more wells. The pH exceeded the basic standard, and trichlorofluoromethane (Freon 11), which has no drinking water standard, was present in elevated levels (Arnett and Mamatey 1996).

At the F-Area Sanitary Sludge Land Application Site, tritium, specific conductance, lead, and copper were found to exceed their drinking water standards in one or more wells (Arnett and Mamatey 1996). Groundwater near the F-Area Acid/Caustic Basin consistently exceeded drinking water standards for gross alpha. Alkalinity, gross beta, nitrate as nitrogen, pH, and total alpha-emitting radium were above their respective standards in one or more wells (Arnett and Mamatey 1996). The groundwater near the F-Area Coal Pile Runoff Containment Basin did not exceed any chemical or radiological standard during 1995 (Arnett and Mamatey 1996).

4.4.3.3 Potential Sources of Groundwater Contamination

[Text Deleted]

At SRS, groundwater monitoring for radioactive constituents began in the 1950s, while monitoring for nonradioactive constituents began in 1974. The SRS environmental monitoring R1 program now encompasses more than 100 locations, including waste disposal sites, chemical storage areas, tanks, sewers, spill areas, buildings, and proposed construction areas (Noah 1995).

Groundwater beneath an estimated 5% to 10% of SRS has been contaminated by industrial solvents, tritium, metals, or other constituents used or generated by operations. Groundwater in these areas contains one or more of these constituents at or above primary drinking water standards (Noah 1995). In most instances, the contamination is confined to the uppermost aquifer system (water table). R1

The groundwater in the Upper Three Runs aquifer beneath the MFFF site is contaminated with various heavy industrial and nuclear contaminants. Groundwater contamination is present beneath the entire MFFF site, but is most pronounced beneath the western edge of the site. The sources of groundwater contamination under the site are related to the OFASB and upgradient sources inside the F Area. R1

The 2000 RCRA Part B Permit Renewal Application, Volume VII, Mixed Waste Management Facility (MWMF) at SRS (WSRC 2000a) provides a comprehensive description of groundwater contamination plumes in F Area. Also, the RCRA Facility Investigation/Remedial Investigation Report for the Old F-Area Seepage Basin (OFASB; WSRC 1995) defines the soil and groundwater contamination from past disposal practices into the seepage basin.

The OFASB is located just northwest of the MFFF site. The contaminated soil zone at the OFASB was remediated in 2000. A mixing zone agreement was implemented to manage groundwater associated with the OFASB. Under the terms of the mixing zone agreement, SRS monitors a network of groundwater wells at OFASB (see Figure 4-12). Recently, three wells (FNB-13, FNB-14, and FNB-15) at the OFASB compliance boundary have exceeded allowable standards for one nonradioactive constituent (nitrate) and several radioactive constituents (tritium, iodine-129, and strontium-90). SRS is investigating whether these exceedances are related to OFASB or to another source(s) in F Area. (WSRC 2001).

Water elevation data and computer modeling indicate that shallow groundwater flows away from the OFASB in a north-northwesterly direction, and is captured by a tributary of Upper Three Runs. A small component of this groundwater flows beneath the westernmost corner of the MFFF site (see Figure 4-12). Depth to groundwater in the area near the OFASB and the MFFF site ranges from 76 to 93 ft (23.2 to 28.3 m) (below present ground surface). MFFF site preparation will involve shallow grading and excavation, only 40 ft (12.2 m) deep. These activities are not expected to encounter groundwater. R1

Recent comprehensive geotechnical investigations were conducted during the summer of 2000 at the MFFF site. Radiological testing was performed for drill cuttings and all samples. During this program, no radioactive contamination was encountered at the MFFF site.

As a consequence of the exceedances in wells FNB-13, FNB-14, and FNB-15 noted above, DCS performed a groundwater survey on the MFFF site before beginning additional geotechnical work. The results of that sampling confirm the absence of groundwater above the Tan Clay confining zone. Groundwater beneath the Tan Clay confining zone is contaminated from upgradient sources, and not solely from the OFASB. Concentrations of gross alpha and beta activity, tritium, uranium, and trichloroethyene exceeded maximum contaminant limits for drinking water. The source of groundwater contamination is from various heavy industrial and nuclear operations over the past 50 years in the F-Area. The contaminants appear to originate inside F Area and extend beneath the MFFF site with movement in a fan-like direction of groundwater flow under the MFFF site. Contamination is most pronounced under the western edge of the site. Contamination was confined to the groundwater below the Tan Clay confining zone of the Dry Branch Formation (WSRC 2002). The deepest MFFF construction activities are anticipated to occur at least 30 ft (9.1 m) above the zone of contamination.

4.4.3.4 Potential Changes in Baseline Hydrology as a Result of Recent Activities

At SRS, the Atlantic Coastal Plain sediments are divided into two major aquifer systems (Floridan and Dublin-Midville) and two confining systems (Appleton and Meyers Branch). These systems are subdivided further into additional aquifer and confining units. The Dublin-Midville aquifer system is known to sustain single-well yields of 2.7 million gal/day (10.2 million L/day). This system is being utilized well below its capacity.

At SRS, most groundwater production is from the Dublin-Midville aquifer system (i.e., about 9 to 12 million gal/day [34 to 45 million L/day]), with a few lower-capacity wells pumping from the Floridan aquifer system, the uppermost aquifer system. Every major operating area at SRS has groundwater production wells.

SRS uses groundwater as a main water supply source because of (1) the convenience afforded by the availability of a prolific source, (2) the transmissivity of the Dublin-Midville aquifer system, and (3) the high quality of the water. Groundwater withdrawals are used primarily for process water, while other uses include domestic water and fire protection. Further withdrawals could potentially impact the productivity and stability of the aquifer system.

4.5 METEOROLOGY AND AIR QUALITY

This section describes the meteorology and air quality in the locale of the MFFF. The local meteorology is characterized in Section 4.5.1 in terms of temperature, precipitation, humidity, wind patterns, atmospheric transport and dispersion climatology, and storm characteristics. The sources of the meteorological data are also provided in Section 4.5.1. Existing levels of air pollution and the local air quality are discussed in Section 4.5.2. Lastly, the impact of local terrain and large bodies of water on meteorological conditions is discussed in Section 4.5.3.

4.5.1 Onsite Meteorological Conditions

The climate in the region around and the area near the MFFF is summarized and discussed in the following sections.

4.5.1.1 Data Sources

The description of the regional climatology of SRS is based on *Climatography of the United States No. 60, Climate of South Carolina* published by the National Climatic Data Center (DOC 1977) and the discussion in Section 1.4.1 of the SRS GSAR (WSRC 1999a). It is also based on long-term meteorological data collected by the National Weather Service at Bush Field in Augusta, Georgia, as summarized by the National Climatic Data Center (DOC 1999a). Bush Field is located approximately 12 mi (19.3 km) northwest of SRS. Normals, means, and extremes of temperature, precipitation, and wind speed are taken from DOC (1999a). Data on tornado occurrences and hurricanes are derived from Grazulis (1993) and the SRS GSAR (WSRC 1999a).

4.5.1.2 General Climate

The general climate was described in Section 3.5.1.1 of the SPD EIS (DOE 1999c) and has been modified and updated.

The SRS region has a temperate climate with short, mild winters and long, humid summers. Throughout the year, the climate is frequently affected by warm, moist maritime air masses. Summer weather usually lasts from May through September, when the area is subject to the influence of the western extension of the semi-permanent Atlantic subtropical anticyclone, or the "Bermuda high" pressure system. As a result, winds are generally light and weather associated with low-pressure systems and fronts usually remain well to the north of the area. Because the Bermuda high is a persistent feature, there are few breaks in the summer heat. High temperatures during the summer months are greater than 90°F (32.2°C) on more than half of all days (DOC 1999a). The relatively high heat and humidity often result in scattered afternoon and evening thunderstorms.

The influence of the Bermuda high begins to diminish during the fall, resulting in drier weather and temperatures that are more moderate. During the month of October, a semi-permanent Appalachian anticyclone results in mild dry weather. Average rainfall for the fall months is lower than average for the other months of the year. Frequently, fall days are characterized by cool, clear mornings and warm, sunny afternoons. Average daily temperatures in the fall range from a high of 76°F (24.4°C) to a low of 50°F (10°C). During the winter, migratory low-pressure systems and associated fronts influence the weather of SRS. Conditions frequently alternate between warm, moist, subtropical air from the Gulf of Mexico region and cool, dry, polar air. Occasionally, an arctic air mass will influence the area; however, the Appalachian Mountains to the north and northwest of SRS moderate the cold temperatures associated with the polar or arctic air. Consequently, less than one-third of the winter days have minimum temperatures below freezing, and temperatures below 20°F (-6.7°C) are infrequent.

Spring is characterized by a higher frequency of occurrence of tornadoes and severe thunderstorms than the other seasons of the year. This weather is often associated with the passage of cold fronts. Although weather during the spring is variable and relatively windy, temperatures are usually mild.

The average annual temperature at SRS is 63.2°F (17.3°C). A second data set from SRS yields an annual average temperature of 64.7°F (18.2°C) (WSRC 2000c). Temperatures vary from an average daily minimum of 32°F (0°C) in January to an average daily maximum of 91.7°F (33.2°C) in July. Long-term monthly and annual temperature data for Bush Field in Augusta, Georgia are summarized in Table 4-4. The average annual precipitation at SRS is about 45 in (114 cm). Data from 1967 to 1996 at SRS show an annual average precipitation of 49.5 in (126 cm). Precipitation is distributed fairly evenly throughout the year, with the highest in summer and the lowest in autumn. The summer precipitation amounts are mainly due to afternoon thunderstorms or the influence of tropical storms. Long-term monthly and annual precipitation data for Bush Field are summarized in Table 4-5.

On an annual average basis, relative humidities at Bush Field range from a high of 83% in the early morning hours to 51% in the afternoon. Comparable August values at SRS are 97% in the early morning hours to 50% in the afternoon. On a seasonal basis, the highest relative humidities occur in late summer during the months of August and September while spring (i.e., March and April) relative humidities are generally the lowest. The highest early morning relative humidity in August and September is 91% while the lowest afternoon values are 55% and 56% for August and September, respectively. In April, the early morning relative humidity averages 85% and the afternoon value is 45%.

A better measure of atmospheric moisture is the dew point temperature, which indicates the actual amount of moisture in the air because it is the temperature at which saturation occurs. Monthly average dew point temperatures in this area range from a high of approximately 69°F (20.6°C) in July and August to lows of approximately 34°F (1.1°C) in January. Heavy fog with visibility below 0.25 mi (0.4 km) occurs at Bush Field with an average annual frequency of 31.6 days per year.

Based on a short record of measurements from the SRS Central Climatology Station (i.e., 1995 to 1996), the annual average absolute humidity is 11.1 g/m^3, ranging from 18.4 g/m^3 in July to 6.0 g/m^3 in December and January (WSRC 2000c).

The mixing height is the level of the atmosphere below which pollutants are easily mixed; it is often used to approximate the base of an elevated inversion. Estimates of seasonally averaged morning mixing heights for SRS were interpolated from data presented in *Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution Throughout the Contiguous United States* (Holzworth 1972) and are presented in Table 4-6. The Holzworth data[1] are derived from radiosonde observations during the five-year period 1960 to 1964.

[1] Although the source of data is for a 40-year old period, this is the only available data source supplying this type of information and the age of the data should not be relevant to seasonally averaged mixing heights.

4.5.1.3 Wind Patterns and Dispersion Climatology

Winds in the SRS region are generally light to moderate with the highest speeds occurring during spring with an average of approximately 7 mph (11.3 km/hr) for those months at Bush Field. The lightest winds occur in the summer and fall with the lowest monthly average wind speed of 5.1 mph (8.2 km/hr) occurring in August. The highest monthly wind speed of 7.7 mph (12.4 km/hr) occurs in March, and the long-term mean wind speed for the year is 6.2 mph (10 km/hr) at Bush Field. The prevailing wind direction at Augusta is generally from the northwest during the winter months, from the southeast during the late spring and early autumn, and from the southwest in the summer. There is no overall prevailing wind direction because it is variable throughout the year.

The highest observed 1-minute wind speed at Augusta is 62 mph (100 km/hr) from the east (June 1965) based on 42 years of observations, while the peak gust is 60 mph (96.5 km/hr) from the northwest (June 1988) based on 10 years of observations. The peak gust should be higher than the fastest mile wind speed due to its shorter duration, but in this case, the difference in the period of record (42 years vs. 10 years) results in a smaller peak gust. Higher localized wind speeds have occurred during storms (see Section 4.5.1.4).

A meteorological database for the 5-year period 1992 to 1996 is currently used for safety analysis at SRS. An averaged wind rose plot for the H-Area tower for this period of record is shown in Figure 4-13. As indicated by this plot, there is no strong prevailing wind direction at the site. | R1
Northeasterly winds occurred approximately 10% of the time (mostly during late summer, fall, and early winter), and west to southwest winds occurred about 8% of the time (mostly late winter, spring, and early summer). Annual average wind speeds ranged from 9.4 to 8.0 mph (15.1 to 12.9 km/hr).

The relative ability of the atmosphere to disperse air pollutants is commonly characterized in terms of Pasquill stability class. The Pasquill stability classes range from class A (very unstable conditions characterized by considerable turbulence producing rapid dispersion) to class G (extremely stable conditions with little turbulence and very weak dispersion). The percent occurrence of Pasquill stability class for each of the eight SRS area towers is summarized in Table 4-7. Stable conditions were observed between 20% and 30% of the time during the five-year report.

A joint frequency distribution of wind speed, wind direction, and stability class for the 1992 to 1996 period of observations from the 200-ft (61.0-m) elevation of the SRS H-Area meteorological tower are presented in Table 4-8.

4.5.1.4 Storms

The SRS region occasionally experiences severe weather in the form of violent thunderstorms, tornadoes, and hurricanes. Although thunderstorms are common in the summer months, the more violent storms are commonly associated with squall lines and active cold fronts in the spring. Augusta averages 52.9 thunderstorm days per year with the highest number of days (9 to

12 days per month) occurring in June, July, and August (DOC 1999a). The occurrence of hail with thunderstorms is infrequent. Based on observations in a 1-degree square of latitude and longitude that includes SRS, hail occurs once every two years on the average (Pautz 1969).

A total of 17 "significant" tornadoes occurring in Aiken or Barnwell Counties in South Carolina or in Burke County, Georgia, have been documented (Grazulis 1993) for the period 1880 to 1995. This reference defines a "significant" tornado as one causing confirmable Fujita Scale classification F2 damage or one that has killed a person. The Fujita Scale classification system is explained in Table 4-9. In addition, there have been nine confirmed tornadoes passing through or close to SRS since operations began. A tornado that occurred on October 1, 1989, knocked down several thousand trees over a 16-mi (25.7-km) path across the southern and eastern portions of the site. Wind speeds produced by this F-2 tornado were estimated to be as high as 150 mph (241 km/hr). Four F-2 tornadoes struck forested areas of SRS on three separate days during March 1991 (Parker 1991). Considerable damage to trees was observed in the affected area. The other four confirmed tornadoes were classified as F-1 and produced relatively minor damage. None of the nine tornadoes caused damage to buildings. Tropical storms or hurricanes affect the state about every other year. A total of 36 hurricanes have caused damage in South Carolina between 1700 and 1989. Most hurricanes only affect the Outer Coastal Plain and rapidly decrease in intensity as they move inland. However, considerable flooding can occur from hurricanes that come far inland. The average frequency of occurrence of a hurricane in the state is once every eight years. However, the observed interval between hurricane occurrences has ranged from two months to 27 years. Approximately 80% have occurred in August and September when hurricane activity in the Atlantic Ocean reaches its maximum.

Because SRS is approximately 100 mi (161 km) inland, winds associated with tropical weather systems usually diminish below hurricane force (sustained speeds of 75 mph [120 km/hr] or greater). However, winds associated with Hurricane Gracie, which passed to the north of SRS on September 29, 1959, were measured as high as 75 mph (121 km/hr) on an anemometer located in F Area. No other hurricane force wind has been measured onsite. On September 22, 1989, the center of Hurricane Hugo passed about 100 mi (161 km) northeast of SRS. The maximum 15-minute average wind speed observed onsite during this hurricane was 38 mph (61 km/hr). The highest observed instantaneous wind speed was 62 mph (100 km/hr). The data were collected from the onsite tower network (measurements taken at 200 ft [60 m] above ground). Extreme rainfall and tornadoes, which frequently accompany tropical weather systems, usually have the most significant hurricane-related impact on SRS operations (Hunter 1990).

4.5.2 Existing Levels of Air Pollution

Existing air quality was discussed in Section 3.5.1.1.1 of the SPD EIS (DOE 1999c) and has been updated to reflect more recent data. Air pollution refers to any substance in the air that | R1
could harm human or animal populations, vegetation, or structures, or that unreasonably interferes with the comfortable enjoyment of life and property. Air pollutants are transported, dispersed, or concentrated by meteorological and topographical conditions. Air quality is affected by air pollutant emission characteristics, meteorology, and topography.

SRS is near the center of the Augusta-Aiken Interstate Air Quality Control Region #53. None of the areas within SRS and its surrounding counties are designated as non-attainment areas with respect to the National Ambient Air Quality Standards (NAAQS) for criteria air pollutants (40 CFR §81.311 and §81.341). Existing ambient concentrations are compared to applicable NAAQS and the ambient air quality standards for the states of South Carolina and Georgia in Table 4-10.

There are no prevention of significant deterioration (PSD) Class I areas within 62 mi (100 km) of SRS. None of the facilities at SRS have been required to obtain a PSD permit (DOE 1996b).

The primary emission sources of criteria air pollutants and/or air toxics at SRS are the nine coal-burning boilers and four fuel-oil-burning package boilers (when operating) that produce steam and electricity, diesel engine-powered equipment, the DWPF, groundwater air strippers, and various other process facilities. Other emissions and sources include fugitive particulates from coal piles and coal-processing facilities, vehicles, controlled burning of forestry areas, and temporary emissions from various construction-related activities (DOE 1996b).

Table 4-10 presents the ambient air concentrations attributable to sources at SRS. These concentrations are based on emissions for the year 1994 (DOE 1998a; DOE 1998b). Only those hazardous pollutants that would be emitted for the MFFF alternatives are presented. Additional information on ambient air quality at SRS is in the *SRS Environmental Report for 1999* (Arnett and Mamatey 2000a). Concentrations shown in Table 4-10 attributable to SRS are in compliance with applicable guidelines and regulations. Data for 2000 from nearby South Carolina monitors R1 at Beech Island, Jackson, and Barnwell indicate that the NAAQS for particulate matter, lead, ozone, sulfur dioxide, and nitrogen dioxide are not exceeded in the area around SRS (SCDHEC 2002). Air pollutant measurements at these monitoring locations during 2000 showed for nitrogen dioxide an annual average concentration of 9.4 μg/m^3; for sulfur dioxide, concentrations of 57 μg/m^3 for 3-hr averaging, 18 μg/m^3 for 24-hr averaging, and 5 μg/m^3 for the annual average; for total suspended particulates, an annual average concentration of 40 μg/m^3; and for particulate matter, concentrations of 62 μg/m^3 for 24-hr averaging and 19 μg/m^3 for the annual average. R1

4.5.3 Impact of Local Terrain and Large Bodies of Water on Meteorological Conditions

Local terrain in the form of hills, valleys, and large water bodies can have a significant impact on the meteorological conditions. In the vicinity of the facility, the terrain can be described as gently rolling, forested hills. In general, terrain elevations decrease gradually from the Appalachian foothills northwest of the site toward the Atlantic coastal plain to the southeast. The local SRS terrain elevations also generally decrease gradually toward the Savannah River, which runs along the southwestern boundary of the site. Site elevations range from 100 ft (30.5 m) to about 400 ft (122 m) above msl.

The closest pronounced topographic feature (e.g., hill, large lake) is approximately 20 mi (32.2 km) from the site; the local terrain has little effect on wind and stability climatology at

SRS. During stable atmospheric conditions, some channeling or airflow stagnation could occur in some of the more pronounced valleys. However, any terrain-induced increase in pollutant concentrations would be much localized and short-lived. SRS is too far from the Atlantic Ocean to experience any meaningful sea breeze activity.

4.6 ECOLOGY

Section 3.5.8 of the SPD EIS (DOE 1999c) discusses the ecological resources in the vicinity of the MFFF site. This discussion has been updated.

Ecological resources are defined as terrestrial (i.e., predominantly land) and aquatic (i.e., predominantly water) ecosystems characterized by the presence of native and naturalized plants and animals. For the purposes of this ER, those ecosystems are differentiated in terms of habitat support of threatened, endangered, and other special-status species (i.e., "nonsensitive" versus "sensitive" habitat).

4.6.1 Nonsensitive Habitat

Nonsensitive habitat comprises those terrestrial and aquatic areas of the site that typically support the region's major plant and animal species.

4.6.1.1 General Site Description

At least 90% of the SRS land cover is composed of upland pine and bottomland hardwood forests (DOE 1997a). Five major plant communities have been identified at SRS: bottomland hardwood (most commonly sweetgum and yellow poplar); upland hardwood-scrub oak (predominantly oaks and hickories); pine/hardwood; loblolly, longleaf, and slash pine; and swamp. The loblolly, longleaf, and slash pine community covers about 65% of the upland areas of SRS. Swamp forests and bottomland hardwood forests occur along the Savannah River and the numerous streams found on SRS.

The biodiversity of the region is extensive due to the variety of plant communities and the mild climate. Animal species known to inhabit SRS include 44 species of amphibians, 255 species of birds, 54 species of mammals, and 59 species of reptiles. Common species include the eastern box turtle, Carolina chickadee, common crow, eastern cottontail, and gray fox (DOE 1996b; WSRC 1997a). Game animals include a number of species, two of which, the white-tailed deer and feral hogs, are hunted onsite (DOE 1996b). Raptors, such as the Cooper's hawk and black vulture, and carnivores, such as the raccoon, are ecologically important groups at SRS (DOE 1996b).

Aquatic habitat within SRS includes manmade ponds, Carolina bays, reservoirs, and the Savannah River and its tributaries.

There are more than 50 manmade impoundments throughout the SRS site that support populations of bass and sunfish. Carolina bays, a type of wetland unique to the southeastern

United States, are natural shallow depressions that occur in interstream areas. These bays can range from lakes to shallow marshes, herbaceous bogs, shrub bogs, or swamp forests. Among the 299 Carolina bays found throughout SRS, fewer than 20 have permanent fish populations. Redfin pickerel, mud sunfish, lake chubsucker, and mosquito fish are present in these bays.

Although sport and commercial fishing is only permitted on portions of SRS (Crackerneck Wildlife Management Area), the Savannah River is used extensively for both. Important commercial species are the American shad, hickory shad, and striped bass, all of which are anadromous. The most important warm-water game fish are bass, pickerel, crappie, bream, and catfish (DOE 1996b; WSRC 1997a).

4.6.1.2 Proposed Facility Location

F Area is situated on an upland plateau between the drainage areas of Upper Three Runs and Fourmile Branch. This heavily industrialized area is dominated by buildings, paved parking lots, graveled construction areas, and lay down yards (Figure 4-14); little natural vegetation remains inside the fenced areas. Grassed areas occur around the administration buildings, and some vegetation is present along drainage ditches, but most of the developed areas have no vegetation (DOE 1994a; 1995a). The most common plant communities in the vicinity of F Area include loblolly, longleaf, and slash pine; upland hardwood-scrub oak; pine/hardwood; and bottomland hardwood (DOE 1995b; DOE 1996b). Cleared fields are also common in F Area, and a roughly 15-ac (6.1-ha) oak-hickory forest area designated as a National Environmental Research Park set aside is northwest of F Area (DOE 1996b). The MFFF site is composed primarily (68%) of mixed evergreen and evergreen forest in its undeveloped areas (Figure 4-14) (DOE 1995b). R1

A recent (1994 to 1997) study was conducted to document the composition and diversity of urban wildlife, those species of amphibians, birds, mammals, and reptiles that inhabit or temporarily use the developed areas on SRS. Results indicate that the use of the developed areas by wildlife species is more common than has been previously reported (Mayer and Wike 1997). A total of 41 wildlife species were observed in and around F Area, including 18 species of birds, 11 species of mammals, and 12 species of reptiles.

Bird species commonly seen include the bufflehead, turkey vulture, black vulture, killdeer, rock dove, mourning dove, chimney swift, great crested flycatcher, barn swallow, common crow, fish crow, northern mockingbird, American robin, European starling, and common grackle. Frequently sighted mammals include the Virginia opossum, eastern cottontail, house mouse, feral cat, striped skunk, and raccoon. The only reptile commonly observed is the banded water snake (Mayer and Wike 1997).

Upper Three Runs and its tributaries and three Carolina bays constitute the aquatic habitat in the vicinity of F Area. Streams support largemouth bass, black crappie, and various species of pan fish. Upper Three Runs has a rich fauna; more than 551 species of aquatic insects have been collected (DOE 1996b; WSRC 1997a). It is important as a spawning area for blueback herring, and as a seasonal nursery habitat for American shad, striped bass, and other Savannah River species. Aquatic resources information on the three Carolina bays is unavailable (DOE 1996b).

4.6.2 Sensitive Habitat

Sensitive habitat comprises those terrestrial and aquatic (including wetlands) areas of the site that support threatened and endangered, state-protected, and other special-status plant and animal species.

4.6.2.1 General Site Description

SRS wetlands, most of which are associated with floodplains, streams, and impoundments, include bottomland hardwood, cypress-tupelo, scrub-shrub, and emergent vegetation, as well as open water. Swamp forest along the Savannah River is the most extensive wetlands vegetation type (DOE 1996b).

Sixty-one threatened, endangered, and other special-status species listed by the federal government or the state of South Carolina may be found in the vicinity of SRS. Table 4-11 identifies those potentially occurring in the vicinity of F Area. No critical habitat for threatened or endangered species exists on SRS (DOE 1996b).

4.6.2.2 Proposed Facility Location

Figures 4-14 and 4-15 identify the land cover characteristics and show the location of wetlands in the general vicinity of F Area. No wetlands are located in the MFFF and WPB site areas (refer to Figure 4-3 for WSB location). R1

No federally listed threatened or endangered species are known to occur in F Area. The American alligator, although listed as threatened (by virtue of similarity in appearance to the endangered crocodile) is fairly abundant on SRS. It was recently observed near F Area, but its occurrence there is seen as uncommon. Furthermore, no state-listed protected species have been found in any developed area on SRS, and of the state-listed organisms known to occur, none would be expected to use any of the disturbed areas for extended periods (Mayer and Wike 1997).

The Pen Branch area, about 8.7 mi (14 km) southwest of the proposed sites, and an area south of Par Pond, about 7.5 mi (12 km) to the southeast, support active bald eagle nests. Wood storks have been observed about 13 mi (21 km) from the proposed site, near the Fourmile Branch delta. The closest colony of red-cockaded woodpeckers is about 3.1 mi (5 km) away, but suitable forage habitat exists on the proposed sites. The smooth purple coneflower, the only endangered plant species found on SRS, could be found on the proposed sites (DOE 1996b). Botanical surveys conducted by the Savannah River Forest Station in 1992 and 1994 identified three populations of Oconee azalea in the area northwest of F Area. This state-listed rare plant species was found on the steep slopes adjacent to the Upper Three Runs floodplain (DOE 1995b).

Surveys conducted in 1998 and 2000 in the area north of F Area and east of Upper Three Runs did not find any federally listed threatened, endangered, proposed, or sensitive plant or animal species (DOA 2000). Of the listed species, appropriate habitat was found only for the red-cockaded woodpecker, although there were no sightings during the survey. Appropriate habitat is lacking in the survey area for the bald eagle, wood stork, American alligator, and shortnosed sturgeon.

4.7 NOISE

Noise is unwanted sound that interferes or interacts negatively with the human or natural environment. Noise may disrupt normal activities or diminish the quality of the environment. The existing sources of noise were described in Section 3.5.1.2 of the SPD EIS (DOE 1999c).

4.7.1 General Site Description

Major noise sources at SRS are primarily in developed or active areas and include various industrial facilities, equipment, and machines (e.g., cooling systems, transformers, engines, pumps, boilers, steam vents, paging systems, construction and materials-handling equipment, and vehicles). Major noise emission sources outside of these active areas consist primarily of vehicles and rail operations. Existing SRS-related noise sources of importance to the public are those related to transportation of people and materials to and from the site, including trucks, private vehicles, helicopters, and trains (DOE 1996b).

Another important contributor to noise levels is traffic to and from SRS operations along access highways through the nearby towns of New Ellenton, Jackson, and Aiken. Noise measurements recorded during 1989 and 1990 along South Carolina Highway 125 in the town of Jackson at a point about 50 ft (15 m) from the roadway indicate that the 1-hr equivalent sound level from traffic ranged from 48 to 72 dBA. The estimated day-night average sound levels along this route were 66 dBA for summer and 69 dBA for winter. Similarly, noise measurements along South Carolina Highway 19 in the town of New Ellenton at a point about 50 ft (15 m) from the roadway indicate that the 1-hr equivalent sound level from traffic ranged from 53 to 71 dBA. The estimated average day-night average sound levels along this route were 68 dBA for summer and 67 dBA for winter (NUS 1990).

Most industrial facilities at SRS are far enough from the site boundary that noise levels from these sources at the boundary would not be measurable or would be barely distinguishable from background levels.

The states of Georgia and South Carolina, and the counties in which SRS is located, have not established any noise regulations that specify acceptable community noise levels, with the exception of a provision in the Aiken County Zoning and Development Standards Ordinance that limits daytime and nighttime noise by frequency band (DOE 1996b).

The EPA guidelines for environmental noise protection recommend an average day-night average sound level of 55 dBA as sufficient to protect the public from the effects of broadband environmental noise in typically quiet outdoor and residential areas (EPA 1974). Land-use compatibility guidelines adopted by the Federal Aviation Administration and the Federal Interagency Committee on Urban Noise indicate that yearly day-night average sound levels less than 65 dBA are compatible with residential land uses and levels up to 75 dBA are compatible with residential uses if suitable noise reduction features are incorporated into structures (14 CFR Part 150). It is expected that for most residences near SRS, the day-night average sound level is less than 65 dBA and is compatible with the residential land use, although for some residences along major roadways noise levels may be higher.

4.7.2 Proposed Facility Location

No distinguishing noise characteristics at F Area have been identified. F Area is far enough (5.8 mi [9.3 km]) from the site boundary that noise levels from the facilities are not measurable or are barely distinguishable from background levels.

4.8 REGIONAL HISTORIC, SCENIC, AND CULTURAL RESOURCES

Field studies conducted over the past two decades by the South Carolina Institute of Archaeology and Anthropology of the University of South Carolina have provided considerable information about the distribution and content of cultural resources at SRS. About 60% of SRS has been surveyed, and 858 historic and prehistoric archaeological sites have been identified. Although final eligibility determinations have not yet been made on a majority of the sites, 67 are considered potentially eligible for listing on the National Register of Historic Places (DOE 1999c).

Cultural resources at SRS are managed under the terms of a Programmatic Memorandum of Agreement (PMOA) executed between DOE-SR, the South Carolina State Historic Preservation Officer, and the Advisory Council on Historic Preservation, on August 24, 1990. Guidance on the management of cultural resources at SRS is included in the *Archaeological Resource Management Plan of the Savannah River Archaeological Research Program* (SRARP 1989).

Historic, prehistoric, visual, and Native American resources are discussed in Sections 4.8.1 through 4.8.4, respectively.

4.8.1 Historic Resources

About 400 historic sites or sites with historic components have been identified within SRS property. None of the identified historic sites fall within the location of the proposed MFFF facility.

4.8.2 Prehistoric Resources

Prehistoric sites at SRS consist of the remains of villages, base camps, limited-activity sites, quarries, and workshops. An extensive archaeological survey program, begun at SRS in 1974, includes numerous field studies that include reconnaissance surveys, shovel testing, and intensive site testing and excavation. There is prehistoric evidence in more than 800 sites, some of which fall in the vicinity of the proposed facility. Fewer than 8% of the 800 sites have been evaluated for National Register eligibility (DOE 1999c); many of the sites are away from development and are in little danger of serious loss.

Archaeological surveys of F Area in the vicinity of the proposed MFFF site identified four prehistoric sites (38AK330, 38AK548, 38AK546/547, and 38AK757) that could be affected by construction of the proposed facilities[2]. Sites 38AK330, 38AK548, and 38AK546/547 were identified during 1993 to 1994 surveys. Site 38AK757 was identified during surveys conducted between December 11, 1998, and February 9, 2000, and also in mid-November 1999. Of these sites, 38AK546/547 and 38AK757 have been found eligible for listing in the National Register of Historic Places under Criterion D[3] (Green 2000). The State Historic Preservation Office also concurred with the finding that sites 38AK330 and 38AK548 were not eligible and that no further work was required concerning those two sites (Green 2000). Mitigation activities R1 associated with the archaeological site that is located on the MFFF site commenced in December 2001. All field activities associated with mitigating site 38AK546/547 were completed in April R1 2002. Mitigation of Site 38AK757 should be complete by August 2002.

4.8.3 Visual Resources

Visual resources at SRS were discussed in Section 3.5.10.2 of the SPD EIS (DOE 1999c).

The dominant viewshed in the vicinity of SRS consists mainly of agricultural land and forest, with some limited residential and industrial areas. The SRS landscape is characterized by wetlands and upland hills. Vegetation is composed of bottomland hardwood forests, scrub oak and pine woodlands, and wetland forests. DOE facilities are scattered throughout SRS and are brightly lit at night. These facilities are generally not visible offsite because views are limited by rolling terrain, frequent hazy atmospheric conditions, and heavy forests and vegetation. The only areas visually impacted by the DOE facilities are those within the view corridors of South Carolina Highway 125 and SRS Road 1.

The developed areas and utility corridors (i.e., transmission lines and aboveground pipelines) of SRS are consistent with a Visual Resources Management (VRM) Class IV designation. The remainder of SRS is consistent with VRM Class III or IV (DOE 1996b; DOI 1986a, 1986b).

Industrial facilities within F Area consist of large concrete structures, smaller administrative and support buildings, and parking lots (DOE 1994a). The structures range in height from 10 to 100

---

[2]Although the SPD EIS ROD (DOE 2000b) identified five sites that were potentially affected by MFFF construction, subsequent shifting of the facility site left one site outside the potential impact area.

[3]Criterion D – "Property has yielded, or is likely to yield, information important in prehistory or history." (DOI 1991).

ft (3 to 30 m), with a few stacks and towers that reach 200 ft (61 m). The facilities in this area are brightly lit at night and visible when approached via SRS access roads. Visual resource conditions in F Area are consistent with VRM Class IV (DOI 1986a, 1986b; Sessions 1997a). F Area is about 4.3 mi (7 km) from South Carolina Highway 125 and 5.3 mi (8.5 km) from SRS Road 1. Public view of F-Area facilities is restricted by heavily wooded areas bordering segments of the SRS Road 1 system and site-crossing South Carolina Highway 125. Moreover, those facilities are not visible from the Savannah River, which is about 6.2 mi (10 km) to the west.

4.8.4 Native American Resources

Less than 1% of the population of counties within a 10-mi (16-km) radius of the proposed MFFF site are of American Indian decent. Native American groups with traditional ties to the area include the Apalachee, Cherokee, Chickasaw, Creek, Shawnee, Westo, and Yuchi. At different times, each of these groups was encouraged by the English to settle in the area to provide protection from the French, Spanish, or other Native American groups. Main villages of both the Cherokee and Creek were located southwest and northwest of SRS, respectively, but both groups may have used the area for hunting and gathering activities. During the early 1800s, most of the remaining Native Americans residing in the region were relocated to the Oklahoma Territory (DOE 1999c).

Native American resources in the region include remains of villages or town sites, ceremonial lodges, burials, cemeteries, and natural areas containing traditional plants used in religious ceremonies. Literature reviews and consultations with Native American representatives have revealed concerns related to the American Indian Religious Freedom Act within the central Savannah River valley, including some sensitive Native American resources and several plants traditionally used in ceremonies.

In 1991, DOE conducted a survey of Native American concerns about religious rights in the central Savannah River valley. During this study, three Native American groups, the Yuchi Tribal Organization, the National Council of Muskogee Creek, and the Indian People's Muskogee Tribal Town Confederacy, expressed continuing interest in the SRS region with regard to the practice of their traditional religious beliefs. The Yuchi Tribal Organization and the National Council of Muskogee Creek have expressed concerns that several plant species (e.g., redroot [*Lachnanthese carolinianum*], button snakeroot [*Erynglum yuccifolium*], and American ginseng [*Panax quinquefolium*]) traditionally used in tribal ceremonies could exist on SRS. Redroot and button snakeroot are known to occur on SRS but are typically found in wet, sandy areas such as evergreen shrub bogs and savannas. Neither species is likely to be found in F Area due to clearing prior to the establishment of SRS in the 1950s (DOE 1994a). Consultations were initiated with appropriate Native American groups to determine any concerns associated with the actions evaluated in the SPD EIS (DOE 1999c).

4.9 REGIONAL DEMOGRAPHY

A demographic evaluation was conducted to identify population distribution and anticipated growth within a 50-mi (80-km) radius of the proposed MFFF site. The analysis also reviewed detailed characteristics of the population within a more local, 10-mi (16-km) radius. All land within a 5-mi (8-km) radius of the MFFF is within SRS and contains no residential population.

4.9.1 Permanent Population

A total of about 621,527 people resided within 50 mi (80 km) of the MFFF site in 1990. That population is projected to grow by about 92% to a total of 1,042,483 by the year 2030. Table R1
4-12 through 4-16 present population distribution for 1990, 2000, 2010, 2020, and 2030, respectively. The 1990 numbers are based on 1990 U.S. Census counts, while years 2000 through 2030 are projections compiled for the SRS GSAR (WSRC 1999a) and are based on growth projections provided by the University of Georgia (WSRC 1993). The population growth projected by the GSAR was compared to actual population growth as determined by the 2000 census. The GSAR predicted a 14% increase in population within 50 mi (80 km) of the MFFF for the year 2000. Checking against actual increases from the 2000 census DCS determined that the county populations within 50 mi (80 km) actually increased by 16%. Therefore the GSAR R1
underestimated population increase by 2%. Calculation of the population dose for the offsite public used the projected population for 2030. Operation of the MFFF is expected to end in 2027 based on a 20-year license and startup in 2007. Use of a population distribution projected for a time later than the end of operational life ensures conservative dose calculations and provides a buffer for underestimates of population growth or if the start of the project is delayed.

The analysis included spatial distribution of the population based on a circular grid comprised of 22 ½ degree sectors centered on the 16 cardinal compass point directions and six radial distances of 0 to 5, 5 to 10, 10 to 20, 20 to 30, 30 to 40, and 40 to 50 miles (0 to 8, 8 to 16, 16 to 32.2, 32.2 to 48.3, 48.3 to 64.4, and 64.4 to 80 km). Since all land within a 5-mi (8-km) radius of the MFFF site is within SRS and contains no residential population, the usual 1 mi (1.6 km) increment analysis for the area within 5 mi (8 km) of the site is not shown.

Of the combined population of counties that are partially or entirely within the 50-mi (80-km) radius of the MFFF, about 48% is male and 52% is female. Racially, the population is predominantly white, with 34% black and about 1% Asian or Pacific Islander. Less than 0.1% of the population is of Hispanic decent (DOC 1998a, 1998b).

The area within 50 mi (80 km) includes all, or portions of, two major metropolitan areas where large concentrations of population may be found. The Augusta-Aiken Metropolitan Statistical Area[4] (MSA), which includes Columbia, Richmond, and McDuffie Counties in Georgia, and Edgefield and Aiken Counties in South Carolina, is anchored by the city of Augusta, which is over 20 mi (32.2 km) west-northwest of the site. The Augusta MSA contained 415,220 people in 1990, and an estimated 458,271 people in 1998, primarily in the cities of Augusta, Aiken, and North Augusta (DOC 1999b). The closest boundary of the Columbia City MSA, which includes Lexington and Richland Counties (South Carolina), is located over 30 mi (48.3 km) northeast of the MFFF site: Columbia City, the core of this MSA, is located outside of the 50-mi (80-km) radius. The Columbia City MSA contained 453,932 people in 1990 and an estimated 512,316 people in 1998 (DOC 1999c). Greater than 50% of the population in the Columbia City MSA live over 50 mi (80 km) from the MFFF site.

The local area within a 10-mi (16-km) radius around the MFFF site is comprised of portions of three counties, Aiken and Barnwell, South Carolina, and Burke County, Georgia. The MFFF is located on SRS in Aiken County. Only SRS facilities, and no residential population, are located within 5 mi (8 km) of the proposed site.

The area between 5 and 10 mi (8 and 16 km) from the MFFF site contained about 6,500 people in 1990 (WSRC 1999a). That population is projected to grow to a total of approximately 12,000 by the year 2040 (WSRC 1999a). A majority of this local population resides to the north and northwest of the site in the towns of New Ellenton and Jackson, which contained estimated populations of 7,197 and 2,843 people in 1998, respectively (DOC 2000a). Existing and projected population between 5 and 10 mi (8 and 16 km) of the MFFF site are included in Tables 4-12 through 4-16.

As shown in Table 4-17, the racial and ethnic mix of the local counties' populations, as well as the states of South Carolina and Georgia, is predominantly white or black. Less than 2% of the population is comprised of individuals of Hispanic, Native American, or other non-white or black racial or ethnic background.

The U.S. Census Bureau estimated that 1,765 people resided in group quarters[5] in Aiken County, 297 in Barnwell County, and 216 in Burke County in 1997 (DOC 1998b). The only residential institutions classified as "group quarters" within 10 mi (16 km) of the site are three residential care facilities located in New Ellenton: the New Ellenton Nursing Center (26 beds), Coleman's Residential Care (10 beds), and Parker's Residential Care Home (nine beds) (SCDHEC 1999b).

[4] The U.S. Census Bureau defines a Metropolitan Statistical Area (MSA) as a large population nucleus, together with adjacent communities that have a high degree of economic and social integration with that nucleus. Each MSA contains one or more central counties containing the area's main population concentration, an urbanized area with at least 50,000 inhabitants. An MSA may also include outlying counties that have close economic and social relationships with the central counties.

[5] Group quarters include prisons, nursing homes, psychiatric hospitals, juvenile institutions, college dormitories, military quarters, and homeless shelters.

The closest of these three facilities, Parker's Residential Care Home on Pine View Drive, is over 6 mi (9.6 km) northwest of the proposed MFFF site.

A minimal number of facilities, mostly schools, containing transient populations are located within the 10-mi (16-km) area surrounding the proposed MFFF site. Five public schools are located within the area to the northwest and west, with the closest being over 6 mi (9.6 km) away from the site. Table 4-18 lists local public schools within 10 mi (16 km) of the MFFF site and recent enrollments (1998 to 1999). The students in these schools are assumed to be part of the resident population within 50 mi (80 km) of the MFFF.

4.9.2 Transient Population

The proposed MFFF site is located in F Area of SRS. There are no facilities or population within 5 mi (8 km) of the MFFF site that are not part of the SRS complex. In December 1998, the total onsite employment at SRS during the day shift of a weekday was 14,177, including 12,622 WSRC employees; 520 DOE employees; and 742 Wackenhut Services Inc. (WSI) employees (the balance included United States Forest Service, Savannah River Ecology Lab, and other contractors to DOE-SR). The population of workers at SRS has decreased to approximately 13,590 in 2002, including 12,051 employed by WSRC (M&O Contractor); 823 employed by WSI; 459 employees under DOE-SR; and 257 other SRS contract employees (Bozzone 2002). R1
Table 4-19 identifies the distribution of SRS employees by county of residence within the region of influence (ROI).

The local area surrounding the proposed facility is not a destination for tourism. As a result, seasonal variations in population resulting from tourist activities are negligible.

4.10 SOCIOECONOMIC CHARACTERISTICS AND COMMUNITY SERVICES

4.10.1 Local Socioeconomic Characteristics

As of April, 2002, SRS employed approximately 13,590 persons. As shown in Table 4-19, R1
approximately 90% of that workforce resides within five counties: Aiken, Barnwell, and Edgefield, South Carolina, and Columbia and Richmond, Georgia. This information was used to determine the residential preference of people currently employed at SRS and to estimate where new workers might reside if they must relocate into the area. The five-county area is referred to as the ROI.

As shown on Table 4-20, over 20% of the population of a majority of the counties in the 50-mi (80-km) region (i.e., 14 out of 21) had income levels below the federal poverty threshold; only Aiken and Lexington Counties in South Carolina, and Columbia and Glascock Counties in Georgia had lower percentages of population below the poverty threshold than their respective state averages. Only Aiken and Lexington Counties exceeded state averages for per capita income in 1994 (DOC 1998a, 1998b).

Within the three counties that make up the local 10-mi (16-km) area, Burke County, Georgia, contains the least affluent population, with a 1990 per capita income of $11,172 and about 30.3% of its population living below the poverty level in 1989 (Table 4-21). In the same years, the per capita income for the state of Georgia was $17,123 with approximately 14.7% of its population living below the poverty level. Within South Carolina, Aiken County had per capita income and poverty levels superior to the state average, but Barnwell County was considerably below in income (i.e., about 20% below the state average) and contained a higher percentage of individuals below poverty level. As shown in the two right column of Table 4-21, while income levels have grown slightly since 1989, the percentage of the population with incomes below the poverty level in each of the three local counties has remained consistent (DOC 1998a). Unemployment in the local area ranged from a high of 16% in Burke County to a low of 7% in Aiken County in 1996 (DOC 1996). R1 R1

4.10.2 Regional Economic Characteristics

4.10.2.1 Employment

Selected unemployment and regional economic statistics for counties located partially or entirely within 50 mi (80 km) of the MFFF site are summarized in Table 4-20. In 1996, unemployment in the region ranged from a high of 16% in Burke County, Georgia, to a low of 3.1% in Bulloch County, Georgia. With the exception of Bulloch and Columbia Counties in Georgia and Lexington County in South Carolina, the county rates of unemployment were consistently higher than the respective state averages of 6% and 4.6%, respectively, for South Carolina and Georgia. In May 2000, the average unemployment rates for the Augusta-Aiken and Columbia City MSAs were 4.5% and 2.7%, respectively.

Within the counties that are entirely or partially within a 50-mi (80-km) radius of the MFFF site, over 90,000 workers, or about 29%, were employed in the services sector of the workforce in 1997. Construction workers comprised about 6% of that workforce, or 18,290 workers, in that same year. Table 4-22 lists 1997 employment by business sector for the counties that are within 50 mi (80 km) of the MFFF site.

4.10.2.2 Housing

The six-county ROI contained over 165,000 housing units in 1990, approximately 10% of which were vacant. Richmond County in Georgia contained the largest number of units (77,288) in this region, followed by Aiken County in South Carolina (49,266) and Columbia County in Georgia (23,745). Barnwell County and Edgefield County in South Carolina each contained less than 8,000 units.

Of the six counties, Columbia County has seen the fastest growth in housing over the past 30 years with increases of 109.2% from 1970 to 1980, and 68.4% from 1980 to 1990. This trend is in line with that county's rapid population growth and appears to be continuing. From 1970 to 1980 and from 1980 to 1990, Columbia County's population grew approximately 80% and 47%, respectively. The state of Georgia estimates that the population of Columbia County grew by an additional 50% to a total of 88,812 people between 1990 and 1997. In 1997, Columbia County issued the largest number of construction permits for new housing (i.e., 868 permits) when compared to the other six ROI counties.

4.10.3 Community Services

4.10.3.1 Education

Five public schools are located within a 10-mi (16-km) radius of the MFFF site, all over 6 mi (9.6 km) from the site. These schools, and their 1999-2000 enrollments, are listed in Table 4-18. The schools operate for 180 days each year, from early-August through mid-May. There are no private schools or colleges in the 10-mi (16-km) area. | R1

4.10.3.2 Public Safety

The five-county ROI (excluding Bamberg County) was served by a total of 973 sworn police officers in 1997, with an average officer-to-population ratio of 2.1 officers per 1,000 persons (DOE 1999c). In 1990, Georgia averaged 2.0 officers per 1,000 persons and South Carolina averaged 1.8 officers per 1,000 persons (DOE 1999c).

Firefighting services in the SRS ROI (excluding Bamberg County) were provided by 1,712 paid and volunteer firefighters in 1997. The average firefighter-to-population ratio in the ROI was 3.8 firefighters per 1,000 persons (DOE 1999c). The average 1990 firefighter-to-population ratios for Georgia and South Carolina were 1.0 firefighter per 1,000 persons, and 0.8 firefighter per 1,000 persons, respectively (DOE 1999c).

4.10.3.3 Health Care

No hospitals are located within a 10-mi (16-km) radius of the MFFF site. The nearest hospital, the Aiken Regional Medical Center, is located about 20 mi (32.2 km) from the MFFF site in the city of Aiken. In 1996, a total of 1,722 physicians served the ROI (excluding Bamberg County). The average physician-to-population ratio in the ROI was 3.8 physicians per 1,000 persons. This ratio compares with a 1996 state average of 2.3 physicians per 1,000 persons for Georgia and 2.2 physicians per 1,000 persons for South Carolina. In 1997, there were 10 hospitals serving the ROI (excluding Bamberg County). The hospital bed-to-population ratio averaged 7.7 beds per 1,000 persons. This ratio compares with a 1990 state average of 4.1 beds per 1,000 persons for Georgia and 3.3 beds per 1,000 persons for South Carolina (DOE 1999c)

4.10.3.4 Local Transportation

Vehicular access to SRS is provided by South Carolina Highways 19, 64, 78, 125, and 278. Two road segments in the ROI could be affected by the disposition alternatives: South Carolina Highway 19 from U.S. Route 78 at Aiken to U.S. Route 278 and South Carolina Highway 230 from U.S. 25 Business at North Augusta to U.S. Routes 25, 78, and 278. Three road improvement projects are planned that are independent of the proposed action but would alleviate traffic congestion leading into SRS.

The first improvement project is the widening of South Carolina Highway 302 (Pine Log Road) from U.S. Route 78 and the construction of new segments to extend the route to South Carolina Highway 19. U.S. Route 25 is also being widened for one-half mile south of I-20. The widening project will be in conjunction with the second improvement project, the new construction of the Bobby Jones Expressway (I-520). The expressway will head in a southwest direction crossing South Carolina Highways 126 and 125 and U.S. Route 1 and continue over the Savannah River to connect with the Georgia portion of the Bobby Jones Expressway, which is already constructed. The third improvement project is the completion of South Carolina Highway 118 around Aiken. South Carolina Highway 118 will be widened with the construction of new segments to complete the by-pass (DOE 1999c). With the exception of the U.S. Route 25 project, which is expected to be completed the year MFFF construction begins, these projects will be completed prior to MFFF construction (SCDOT 2000).

There is no public transportation to SRS. Rail service in the ROI is provided by the Norfolk Southern Corporation and CSX Transportation. SRS is provided rail access via Robbins Station on the CSX Transportation line.

Waterborne transportation is available via the Savannah River. Currently, the Savannah River is used primarily for recreation. SRS has no commercial docking facilities, but it has a boat ramp that has accepted large transport barge shipments.

Columbia Metropolitan Airport in the city of Columbia, South Carolina, and Augusta Regional Airport (Bush Field) in the city of Augusta, Georgia, receive jet air passenger and cargo service from both national and local carriers. Numerous smaller private airports are located in the ROI (DOE 1999c).

4.10.4 Environmental Justice

"Environmental Justice" refers to a federal policy under which federal actions should not result in disproportionately high and adverse environmental impacts on low-income or minority populations. As a general matter, a minority population is defined to exist if the percentage of minorities within a specified area exceeds the percentage of minorities in an entire state by 20%, or if the percentage of minorities within the area is at least 50%. Executive Order 12898 directs federal executive agencies to consider environmental justice under NEPA. Although it is not subject to the executive order, the NRC has voluntarily committed to undertake environmental justice reviews. The scope of DCS' review includes an analysis of impacts on low-income and minority populations.

In determining the area to review for environmental justice, guidance provided by the NRC specifies that "If a facility is located outside the city limits or in a rural area, a 4-mi (6.4-km) radius (50 mi^2 [130 km^2]) should be used. ... The goal is to evaluate the "communities," neighborhoods, or areas that may be disproportionately impacted" (NRC 1999a). The MFFF site within SRS is extremely rural, is entirely within the boundaries of the SRS property, and contains no communities, neighborhoods, or other areas that may be impacted by MOX operations. The nearest population is located more than 5 mi (8 km) from the MFFF site.

A majority of the population within a 10-mi (16-km) radius of the proposed MFFF site resides within Aiken County. Figure 4-16 shows the distribution of minority populations within a 10-mi R1 (16-km) radius of the MFFF site. The figure is based on U.S. Census 1990 block group data. Ethnic and racial characteristics of the total population of each county that is partially located within a 10-mi (16-km) radius of the MFFF site and for the states of Georgia and South Carolina are listed in Table 4-17. Only the racial mix of Burke County is significantly different[6] from that of the state, with the black portion of the county population 29 percentage points higher than the overall black portion of Georgia's population. The portion of Burke County's population within 10 mi (16 km) of the MFFF site, however, is extremely small and over 7 mi (11.3 km) away at its closest point. The racial mix of South Carolina counties within the local area is not significantly different from that of the state as a whole.

Economically, Aiken County exceeds the state averages for per capita income and has a lower percentage of persons with incomes below the poverty threshold (e.g., $9,981 for a family of three with one related child under 18 in 1990). As shown in Table 4-20, both Barnwell and Burke Counties are somewhat below their respective state averages in per capita income and have significantly higher portions of their population with income levels below the poverty threshold. As noted above, however, the portion of Burke County's population within 10 mi (16 km) of the MFFF site is extremely small as is the case for Barnwell County and no population is located within 5 mi (8 km) of the MFFF site. Figure 4-17, based on 1990 U.S. R1 Census block group data, shows the distribution of the population living below the poverty threshold within a 10-mi (16-km) radius of the proposed MFFF site. Additional details of the environmental justice analysis are provided in Appendix C.

4.11 CURRENT RISK FROM IONIZING RADIATION

Major sources and levels of background radiation exposure to individuals in the vicinity of SRS are shown in Table 4-23. Annual background radiation doses to individuals are expected to remain constant over time. The total dose to the population, in terms of person-rem, changes as the population size changes. Background radiation doses are unrelated to SRS operations.

Releases of radionuclides to the environment from SRS operations provide another source of radiation exposure to individuals in the vicinity of SRS. Types and quantities of radionuclides released from SRS operations in 1999 are listed in the *Savannah River Site Environmental Report for 1999* (Arnett and Mamatey 2000a).

---

[6] NRC (1999a) guidance states that "As a general matter (and where appropriate), staff may consider differences greater than 20 percent to be significant."

Doses to the public resulting from these releases are presented in Table 4-24. These doses fall within radiological limits prescribed by 10 CFR Part 20 (DOE 1993), and are much lower than those of background radiation.

SRS workers receive the same dose as the general public from background radiation but may also receive an additional dose from working in facilities with nuclear materials. Table 4-25 presents the average worker and cumulative worker dose to SRS workers based on the most recent published data. These doses fall within the radiological regulatory limits of 10 CFR Part 20.

4.12 EXISTING SRS INFRASTRUCTURE

Site infrastructure includes utilities and other resources to support construction and operation of the MFFF. As discussed elsewhere in the ER, one of the reasons that DOE selected the SRS F Area as the site for the surplus plutonium disposition facilities was the availability of infrastructure to support the facilities. Section 3.5.11 of the SPD EIS (DOE 1999c) discusses the current infrastructure at SRS and in F Area.

SRS uses a 115-kV system in a ring arrangement to supply power to the operations areas. Power is supplied by three transmission lines from the South Carolina Electric & Gas Company. Power for F-Area is provided by the 200-F power loop, supplied by the 251-F electrical substation. This substation consists of two 115/13.8-kV, 24/32 kVA transformers and associated switchgear. F-Area consumption averages about 63,000 MWh/yr. The F-Area capacity is about 700,000 MWh/yr (see Table 4-26). R1

SRS uses a new central domestic water system consisting of several wells and water treatment plants. System capacity is 2,950 gal/min (11,165 L/min). Current usage in F Area is 100 million gal/yr (378 million L/yr) compared to a capacity of 235 million gal/yr (890 million L/yr). R1 Additional process and service water can be provided through deep-well systems in F Area. F Area is served by four wells–with a capacity of 1,100 million gal/yr (4,163 million L/yr). R1 Current usage in F Area is 370 million gal/yr (1,401 million L/yr).

SRS does not use natural gas.

SRS also provides a fire department through three fire stations using a 12-hr rotational shift. Part of the fire department is the SRS Hazardous Materials Response Team and Rescue Team. The fire department is supported by a fleet of 20 vehicles, including six pumpers, one pumper-tanker, one tanker, and one aerial platform ladder truck.

SRS provides an integrated-site emergency response organization. The site emergency response organization provides infrastructure to support all SRS operations, South Carolina and Georgia emergency response teams, and national and international emergency response teams as necessary.

4.13 EXISTING SRS WASTE MANAGEMENT INFRASTRUCTURE

Waste management includes minimization, characterization, treatment, storage, transportation, and disposal of waste generated from ongoing DOE activities. The waste at SRS is managed according to appropriate treatment, storage, and disposal technologies and in compliance with applicable federal and state statutes and DOE Orders. SRS waste management is described in Section 3.5.2 of the SPD EIS (DOE 1999c) and presented below.

4.13.1 Overview of Waste Inventories and Activities

SRS manages the following types of waste: HLW, TRU, mixed TRU, LLW, mixed LLW, hazardous, and nonhazardous. HLW would not be generated by surplus plutonium disposition activities at SRS, and therefore, will not be discussed further. The most recent waste generation R1 rates and the inventory of stored waste from activities at SRS are provided in Table 4-27. More detailed descriptions of the waste management system capabilities at SRS are included in the S&D PEIS (DOE 1996b) and the *Savannah River Site Waste Management Final Environmental Impact Statement* (DOE 1995b).

[Text Deleted] R1

4.13.2 Transuranic and Mixed Transuranic Waste

TRU waste generated between 1974 and the present is stored on 22 storage pads in E Area. The R1 TRU waste storage pads are in the Low-Level Radioactive Waste Disposal Facility (DOE 1995b).

A TRU Waste Characterization and Certification Facility provides extensive containerized waste certification capabilities. The facility prepares TRU waste for treatment and certifies TRU waste R1 for disposal at the Waste Isolation Pilot Plant (WIPP). Drums that are certified for shipment to WIPP will be placed in interim storage on concrete pads in E Area (DOE 1996b). LLW containing concentrations of TRU nuclides between 10 and 100 nCi (referred to as alpha-contaminated LLW) is managed like TRU waste because its physical and chemical properties are similar and similar procedures will be used to determine its final disposition (DOE 1996b). WIPP began receiving waste from SRS on May 8, 2001. R1

4.13.3 Low-Level Radioactive Waste

Both liquid and solid LLW are treated at SRS. Most aqueous LLW streams are sent to the F- and H-Area Effluent Treatment Facility and treated by filtration, reverse osmosis, and ion exchange to remove the radionuclide contaminants. After treatment, the effluent is discharged to Upper Three Runs within the NPDES Permit discharge limitations.

After completion of a series of extensive readiness tests, the Consolidated Incineration Facility began radioactive operations in 1997. The Consolidated Incineration Facility is designed to incinerate both solid and liquid LLW, mixed LLW, and hazardous waste (WSRC 1997b). The

Consolidated Incineration Facility went into temporary shutdown on September 30, 2000, and is presently in suspension. R1

Solid LLW is segregated into several categories to facilitate proper treatment, storage, and disposal. Solid LLW that radiates less than 200 mrem/hr at 2 in (5.1 cm) from the unshielded container is considered low-activity waste. If it radiates greater than 200 mrem/hr at 2 in (5.1 cm), it is considered intermediate-activity waste. Intermediate-activity tritium waste is intermediate-activity waste with more than 10 Ci of tritium per container. Long-lived waste is contaminated with long-lived isotopes that exceed the WAC for onsite disposal (DOE 1996b).

Four basic types of vaults and buildings are used for storing the different waste categories: low-activity waste vaults, intermediate-level non-tritium vaults, intermediate-level tritium vaults, and the long-lived waste storage building. The vaults are below-grade concrete structures, and the storage building is a metal building on a concrete pad (DOE 1996b).

Currently, DOE places low-activity LLW in carbon steel boxes and deposits them in the low-activity waste vaults in E Area. Intermediate-activity LLW is packaged according to waste form and disposed of in the intermediate-level waste vaults in E Area. Long-lived wastes are stored in the Long-Lived Waste Storage Building in E Area until treatment and disposal technologies are developed (DOE 1995b).

Saltstone generated in the solidification of LLW salts extracted from HLW is disposed of in the Z-Area Saltstone Vaults. Saltstone is solidified grout formed by mixing the LLW salt with cement, flyash, and furnace slag. Saltstone is the highest volume of solid LLW disposed of at SRS. SRS disposal facilities are projected to meet solid LLW disposal requirements, including LLW from offsite, for the next 20 years (DOE 1996b).

4.13.4 Mixed Low-Level Radioactive Waste

The Federal Facility Compliance Agreement (FFCA) of October 6, 1992, addresses SRS R1
compliance with RCRA Land Disposal Restrictions (LDR). The FFCA requires DOE facilities storing mixed waste to develop site-specific treatment plans and to submit them for approval (DOE 1996b). The site treatment plan for mixed waste specifies treatment technologies or technology development schedules for SRS mixed waste (Arnett and Mamatey 1996). SRS is allowed to continue to generate and store mixed waste, subject to LDR. Schedules to provide compliance through treatment in the Consolidated Incineration Facility are included in the FFCA (DOE 1996b).

The SRS mixed waste program consists primarily of safe storage and characterization for R1
commercial treatment and disposal. Mixed LLW is stored in A, E, M, N, and S Areas in various tanks and buildings. These facilities include burial ground solvent tanks, the M-Area Process Waste Interim Treatment/Storage Facility, the Savannah River Technology Center Mixed Waste Storage Tanks, and the DWPF Organic Waste Storage Tank (DOE 1995b). These South Carolina Department of Health and Environmental Control permitted facilities will remain in use until appropriate treatment and disposal is performed on the waste (DOE 1996b).

[Text Deleted] R1

4.13.5 Hazardous Waste

Hazardous waste is accumulated at the generating facility for a maximum of 90 days, or stored in DOT-approved containers in three RCRA-permitted hazardous waste storage buildings and on three interim status storage pads in B and N Areas. Most of the waste is shipped offsite to commercial RCRA-permitted treatment and disposal facilities using DOT-certified transporters. In 1995, 2,538 ft^3 (72 m^3) of hazardous waste were sent to onsite storage. Of this amount, 712 ft^3 (20 m^3) were shipped offsite for commercial treatment or disposal (Arnett and Mamatey 1996).

4.13.6 Nonhazardous Waste

In 1994, the centralization and upgrading of the sanitary wastewater collection and treatment systems at SRS were completed. The program included the replacement of 14 of 20 aging treatment facilities scattered across the site with a new 1.1 million-gal/day (4.1 million L/day) central treatment facility and connecting them with a new 18-mi (29-km) sanitary sewer system. The central treatment facility treats sanitary wastewater by the extended aeration activated sludge process. The treatment facility separates the wastewater into two forms: clarified effluent and sludge. The liquid effluent is further treated by the nonchemical method of ultraviolet light disinfection to meet NPDES discharge limitations for the outfall to Fourmile Branch. The sludge is further treated to reduce pathogen levels to meet proposed land application criteria. The remaining sanitary wastewater treatment facilities are being upgraded as necessary by replacing existing chlorination treatment systems with nonchemical ultraviolet light disinfection systems to meet NPDES limitations (DOE 1996b).

SRS has privatized the collection, hauling, and disposal of its sanitary waste (Arnett and Mamatey 1996). SRS-generated solid sanitary waste is sent to the Three Rivers Landfill, which is located just southwest of B Area (DOE 1998b). SRS conducts a recycling program using the City of North Augusta Regional Material Recovery Facility. In 1999, in excess of 35% of the compactible sanitary waste stream was recycled (WSRC 1999b). SRS disposes of other nonhazardous waste that consists of scrap metal, powerhouse ash, domestic sewage, scrap wood, construction debris, and used railroad ties in a variety of ways. Scrap metal is sold to salvage vendors for reclamation. Powerhouse ash and domestic sewage sludge are used for land reclamation. Scrap wood is burned onsite or chipped for mulch. Construction debris is used for erosion control. Railroad ties are shipped offsite for disposal (DOE 1996b).

4.13.7 Waste Minimization

The total amount of waste generated and disposed of at SRS has been and continues to be reduced through the efforts of the pollution prevention and waste minimization program at the site. This program is designed to achieve continuous reduction of waste and pollutant releases to the maximum extent feasible and in accordance with regulatory requirements while fulfilling national security missions (DOE 1996b). The program focuses mainly on source reduction, recycling, and increasing employee participation in pollution prevention. For example, 1995 nonhazardous solid waste generation was 32% below that of 1994, and the disposal volume of other solid waste, including radioactive and hazardous wastes, was 38% below 1994 levels. In 1995, SRS achieved a 9% reduction in its radioactive waste generation volume compared with 1994. Total solid waste volumes have declined by more than 70% since 1991. Radioactive solid waste volumes have declined by about 63%, or more than 600,000 ft (182,880 m) from 1991 through 1995. In 1995, more than 3,300 tons (2,990 metric tons) of nonradioactive materials were recycled at SRS, including 1,062 tons (963 metric tons) of paper and cardboard (Arnett and Mamatey 1996). During 1999, over 90 projects were implemented by waste generators that resulted in an avoidance of approximately 88,000 ft^3 (2,492 m^3) of radioactive and hazardous waste (WSRC 1999b).

Figures

This page intentionally left blank.

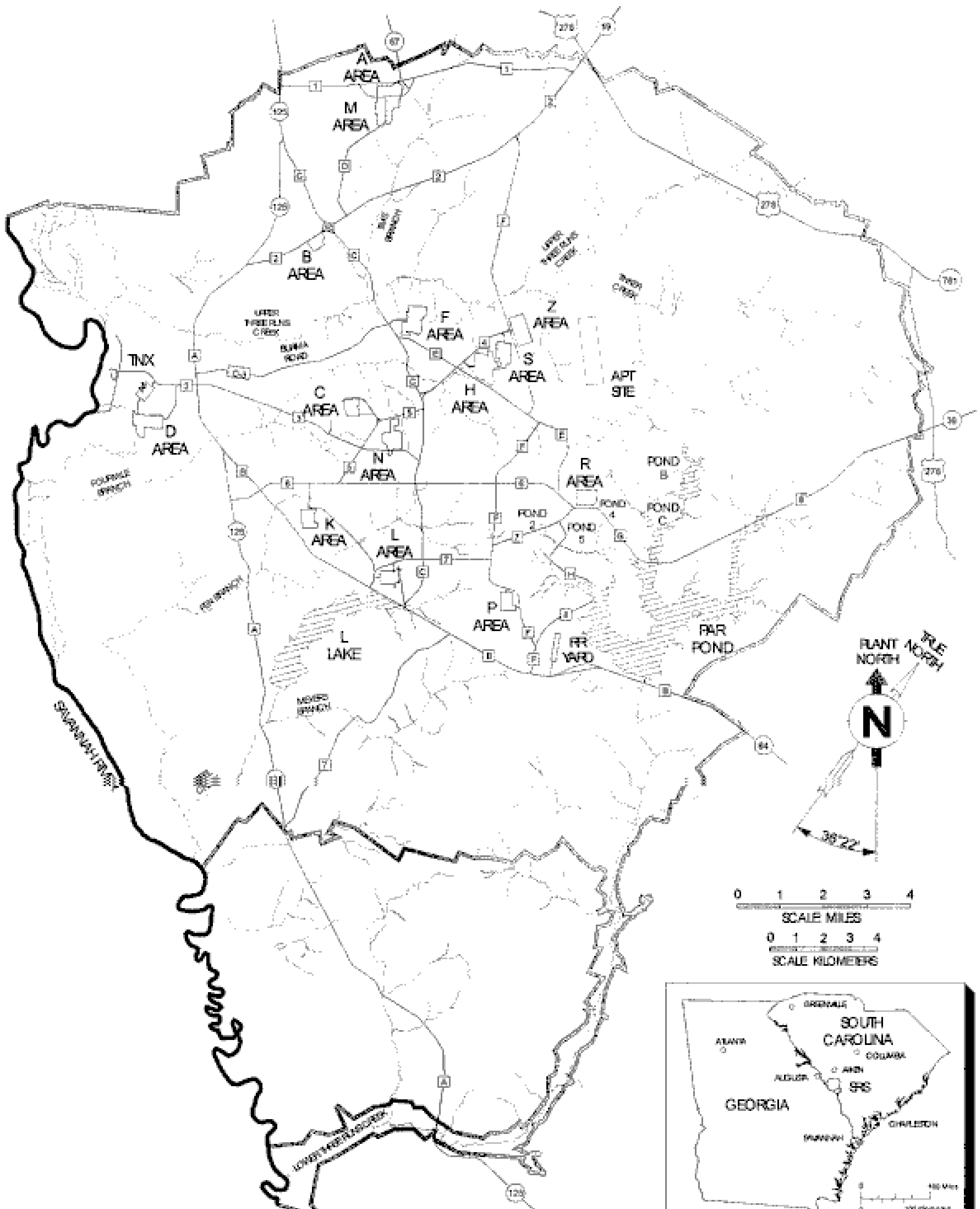


Figure 4-1. Location of the Savannah River Site

This page intentionally left blank.

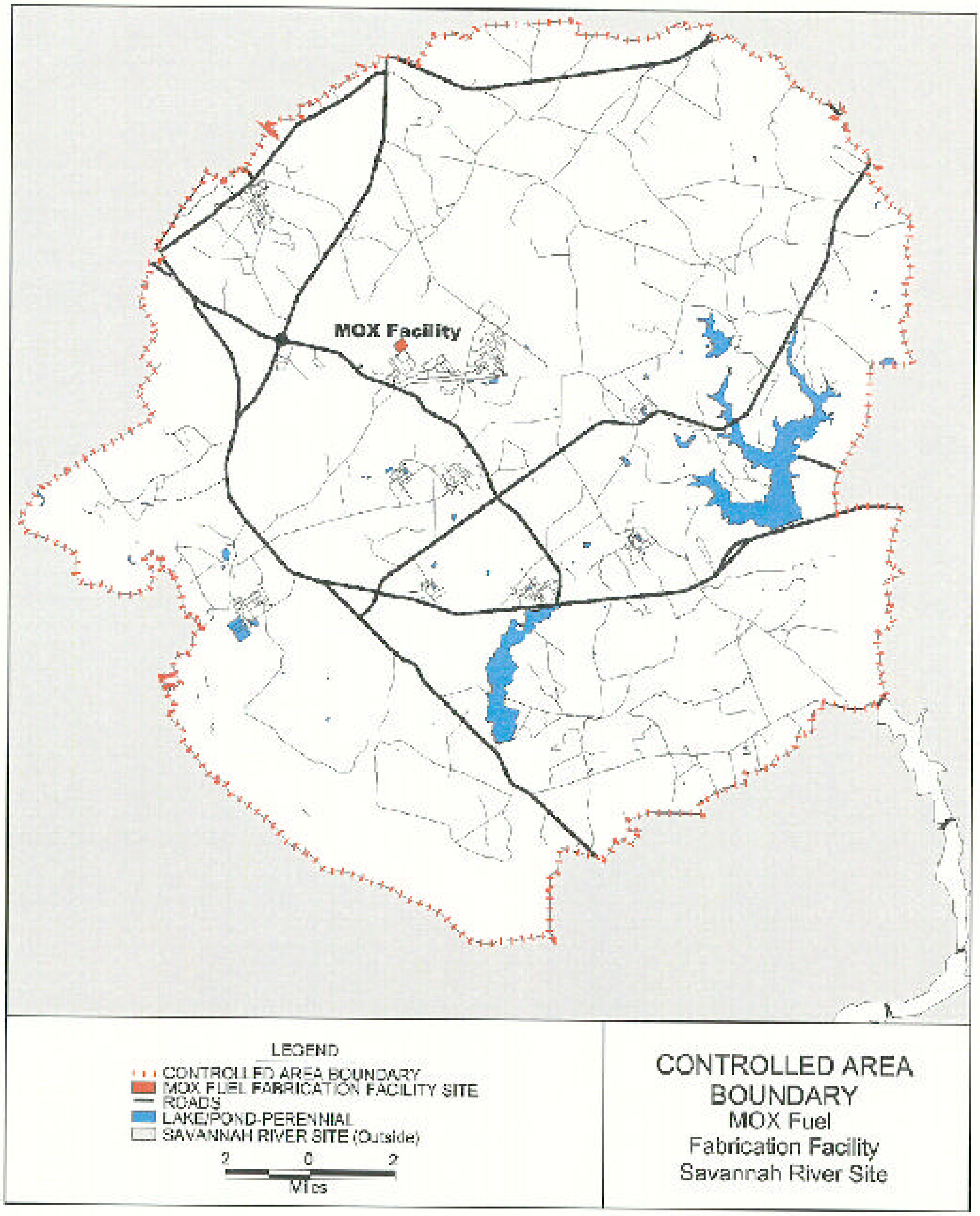
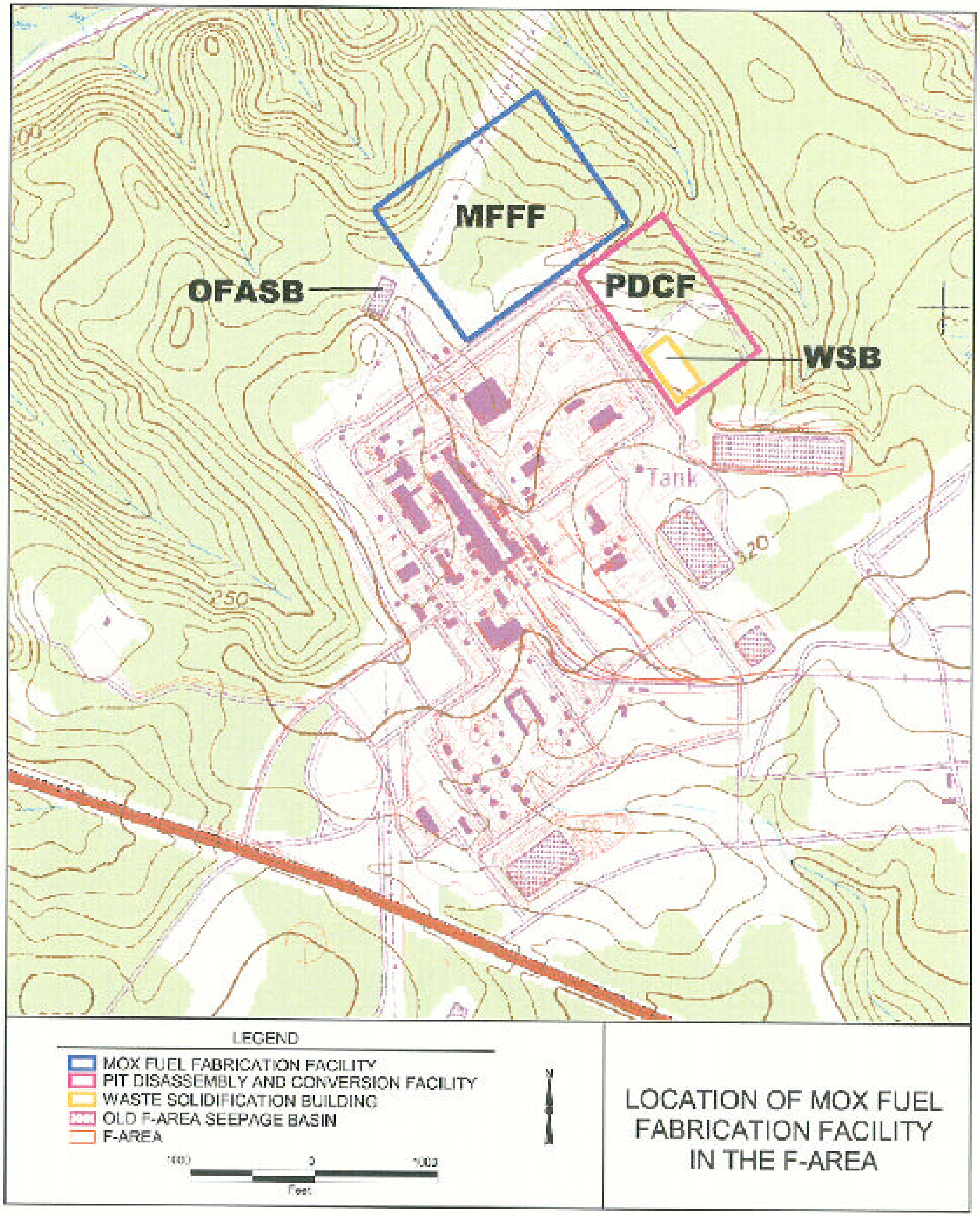


Figure 4-2. Location of F Area and Controlled Area Boundary

C01

This page intentionally left blank.



R2

Figure 4-3. Location of MOX Fuel Fabrication Facility in the F Area

C02

This page intentionally left blank.

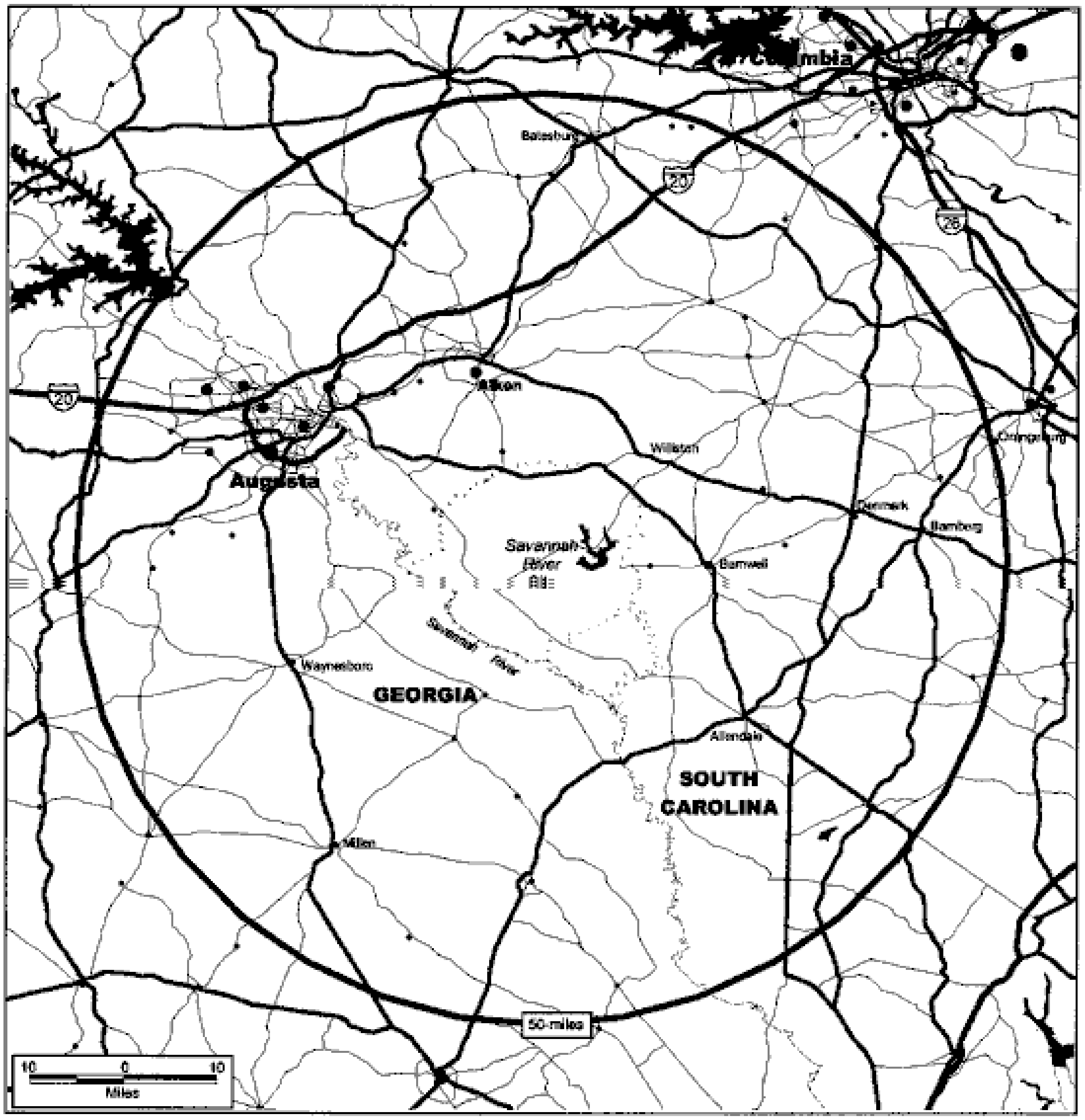


Figure 4-4. Fifty-Mile (80-km) Radius with Towns and Roads

This page intentionally left blank.

This page intentionally left blank.

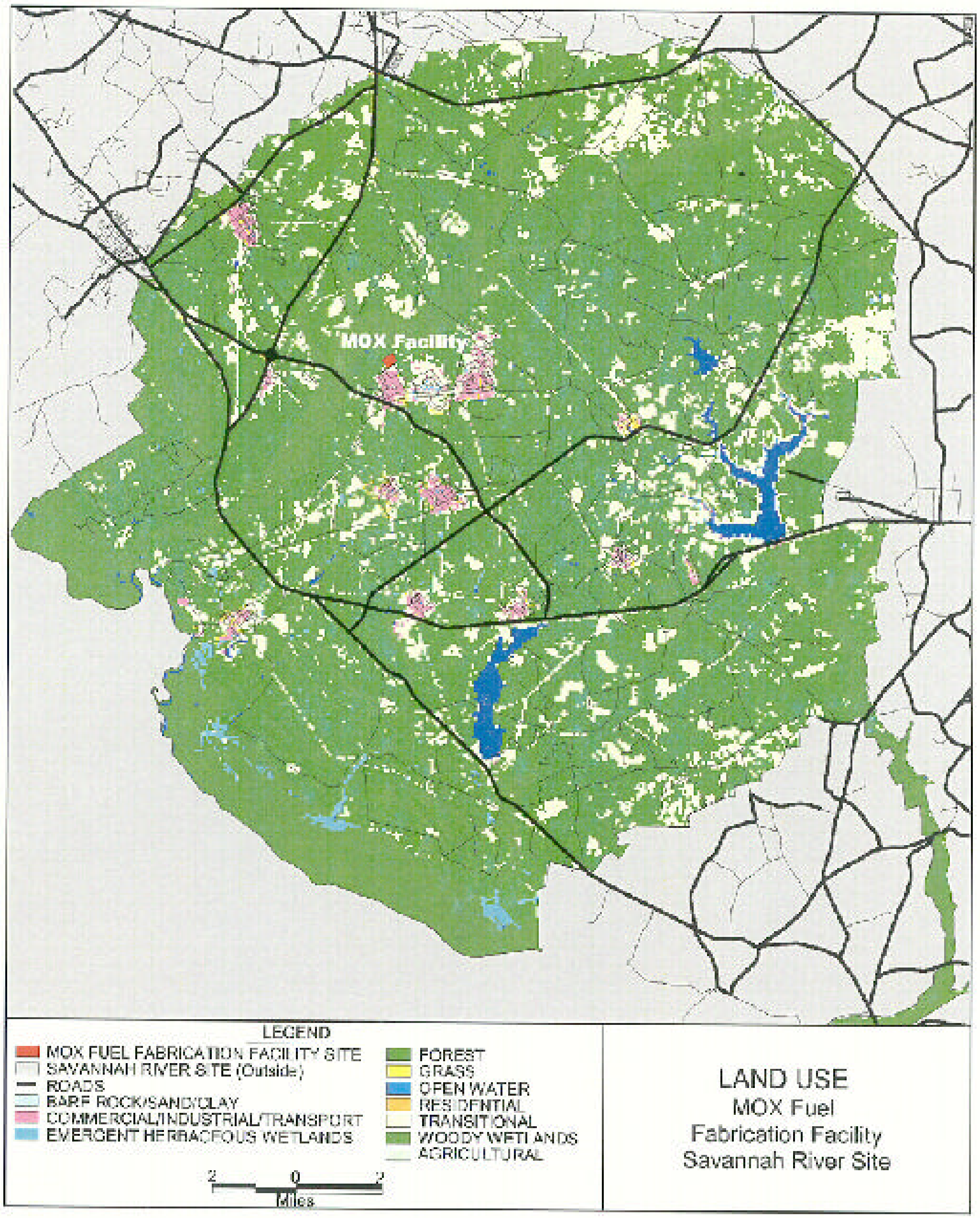
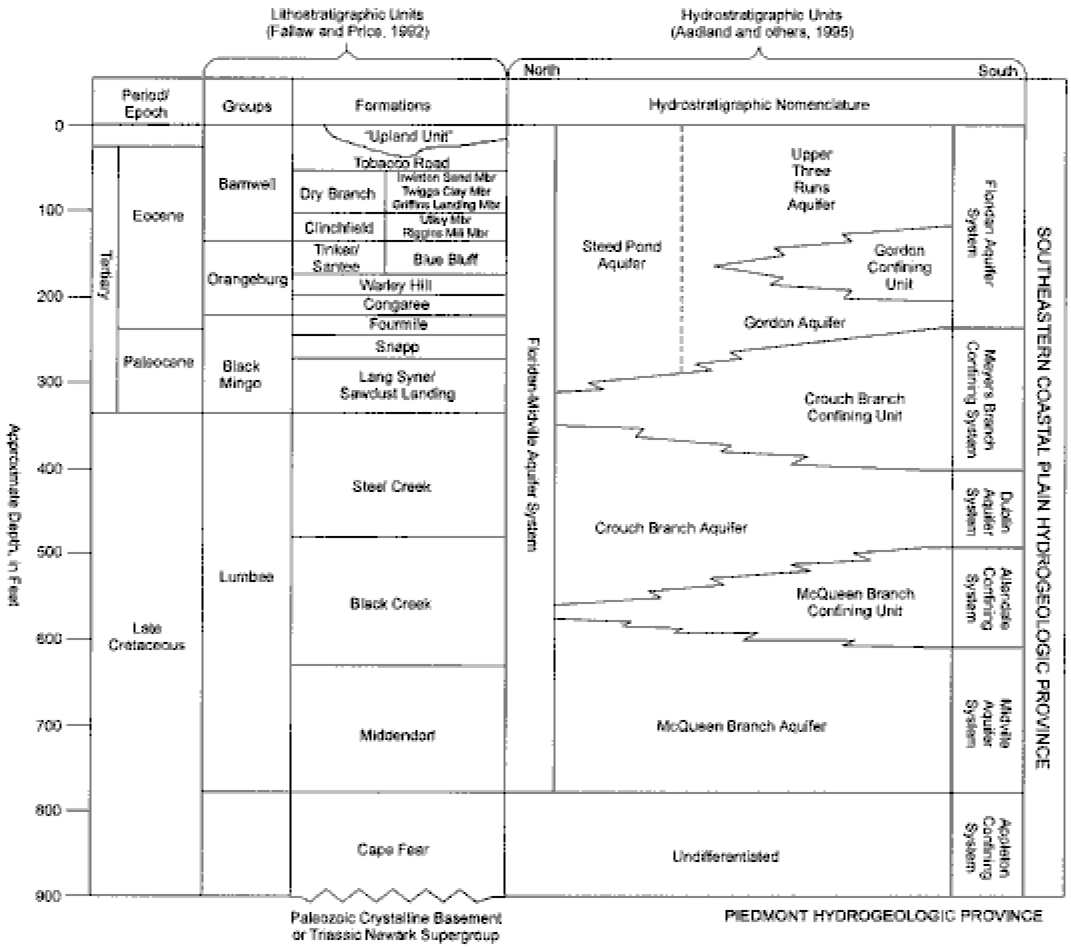


Figure 4-6. Generalized Land Use at SRS

C03

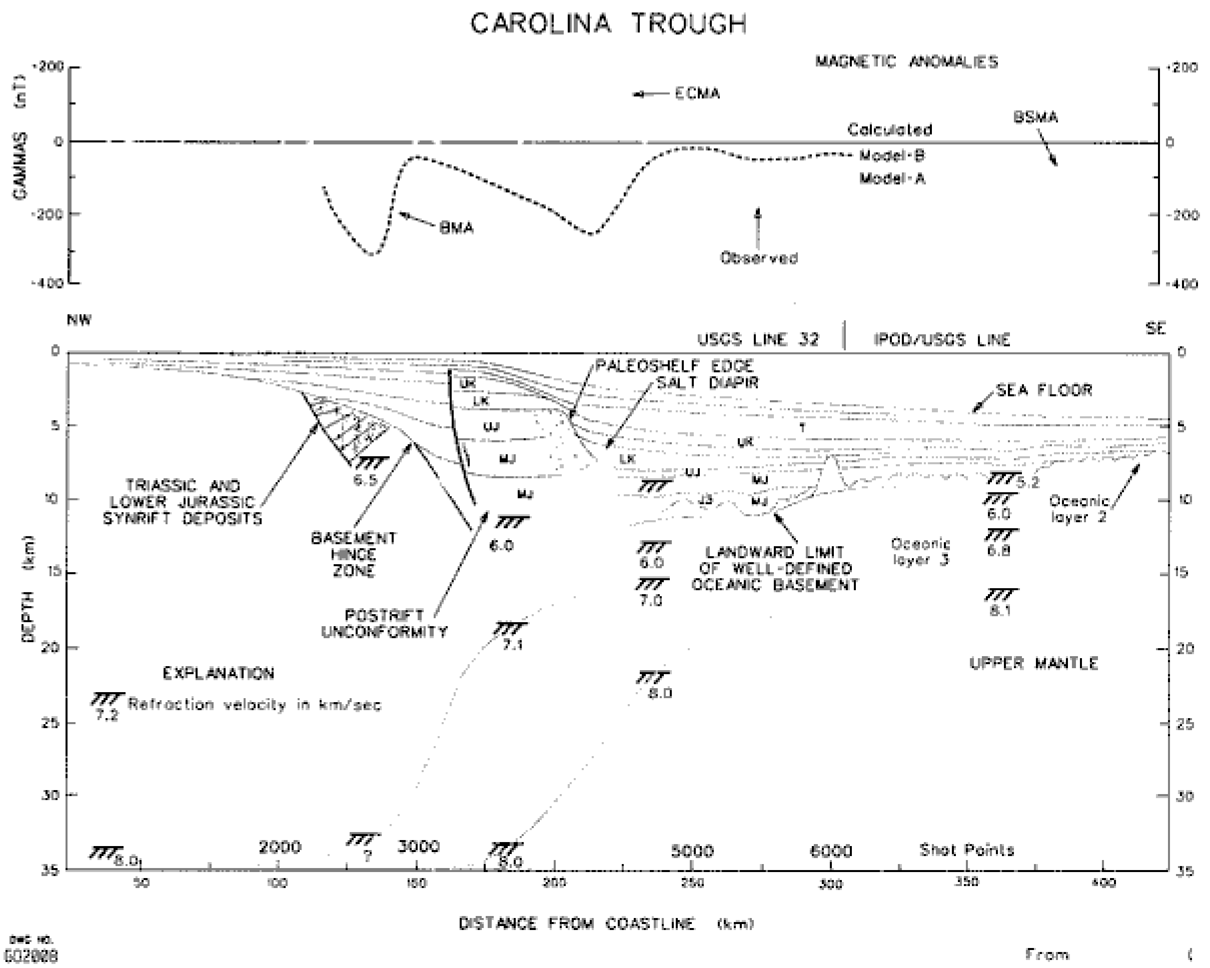
This page intentionally left blank.



Source: SRS GSAR (WSRC 1999a)

Figure 4-7. Relationship Between the Hydro- and Lithostratigraphic Units at SRS

This page intentionally left blank.



Source: SRS GSAR (WSRC 1999a)

Figure 4-8. Crustal Geometry for Offshore South Carolina and North Carolina

This page intentionally left blank.

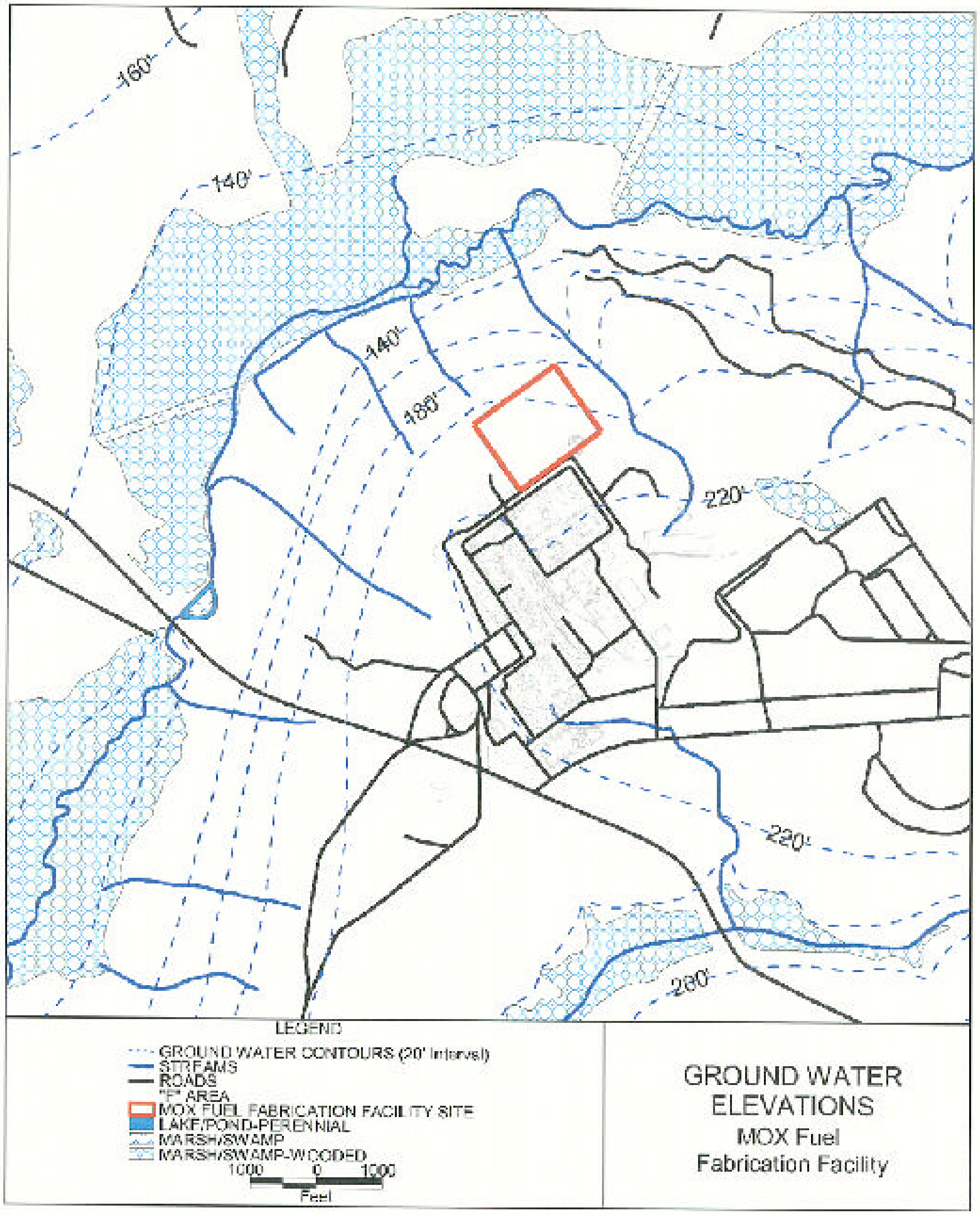


Figure 4-9. Elevation of Water Table in F Area

C04

This page intentionally left blank.

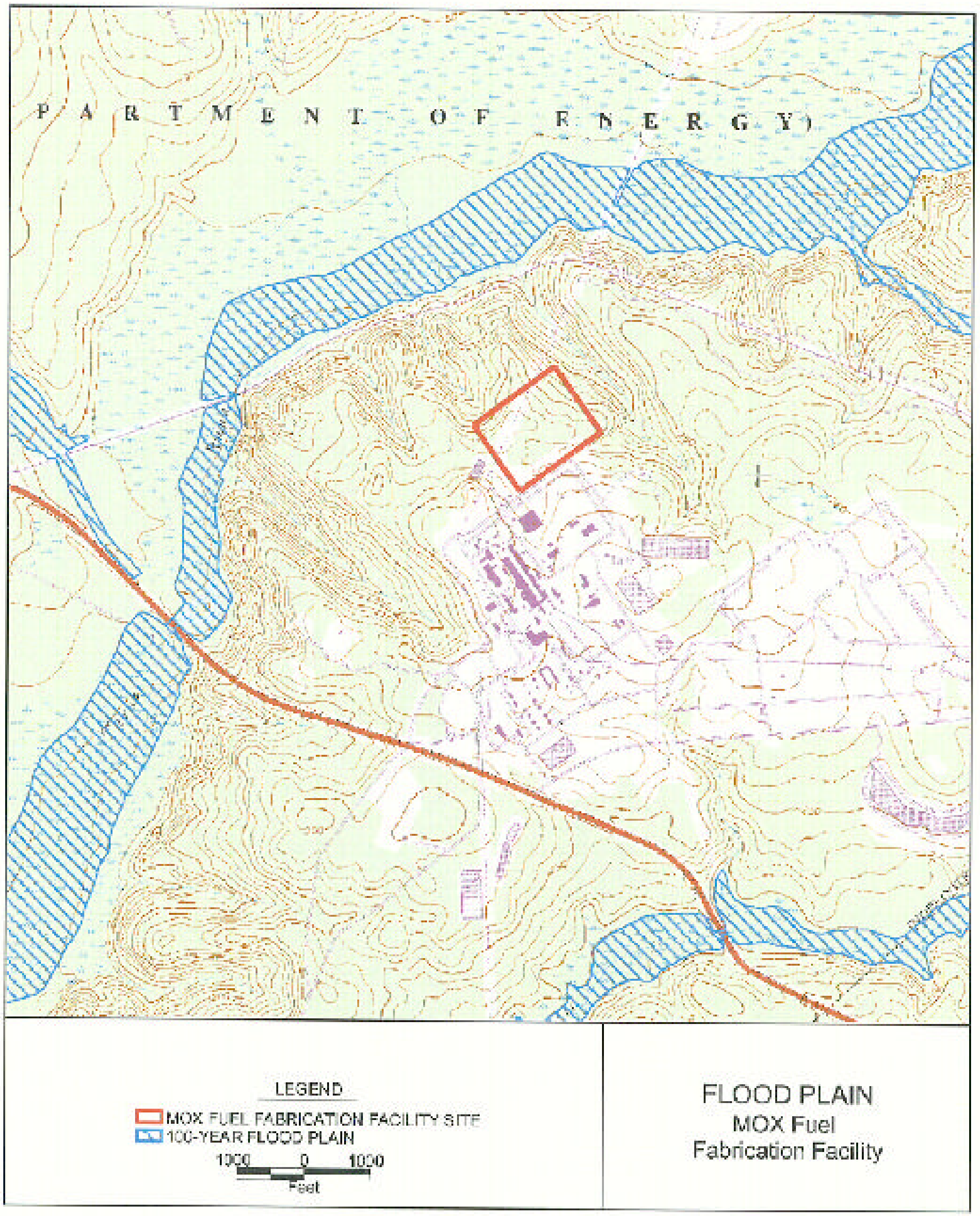
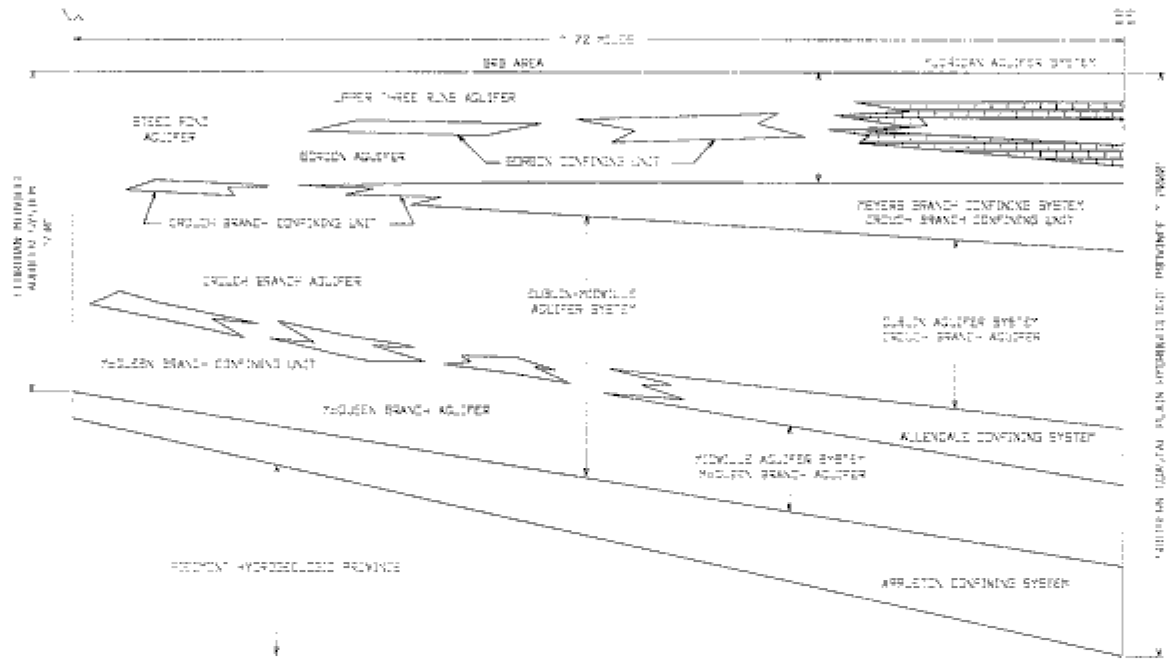


Figure 4-10. Location of 100-Year Floodplain in the Vicinity of the MOX Fuel Fabrication Facility

This page intentionally left blank.



Source: SRS GSAR (WSRC 1999a)

Figure 4-11. Generalized Hydrostratigraphic Cross Section of SRS

This page intentionally left blank.

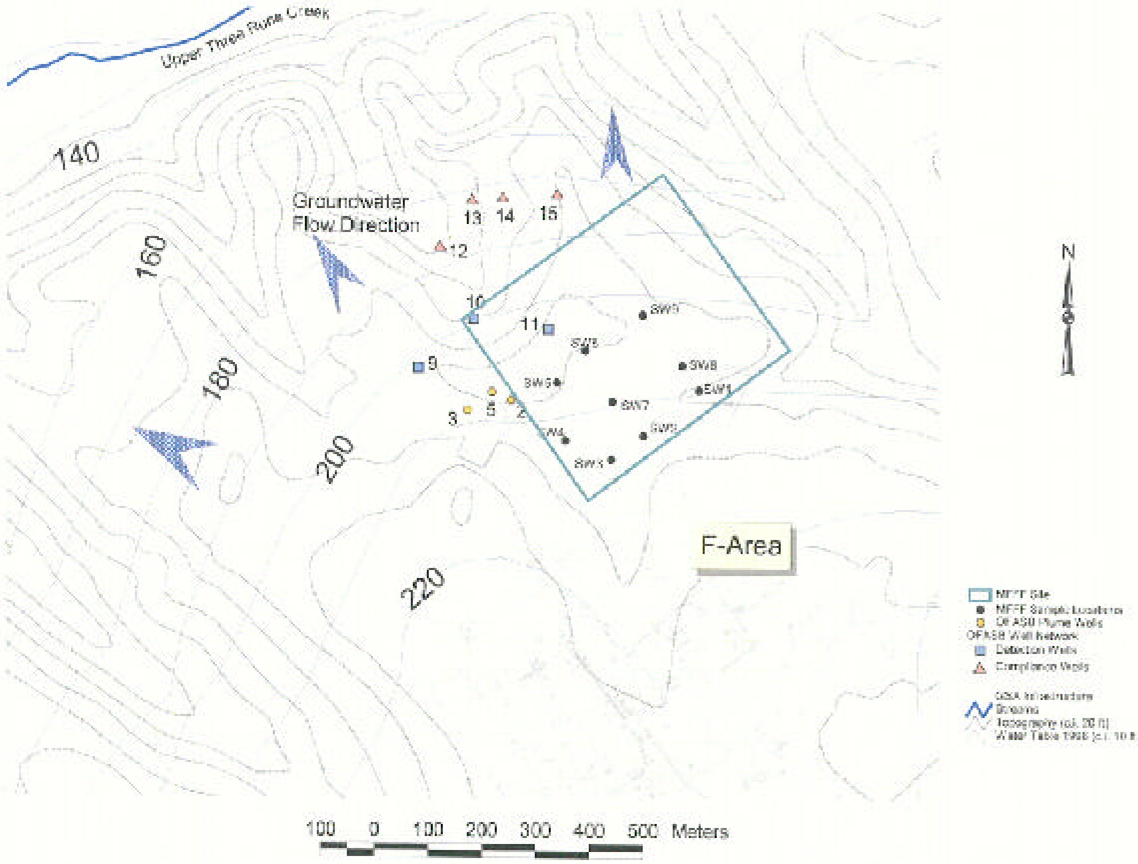
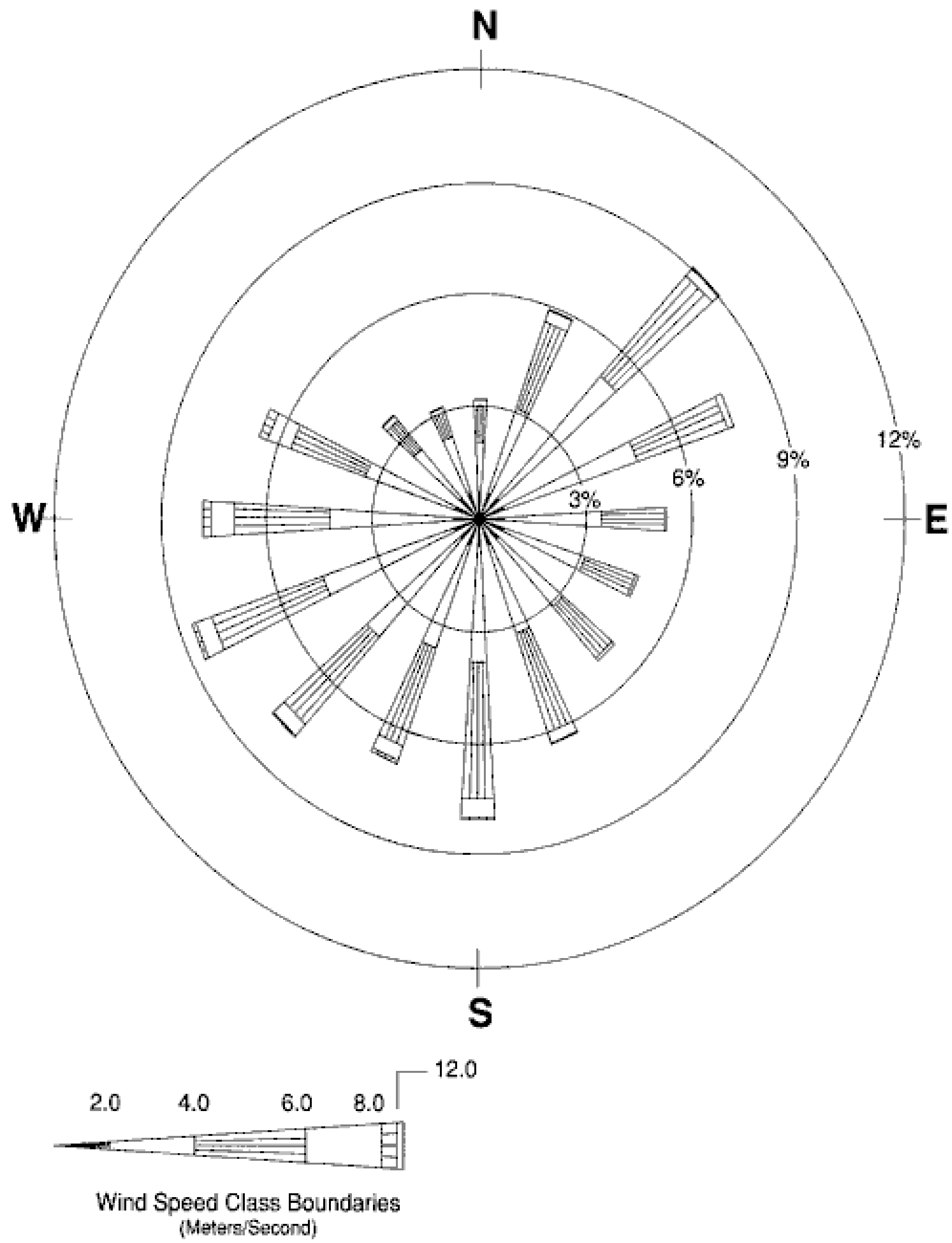


Figure 4-12. Groundwater Monitoring Network Near the OFASB R1, 2

C 06

This page intentionally left blank.



Source: SRS GSAR (WSRC 1999a)

Figure 4-13. Wind Rose Diagram for SRS

This page intentionally left blank.

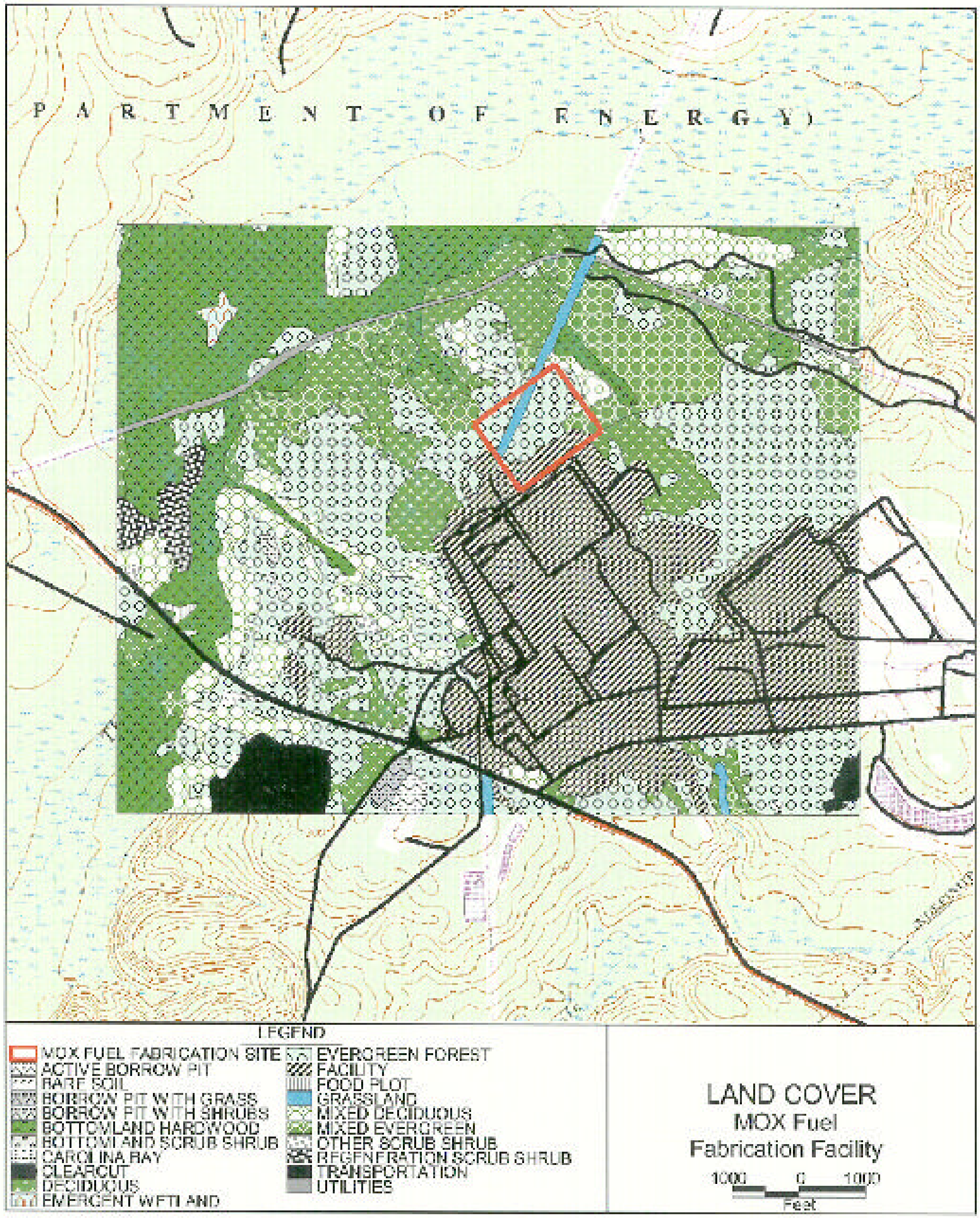


Figure 4-14. Land Cover in F Area

This page intentionally left blank.

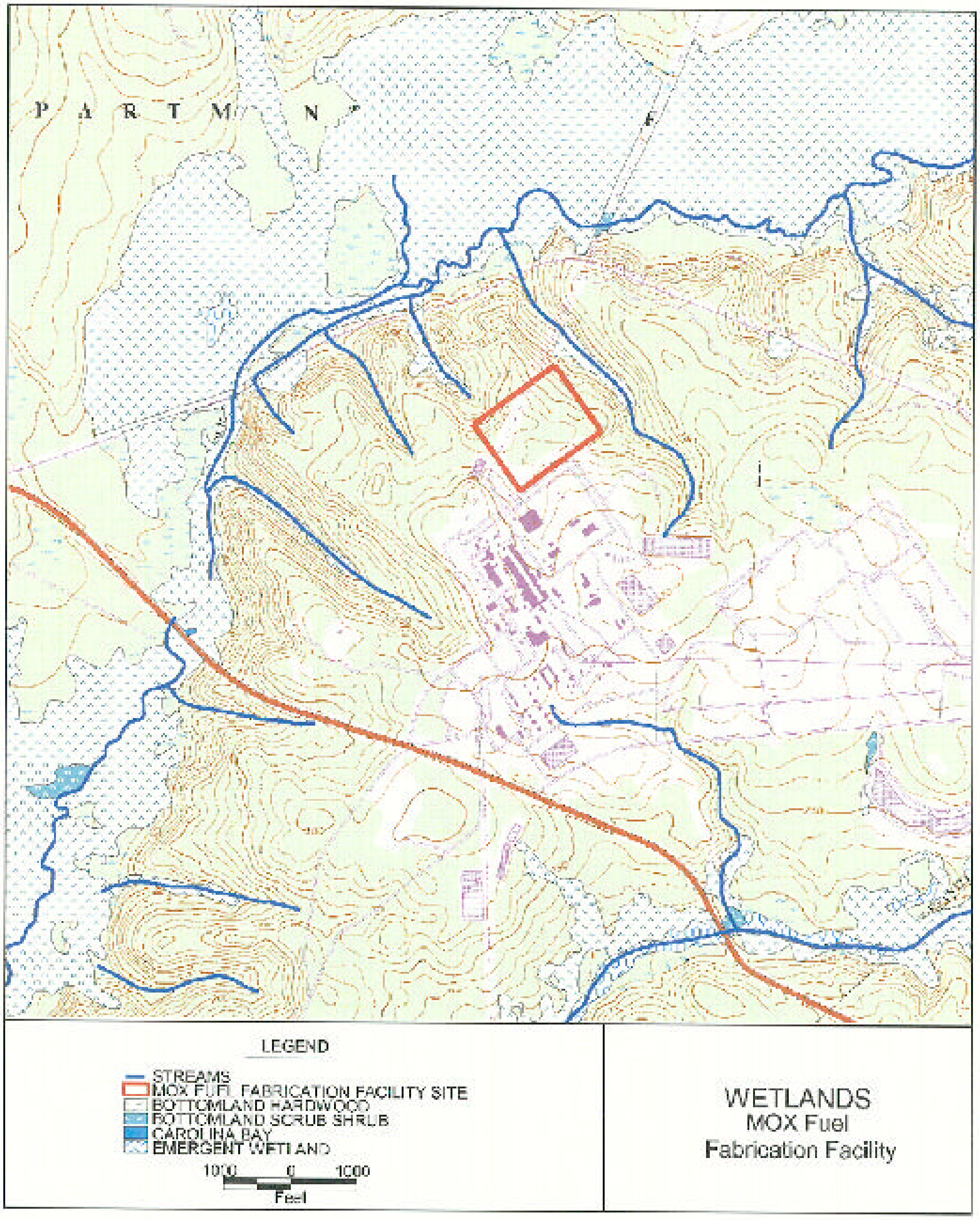


Figure 4-15. Surface Water and Wetlands in F Area

C08

This page intentionally left blank.

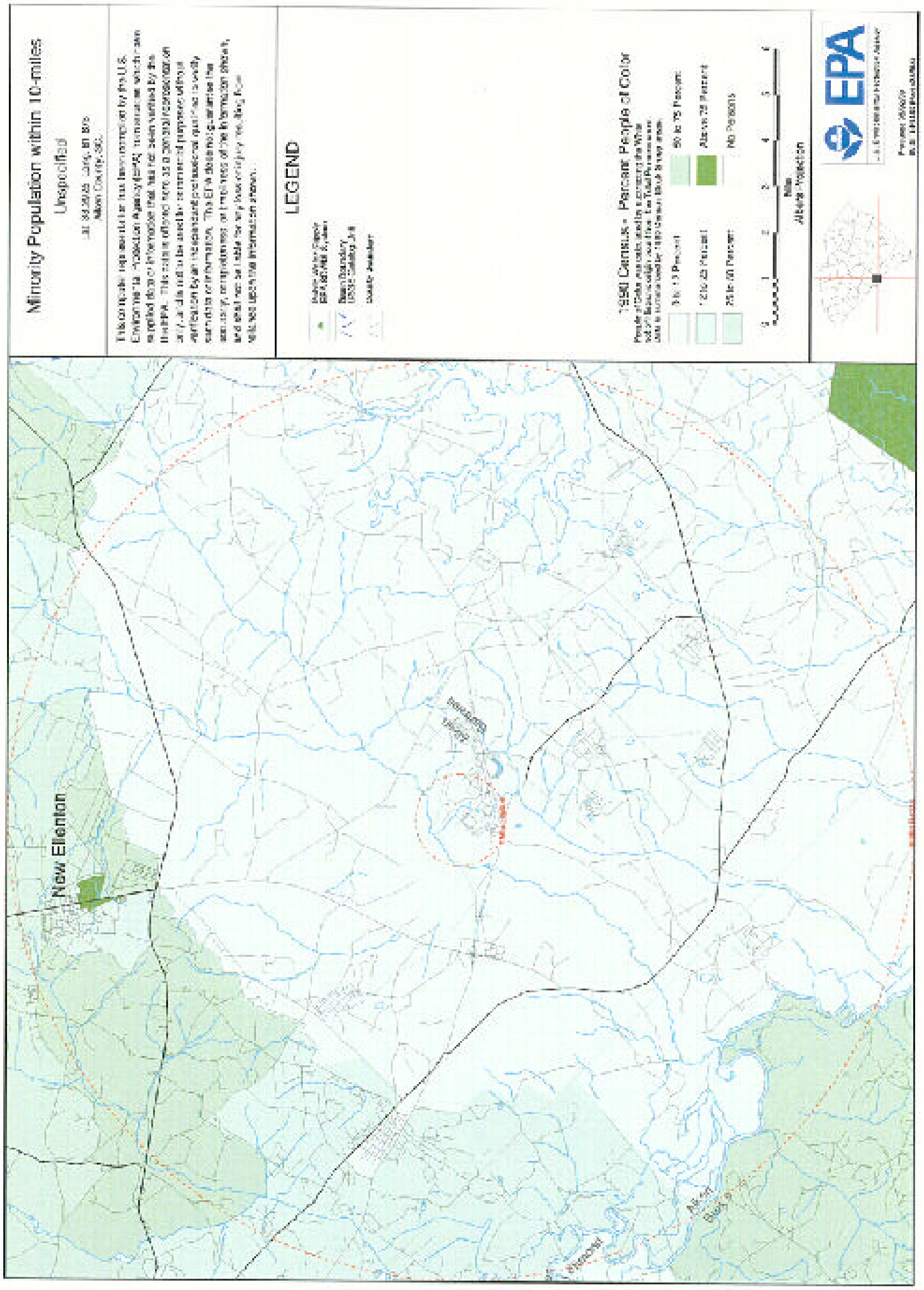


Figure 4-16. Distribution of Minority Population Within 10 Miles (16 km) of the MOX Fuel Fabrication Facility

C09

This page intentionally left blank.

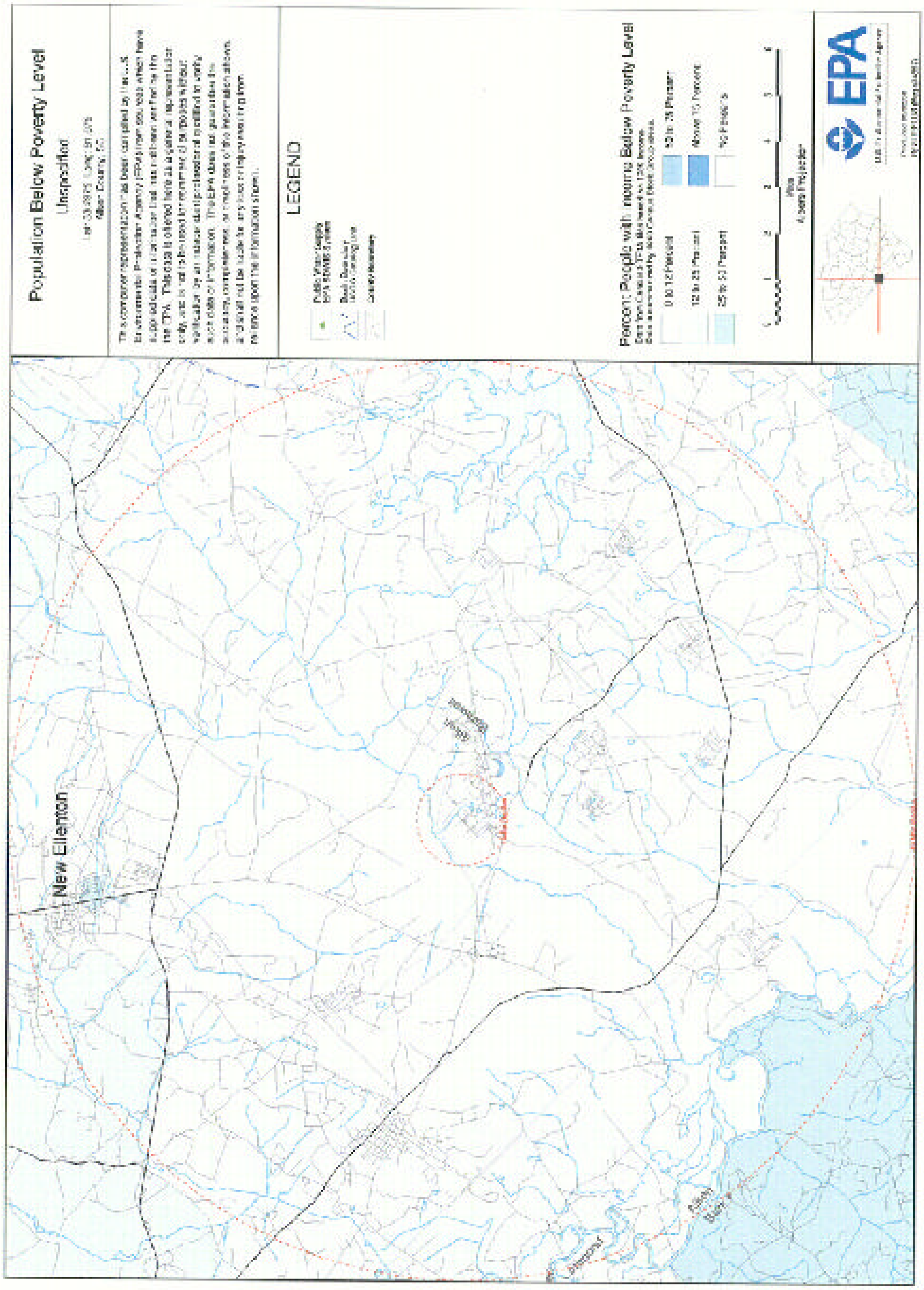


Figure 4-17. Distribution of Population Living Below the Poverty Threshold within 10 Miles (16 km) of the MOX Fuel Fabrication Facility

C10

Tables

This page intentionally left blank.

Table 4-1. Annual Maximum Instantaneous Discharges of the Savannah River at Augusta, Georgia, for Water Years 1921 through 1995 (USGS Flow Data, 1922-1995)

Year	Discharges (cfs)	Year	Discharge (cfs)
1921	129,000	1959	28,500
1922	92,000	1960	34,900
1923	59,700	1961	34,800
1924	56,400	1962	32,500
1925	150,000	1963	31,300
1926	55,300	1964	87,100
1927	39,000	1965	34,600
1928	226,000	1966	39,300
1929	191,000	1967	35,900
1930	350,000	1968	35,900
1931	26,100	1969	45,600
1932	93,800	1970	25,200
1933	48,200	1971	63,900
1934	73,200	1972	33,700
1935	63,700	1973	40,200
1936	258,000	1974	32,900
1937	90,200	1975	45,600
1938	65,300	1976	33,300
1939	82,400	1977	34,200
1940	252,000	1978	43,100
1941	52,200	1979	37,300
1942	115,000	1980	47,200
1943	132,000	1981	17,300
1944	141,000	1982	30,700
1945	62,100	1983	66,100
1946	109,000	1984	34,000
1947	90,200	1985	25,700
1948	76,100	1986	21,000
1949	172,000	1987	29,200
1950	32,500	1988	13,600
1951	41,400	1989	20,200
1952	39,300	1990	35,300
1953	35,200	1991	59,200
1954	25,500	1992	22,100
1955	23,900	1993	45,100
1956	18,600	1994	40,700
1957	18,000	1995	33,600
1958	66,300		

Source: *Water Resources Data for South Carolina USGS Annual Data Reports for Water Years 1967 – 1995* (USGS 1995)

Table 4-2. Annual Maximum Instantaneous Discharges of Upper Three Runs for Water Years 1967 through 1997 R1

Water Year	Discharge at Highway 278[a] (cfs)	Discharge at SRS Road C[b] (cfs)	Discharge at SRS Road A[c] (cfs)
1967	320	-[d]	
1968	237	-	-
1969	301	-	-
1970	303	-	-
1971	420	-	-
1972	382	-	-
1973	472	-	-
1974	260	-	-
1975	341	233	-
1976	429	218	1,230
1977	304	210	717
1978	344	195	Not gauged
1979	341	220	996
1980	420	207	951
1981	308	177	620
1982	364	187	793
1983	472	200	1,010
1984	466	235	861
1985	400	186	893
1986	360	167	780
1987	370	202	869
1988	278	156	428
1989	304	172	592
1990	202	174	572
1991	820	253	Unknown
1992	742	243	926
1993	421	266	1,100
1994	302	252	
1995	412	286	1,010
1996	-	222	-
1997	-	211	-

R1

Source: USGS, 2001. *Surface Water Data for South Carolina*; 02197310 Upper Three Runs Above Road C (SRS), SC. http://water.usgs.gov/sc/nwis/annual/calendar_year.

R1

[a] Station 02197300; drainage area 87 mi^2 (225 km^2).

[b] Station 02197310; drainage area 176 mi^2 (456 km^2).

[c] Station 02197315; drainage area 203 mi^2 (526 km^2).

[d] Indicates discharge point that was not monitored.

Table 4-3. Probable Maximum Precipitation for F Area

Time (hr)	Incremental Rainfall (in)	Total Rainfall (in)
0	--	0
1	2.2	2.2
2	2.8	5.0
3	3.1	8.1
4	15.1	23.2
5	4.9	28.1
6	2.7	30.8

Source: *Probable Maximum Precipitation Estimates, United States East of the 105th Meridian,* Hydrometeorological Report No. 51 (Schreiner and Reidel 1978)

Table 4-4. MFFF Site [a] Climatological Summary – Temperature (°F)

Month	Daily Maximum	Daily Minimum	Monthly	Record Highest	Year Occurred	Record Lowest	Year Occurred
January	55.7	32.0	43.9	84	1985	-1	1985
February	60.1	34.7	47.4	86	1962	3	1998
March	68.6	42.2	55.5	93	1995	12	1998
April	76.6	48.6	62.7	96	1986	26	1982
May	83.7	57.5	70.7	100	1964	35	1971
June	89.3	65.6	77.5	105	1952	47	1984
July	91.7	69.9	80.8	107	1980	55	1951
August	90.3	69.1	79.7	108	1983	54	1968
September	85.7	63.1	74.5	105	1999	36	1967
October	77.2	50.3	63.8	97	1954	22	1952
November	68.3	41.6	55.0	90	1961	15	1970
December	59.5	34.8	47.2	82	1998	5	1981
Year	75.6	50.8	63.2	108	1983	-1	1985

Source: *Local Climatological Data, Annual Summary with Comparative Data, 1999, Augusta, GA* (DOC 1999a) R1

[a] Taken at Bush Field, Augusta, Georgia, national weather station

Table 4-5. MFFF Site [a] Climatological Summary – Precipitation (inches)

Month	Normal Monthly	Maximum Monthly	Year Occurred	Minimum Monthly	Year Occurred	24-Hour Maximum	Year Occurred
January	4.05	8.91	1987	0.75	1981	3.61	1960
February	4.27	7.67	1961	0.69	1968	3.69	1985
March	4.65	11.92	1980	0.88	1968	5.31	1967
April	3.31	8.43	1961	0.60	1970	3.96	1955
May	3.77	9.61	1979	0.48	1951	4.44	1981
June	4.13	8.84	1989	0.68	1984	5.08	1981
July	4.24	11.43	1967	1.02	1987	3.71	1979
August	4.50	11.34	1986	0.65	1980	5.98	1964
September	3.02	9.51	1975	0.31	1984	7.30	1998
October	2.84	14.82	1990	T	1953	8.57	1990
November	2.48	7.76	1985	0.09	1960	3.82	1985
December	3.40	8.65	1981	0.32	1955	3.12	1970
Year	44.66	14.82	1990	T	1953	8.57	1990

Source: *Local Climatological Data, Annual Summary with Comparative Data, 1999, Augusta, GA* (DOC 1999a) R1

T – Trace

[a] Taken at Bush Field, Augusta, Georgia, national weather station

Table 4-6. SRS Seasonal Mixing Heights

Season	Mixing Height (meters)	
	Morning	Afternoon
Winter	1,148	3,362
Spring	1,230	5,576
Summer	1,312	5,904
Fall	984	4,592
Annual	1,230	4,756

Source: *Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution Throughout the Contiguous United States* (Holzworth 1972)

Table 4-7. Percent Occurrence of Atmospheric Stability Class for SRS Meteorological Towers

	Percent Occurrence Per Year							
Stability Class	**A Area**	**C Area**	**D Area**	**F Area**	**H Area**	**K Area**	**L Area**	**P Area**
A	17.5	15.6	20.5	13.3	25.9	15.4	16.8	14.9
B	10.6	8.8	11.9	8.3	13.2	9.8	10.2	9.4
C	17.6	15.7	19.4	15.2	20.1	17.0	18.0	16.4
D	26.6	27.1	24.9	28.6	22.1	25.4	25.1	26.5
E	19.6	20.6	17.4	24.9	15.5	21.2	18.7	21.1
F/G	8.0	12.1	6.0	10.6	3.2	11.1	11.1	11.8

Period of record: 1992-1996.

Source: "Updated Meteorological Data for Revision 4 of the SRS Generic Safety Analysis Report" (Hunter 1999).

Table 4-8. Joint Frequency Distribution of Wind Speed, Wind Direction, and Atmospheric Stability Class for 1992-1996 SRS H-Area Meteorological Tower Data

Stability Class A Number of Hourly Observations							
Winds From	Wind Speed (mph)						
	1-3	4-7	8-12	13-18	19-24	25+	Total
N	109	385	452	91	5	0	1,042
NNE	86	320	290	79	2	0	777
NE	105	404	231	15	0	0	755
ENE	106	454	220	14	0	0	794
E	93	463	195	5	0	0	756
ESE	78	345	130	9	1	0	563
SE	65	306	113	10	0	0	494
SSE	80	242	87	4	0	0	413
S	74	324	163	10	0	0	571
SSW	76	341	189	16	1	0	623
SW	94	493	263	24	0	0	874
WSW	96	599	305	43	3	0	1,046
W	78	521	310	38	7	1	955
WNW	80	361	210	50	7	0	708
NW	68	246	105	15	0	0	434
NNW	92	251	160	40	3	1	547
TOTAL	1,380	6,055	3,423	463	29	2	11,352

Note: Total number of observations used for the 1992 to 1996 period = 43,848

Table 4-8. Joint Frequency Distribution of Wind Speed, Wind Direction, and Atmospheric Stability Class for 1992-1996 SRS H-Area Meteorological Tower Data (continued)

Stability Class B Number of Hourly Observations							
Winds From	**Wind Speed (mph)**						
	1-3	**4-7**	**8-12**	**13-18**	**19-24**	**25+**	**Total**
N	9	104	94	7	0	0	214
NNE	13	160	251	75	4	0	503
NE	13	187	283	54	0	0	537
ENE	12	191	292	19	0	0	514
E	5	154	142	18	0	0	319
ESE	2	111	103	11	0	0	227
SE	1	82	71	20	0	0	174
SSE	5	92	82	19	1	0	199
S	5	114	137	16	0	0	272
SSW	6	107	145	39	1	0	298
SW	11	147	242	78	7	0	485
WSW	15	165	331	137	14	1	663
W	2	127	240	202	34	0	605
WNW	12	109	159	151	28	2	461
NW	13	69	68	40	6	0	196
NNW	8	72	77	13	1	0	171
TOTAL	132	1,991	2,717	899	96	3	5,838

Note: Total number of observations used for the 1992 to 1996 period = 43,848

Table 4-8. Joint Frequency Distribution of Wind Speed, Wind Direction, and Atmospheric Stability Class for 1992-1996 SRS H-Area Meteorological Tower Data (continued)

Stability Class C Number of Hourly Observations							
Winds From	**Wind Speed (mph)**						
	1-3	**4-7**	**8-12**	**13-18**	**19-24**	**25+**	**Total**
N	8	66	70	1	0	0	145
NNE	5	172	301	81	3	0	562
NE	4	322	655	203	1	0	1,185
ENE	8	218	376	90	2	0	694
E	5	173	292	37	3	0	510
ESE	4	104	194	38	0	0	340
SE	9	105	184	72	5	0	375
SSE	11	129	184	98	16	1	439
S	13	145	229	86	17	1	491
SSW	4	157	254	126	23	1	565
SW	6	187	326	179	23	0	721
WSW	5	213	341	203	35	1	798
W	4	148	340	321	78	3	894
WNW	7	124	248	270	45	3	697
NW	6	99	119	59	7	0	290
NNW	6	77	62	4	1	0	150
TOTAL	105	2,439	4,175	1,868	259	10	8,856

Note: Total number of observations used for the 1992 to 1996 period = 43,848

Table 4-8. Joint Frequency Distribution of Wind Speed, Wind Direction, and Atmospheric Stability Class for 1992-1996 SRS H-Area Meteorological Tower Data (continued)

Stability Class D Number of Hourly Observations							
Winds From	Wind Speed (mph)						
	1-3	4-7	8-12	13-18	19-24	25+	Total
N	4	38	54	0	1	0	97
NNE	10	109	228	40	0	0	387
NE	0	257	718	82	2	0	1,059
ENE	7	151	417	36	0	0	611
E	9	136	354	24	0	0	523
ESE	5	118	307	25	0	0	455
SE	6	147	368	55	1	0	577
SSE	7	163	491	203	14	0	878
S	7	182	648	190	10	0	1,037
SSW	10	170	459	106	9	0	754
SW	7	166	554	105	6	0	838
WSW	6	146	558	53	1	0	764
W	3	133	444	55	10	12	657
WNW	3	98	384	48	2	2	537
NW	5	114	218	31	0	0	368
NNW	11	92	86	2	0	0	191
TOTAL	100	2,220	6,288	1,055	56	14	9,733

Note: Total number of observations used for the 1992 to 1996 period = 43,848

Table 4-8. Joint Frequency Distribution of Wind Speed, Wind Direction, and Atmospheric Stability Class for 1992-1996 SRS H-Area Meteorological Tower Data (continued)

Stability Class E Number of Hourly Observations							
Winds From	**Wind Speed (mph)**						
	1-3	**4-7**	**8-12**	**13-18**	**19-24**	**25+**	**Total**
N	0	4	28	2	0	0	34
NNE	0	40	281	40	0	0	361
NE	2	123	474	27	0	0	626
ENE	0	48	355	40	1	0	444
E	0	34	274	29	0	0	337
ESE	0	70	272	24	0	0	366
SE	2	75	358	20	0	0	455
SSE	2	80	431	41	0	0	554
S	3	112	525	57	0	0	697
SSW	3	98	481	42	0	0	624
SW	1	84	466	85	0	0	636
WSW	0	88	489	30	2	0	609
W	2	58	276	8	6	0	350
WNW	0	59	205	7	1	0	272
NW	0	50	183	3	0	0	236
NNW	0	59	106	0	0	0	165
TOTAL	15	1,082	5,204	455	10	0	6,766

Note: Total number of observations used for the 1992 to 1996 period = 43,848

Table 4-8. Joint Frequency Distribution of Wind Speed, Wind Direction, and Atmospheric Stability Class for 1992-1996 SRS H-Area Meteorological Tower Data (continued)

Stability Class F Number of Hourly Observations							
Winds From	**Wind Speed (mph)**						
	1-3	**4-7**	**8-12**	**13-18**	**19-24**	**25+**	**Total**
N	0	3	10	0	0	0	13
NNE	0	8	98	16	0	0	122
NE	0	10	82	10	0	0	102
ENE	0	5	32	12	0	0	49
E	0	2	44	5	0	0	51
ESE	0	12	68	14	0	0	94
SE	0	9	80	7	0	0	96
SSE	0	11	74	6	0	0	91
S	0	15	96	6	0	0	117
SSW	0	14	71	5	0	0	90
SW	0	10	93	11	0	0	114
WSW	1	21	120	10	0	0	152
W	0	1	29	6	0	0	36
WNW	0	5	28	0	0	0	33
NW	0	8	20	2	0	0	30
NNW	0	16	26	1	0	0	43
TOTAL	1	150	971	111	0	0	1,233

Note: Total number of observations used for the 1992 to 1996 period = 43,848

Table 4-8. Joint Frequency Distribution of Wind Speed, Wind Direction, and Atmospheric Stability Class for 1992-1996 SRS H-Area Meteorological Tower Data (continued)

Stability Class G Number of Hourly Observations							
Winds From	**Wind Speed (mph)**						
	1-3	**4-7**	**8-12**	**13-18**	**19-24**	**25+**	**Total**
N	0	0	1	0	0	0	1
NNE	0	2	7	0	0	0	9
NE	0	0	5	0	0	0	5
ENE	0	0	0	1	0	0	1
E	0	0	1	0	0	0	1
ESE	0	0	6	1	0	0	7
SE	0	0	5	2	0	0	7
SSE	0	0	5	0	0	0	5
S	0	0	8	0	0	0	8
SSW	0	0	5	2	0	0	7
SW	0	1	3	0	0	0	4
WSW	0	0	8	0	0	0	8
W	0	1	0	1	0	0	2
WNW	0	0	1	0	0	0	1
NW	0	0	1	0	0	0	1
NNW	0	2	1	0	0	0	3
TOTAL	0	6	57	7	0	0	70

Note: Total number of observations used for the 1992 to 1996 period = 43,848

Table 4-9. Fujita Tornado Intensity Scale

	Classification	Wind Speed (Mph)	Description of Damage
F0	Gale Tornado	40 - 72	Light damage. Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.
F1	Moderate Tornado	73 - 112	Moderate damage. The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	Significant Tornado	113 - 157	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.
F3	Severe Tornado	158 - 206	Severe damage. Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off ground and thrown.
F4	Devastating Tornado	207 - 260	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
F5	Incredible Tornado	261 - 318	Incredible damage. Strong frame houses lifted off foundation and carried considerable distances to disintegrate; automobile-sized missiles fly through the air in excess of 100 meters; trees debarked; steel-reinforced concrete structures badly damaged.
F6	Inconceivable Tornado	319 - 379	These winds are very unlikely. The small area of damage they might produce would probably not be recognizable along with the mess produced by the F4 and F5 wind that would surround the F6 winds. Missiles, such as cars and refrigerators, would do serious secondary damage that could not be directly identified as F6 damage. If this level is ever achieved, evidence for it might only be found in some manner of ground swirl pattern, for it may never be identifiable through engineering studies.

Table 4-10. Comparison of Ambient Air Concentrations from SRS Sources With Most Stringent Applicable Standards or Guidelines, 1994

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a] (µg/m³)	Concentration (µg/m³)
Criteria pollutants			
Carbon monoxide	8 hours	10,000[b]	632
	1 hour	40,000[b]	5,010
Nitrogen dioxide	Annual	100[b]	8.8
Ozone	8 hours	157[c]	(d)
PM_{10}	Annual	50[b]	4.8
	24 hours	150[b]	80.6
$PM_{2.5}$	3-year annual	15[c]	(e)
	24 hours (98th percentile over 3 years)	65[c]	(e)
Sulfur dioxide	Annual	80[b]	16.3
	24 hours	365[b]	215
	3 hours	1,300[b]	690
Lead	Calendar quarter	1.5[b]	<0.01
Other regulated pollutants			
Gaseous fluoride	30 days	0.8[f]	(g)
	7 days	1.6[f]	0.11
	24 hours	2.9[f]	0.60
	12 hours	3.7[f]	241
Total suspended particulates	Annual	75[f]	43.3

PM – particulate matter

Table 4-10. Comparison of Ambient Air Concentrations from SRS Sources With Most Stringent Applicable Standards or Guidelines, 1994 (continued)

Notes:

[a] The more stringent of the federal and state standards is presented if both exist for the averaging period. The National Ambient Air Quality Standards (NAAQS) (40 CFR Part 50), other than those for ozone, particulate matter, and lead, and those based on annual averages, are not to be exceeded more than once per year. The 1-hr ozone standard is attained when the expected number of days per year with maximum hourly average concentrations above the standard is 1. The 1-hr ozone standard applies only to non-attainment areas. The 8-hr ozone standard is attained when the 3-year average of the annual fourth-highest daily maximum 8-hr average concentration is less than or equal to 157 $\mu g/m^3$. The 24-hr particulate matter standard is attained when the expected number of days with a 24-hr average concentration above the standards is 1. The annual arithmetic mean particulate matter standard is attained when the expected annual arithmetic mean concentration is less than or equal to the standard.

[b] Federal and state standard.

[c] Federal standard.

[d] Not directly emitted or monitored by the site.

[e] No data are available with which to assess $PM_{2.5}$ concentrations.

[f] State standard.

[g] No concentration reported.

Note: The NAAQS also includes standards for lead. No sources of lead emissions have been identified for any of the alternatives presented in Chapter 4. Emissions of other air pollutants not listed here have been identified at SRS but are not associated with any of the alternatives evaluated. These other air pollutants are quantified in the S&D PEIS (DOE 1996b). EPA recently revised the ambient air quality standards for particulate matter and ozone. The new standards, finalized on July 18, 1997, changed the ozone primary and secondary standards from a 1-hr concentration of 235 $\mu g/m^3$ (0.12 ppm) to an 8-hr concentration of 157 $\mu g/m^3$ (0.08 ppm). During a transition period while states are developing state implementation plan revisions for attaining and maintaining these standards, the 1-hr ozone standard will continue to apply in non-attainment areas (EPA 1997a). The 8-hr standard cannot be enforced at this time due to legal challenges. For particulate matter, the current annual standard is retained, and two PM standards are added. These standards are set at a 15-$\mu g/m^3$ 3-year annual arithmetic mean based on community-oriented monitors and a 65-$\mu g/m^3$ 3-year average of the 98th percentile of 24-hr concentrations at population-oriented monitors. The revised 24-hr standard is based on the 99th percentile of 24-hr concentrations. The existing standards will continue to apply in the interim period (EPA 1997b). Values may differ from those of the source document due to rounding.

Source: DOE 1998a, 1998b; 40 CFR Part 50; SCDHEC 1999a.

Table 4-11. Threatened or Endangered Species Potentially Occurring in the Vicinity of F Area

Common Name	Scientific Name	Federal Status	State Status
Birds			
Bald eagle	*Haliaeetus leucocephalus*	Threatened	Endangered
Red-cockaded woodpecker	*Picoides borealis*	Endangered	Endangered
Wood stork	*Mycteria americana*	Endangered	Endangered
Plants			
Oconee azalea	*Rhododendron flammeum*	Not listed	Species of Concern
Smooth purple coneflower	*Echinacea laevigata*	Endangered	Endangered
Reptiles			
American alligator	*Alligator mississippiensis*	Considered Threatened (S/A)[a]	Not listed

[a] Protected under the Similarity of Appearance Provision of the Endangered Species Act.

Source: "Threatened and Endangered Species at SRS" (Osteen 2000)

Table 4-12. Population Distribution – 1990

	5 to 10 mi (3 to 16 km)	10 to 20 mi (16 to 32 km)	20 to 30 mi (32 to 48 km)	30 to 40 mi (48 to 64 km)	40 to 50 mi (64 to 80 km)	TOTAL
N	2,072	21,439	9,195	6,687	10,462	49,855
NNE	235	1,782	2,081	4,100	17,085	25,283
NE	8	1,545	2,730	5,240	11,442	20,965
ENE	0	3,277	4,657	5,189	31,845	44,968
E	1	4,773	5,086	10,908	5,512	26,280
ESE	8	2,166	2,577	2,839	2,891	10,481
SE	0	563	4,543	6,387	10,432	21,925
SSE	0	364	683	1,046	2,507	4,600
S	0	545	1,596	6,730	3,560	12,431
SSW	99	780	2,186	4,805	2,591	10,461
SW	110	1,171	4,578	2,093	2,711	10,663
WSW	101	1,523	4,472	2,586	6,149	14,831
W	241	6,031	10,519	8,946	6,959	32,696
WNW	1,380	5,066	129,791	32,475	14,790	183,502
NW	1,102	15,212	81,259	9,385	3,296	110,254
NNW	1,171	19,728	11,205	6,884	3,344	42,332
TOTAL	6,528	85,965	277,158	116,300	135,576	621,527

Source: SRS GSAR (WSRC 1999a)

Table 4-13. Projected Population Distribution – 2000

	5 to 10 mi (3 to 16 km)	10 to 20 mi (16 to 32 km)	20 to 30 mi (32 to 48 km)	30 to 40 mi (48 to 64 km)	40 to 50 mi (64 to 80 km)	TOTAL
N	2,362	24,440	10,482	7,623	11,927	56,834
NNE	268	2,031	2,372	4,674	19,477	28,822
NE	9	1,761	3,112	5,974	13,044	23,900
ENE	0	3,736	5,309	5,915	36,303	51,263
E	1	5,441	5,798	12,435	6,284	29,959
ESE	9	2,469	2,938	3,236	3,296	11,948
SE	0	642	5,179	7,281	11,892	24,994
SSE	0	415	779	1,192	2,858	5,244
S	0	621	1,819	7,672	4,058	14,170
SSW	10	889	2,492	5,478	2,954	11,823
SW	125	1,335	5,219	2,386	3,091	12,156
WSW	115	1,736	5,098	2,948	7,010	16,907
W	275	6,875	11,992	10,198	7,933	37,273
WNW	1,573	5,775	147,962	37,022	16,861	209,193
NW	1,256	17,342	92,635	10,699	3,757	125,689
NNW	1,335	22,490	12,774	7,848	3,812	48,259
TOTAL	7,338	97,998	315,960	132,581	154,557	708,434

Source: SRS GSAR (WSRC 1999a)

Table 4-14. Projected Population Distribution – 2010

	5 to 10 mi (3 to 16 km)	10 to 20 mi (16 to 32 km)	20 to 30 mi (32 to 48 km)	30 to 40 mi (48 to 64 km)	40 to 50 mi (64 to 80 km)	TOTAL
N	2,693	27,862	11,950	8,690	13,596	64,791
NNE	305	2,316	2,704	5,328	22,204	32,857
NE	10	2,008	3,548	6,810	14,870	27,246
ENE	0	4,259	6,052	6,744	41,386	58,441
E	1	6,203	6,610	14,176	7,163	34,153
ESE	10	2,815	3,349	3,690	3,757	13,621
SE	0	732	5,904	8,301	13,557	28,494
SSE	0	473	888	1,359	3,258	5,978
S	0	708	2,074	8,746	4,627	16,155
SSW	12	1,014	2,841	6,245	3,367	13,479
SW	143	1,522	5,950	2,720	3,523	13,858
WSW	131	1,979	5,812	3,361	7,991	19,274
W	313	7,838	13,670	11,626	9,044	42,491
WNW	1,793	6,584	168,676	42,205	19,221	238,479
NW	1,432	19,770	105,604	12,197	4,283	143,286
NNW	1,522	25,639	14,562	8,946	4,346	55,015
TOTAL	8,365	111,722	360,194	151,144	176,193	807,618

Source: SRS GSAR (WSRC 1999a)

Table 4-15. Projected Population Distribution – 2020

	5 to 10 mi (3 to 16 km)	10 to 20 mi (16 to 32 km)	20 to 30 mi (32 to 48 km)	30 to 40 mi (48 to 64 km)	40 to 50 mi (64 to 80 km)	TOTAL
N	3,070	31,763	13,623	9,907	15,500	73,863
NNE	348	3,640	3,083	6,074	25,312	38,457
NE	12	2,289	4,045	7,763	16,952	31,061
ENE	0	4,855	6,900	7,688	47,180	66,623
E	1	7,071	7,535	16,161	8,166	38,934
ESE	12	3,209	3,818	4,206	4,283	15,528
SE	0	834	6,731	9,463	15,455	32,483
SSE	0	539	1,012	1,550	3,714	6,815
S	0	807	2,365	9,971	5,274	18,417
SSW	13	1,156	3,239	7,119	3,839	15,366
SW	163	1,735	6,783	3,101	4,016	15,798
WSW	150	2,256	6,625	3,831	9,110	21,972
W	357	8,935	15,584	13,254	10,310	48,440
WNW	2,045	7,506	192,291	48,113	21,912	271,867
NW	1,633	22,537	120,389	13,904	4,883	163,346
NNW	1,735	29,228	16,601	10,199	4,954	62,717
TOTAL	9,539	128,360	410,624	172,304	200,860	921,687

Source: SRS GSAR (WSRC 1999a)

Table 4-16. Projected Population Distribution – 2030

	5 to 10 mi (3 to 16 km)	10 to 20 mi (16 to 32 km)	20 to 30 mi (32 to 48 km)	30 to 40 mi (48 to 64 km)	40 to 50 mi (64 to 80 km)	TOTAL
N	3,500	36,210	15,530	11,294	17,670	84,204
NNE	397	3,010	3,515	6,925	28,857	42,704
NE	14	2,609	4,611	8,850	19,325	35,409
ENE	0	5,535	7,865	8,764	53,785	75,949
E	2	8,061	8,590	18,423	9,310	44,386
ESE	14	3,658	4,352	5,466	488	13,978
SE	0	951	7,673	7,409	17,619	33,652
SSE	0	615	1,154	1,767	4,234	7,770
S	0	920	2,696	11,367	6,013	20,996
SSW	15	1,317	3,692	8,115	4,376	17,515
SW	186	1,978	7,732	3,535	4,579	18,010
WSW	171	2,572	7,553	4,368	10,385	25,049
W	407	10,186	17,766	15,109	11,753	55,221
WNW	2,331	8,556	219,212	54,849	24,980	309,928
NW	1,861	25,692	137,243	15,851	5,567	186,214
NNW	1,978	33,320	18,925	11,627	5,648	71,498
TOTAL	10,876	145,190	468,109	193,719	224,589	1,042,483

Source: SRS GSAR (WSRC 1999a)

Table 4-17. Racial and Ethnic Mix of Local Area Population, 1997 (Estimated)

	Aiken County, SC	Barnwell County, SC	Burke County, GA	Georgia	South Carolina
Total Population	133,980	21,830	22,725	6,478,216	3,486,703
White	74.3%	56.0%	43.8%	71.0%	69.0%
Black	24.9%	43.7%	56.0%	26.9%	29.8%
American Indian, Eskimo or Aleut	0.2%	0.2%	0.1%	0.2%	0.3%
Asian or Pacific Islander	0.6%	0.1%	0.2%	1.1%	0.6%
Hispanic (any race)	1.0%	0.8%	0.5%	0.6%	0.3%

Source: *USA Counties*™ *1998, General Profile* (DOC 1998a)

Table 4-18. Public School Population within 10 Miles (16 km) of the MFFF

School	Location	Grades	1998 - 1999 Enrollment
Greendale Elementary	New Ellenton, SC	Pre-K through 5	426
Jackson Middle	Jackson, SC	6 through 8	517
New Ellenton Middle	New Ellenton, SC	6 through 8	263
Redcliff Elementary	Jackson, SC	Pre-K through 5	967
Silver Bluff High	Aiken, SC	9 through 12	914

Source: *South Carolina Education Profiles* (SCDE 1999)

Table 4-19. Year 2002 SRS Employees (approximate) by County of Residence R1

County	WSRC/ M&O	DOE-SR Operations	Savannah River Ecology Lab	WSI	Total	Percent
Aiken, SC	6,380	296	109	360	7,216	53.1
Columbia, GA	1,868	66	5	72	2,012	14.8
Richmond, GA	1,577	66	19	231	1,899	14.0
Barnwell, SC	863	11	3	64	947	7.0
Edgefield, SC	224	3	1	8	236	1.7
Other Counties	1,139	17	28	88	1,280	9.4
TOTAL	12,051	459	165	823	13,590	100

R1

Source: Personal Communication (Bozzone 2002) R1
NA – Not Available

Table 4-20. Economic and Unemployment Data for Counties Within 50 Miles (80 km) of the MFFF

County	1994 Per Capita Income	1993 Percent of Pop. Below Poverty	Unemployment Rate – 1996 (%)
South Carolina	$17,710	16.6	6.0
Aiken	$19,468	13.8	7.0
Allendale	$12,175	34.3	9.1
Bamberg	$13,253	27.9	9.9
Barnwell	$16,736	21.9	10.9
Colleton	$13,988	24.1	6.8
Edgefield	$15,076	17.4	7.4
Hampton	$14,595	24.4	7.3
Lexington	$20,111	9.8	3.3
McCormick	$12,500	21.1	10.2
Orangeburg	$14,932	25.6	10.4
Saluda	$15,316	17.7	6.6
Georgia	$20,212	16.8	4.6
Bulloch	$14,319	22.4	3.1
Burke	$14,270	29.2	16.0
Columbia	$17,810	7.7	4.1
Glascock	$16,417	16.1	9.0
Jefferson	$15,303	27.7	13.4
Jenkins	$14,098	25.2	4.7
Lincoln	$15,358	17.5	6.4
McDuffie	$16,422	20.7	9.3
Richmond	$19,251	21.9	7.3
Warren	$13,747	27.1	9.8

Source: *USA Counties™ 1998, General Profile* (DOC 1998a)

Table 4-21. Income and Poverty Data for the Three-County Local Area

County	1990 Population	1990 Per Capita Income	1989 % Population Below Poverty	1994 Per Capita Income	1993 % Below Poverty
Aiken, SC	120,940	$17,156	14.0	$19,468	13.8
Barnwell, SC	20,293	$13,397	21.8	$16,736	21.9
Burke, GA	20,579	$11,172	30.3	$14,270	29.2
Georgia	6,478,216	$17,123	14.7	$20,212	16.8
So. Carolina	3,487,714	$15,106	15.4	$17,710	16.6

Source: U.S. Census Bureau, 1990 US Census Data; Database: C90STF3C1.
USA Counties™ 1998, General Profile (DOC 1998a)

Table 4-22. 1997 Employment by Business Sector - Counties Within 50 Miles (80 km) of the MFFF

County	Agr., Forestry & Fishing	Mining	Construct.	Manuf.	Transp. & P.U.	Wholesale Trade	Retail Trade	Finance In., & RE	Services	Unclass.	Total
Aiken, SC	252	1,832	1,832	20,843	1,840	643	9,537	1,261	13,066	31	51,137
Allendale, SC	(A)	0	153	1563	(B)	(B)	351	58	318	(A)	2443
Bamberg, SC	35	0	70	1281	169	57	823	118	1041	0	3594
Barnwell, SC	(A)	0	300	3,403	396	(C)	1,290	103	994	(A)	6,961
Colleton, SC	86	(A)	531	1,965	349	496	2,408	486	2,002	(A)	8,323
Edgefield, SC	125	0	213	2,185	89	84	634	98	881	2	4,311
Hampton, SC	51	0	254	1,523	268	281	1,316	136	797	6	4,632
Lexington, SC	452	142	5,534	10,513	4,525	5,376	15,291	2,591	17,003	14	61,441
McCormick, SC	(A)	(A)	83	389	(A)	(B)	(E)	104	(E)	(A)	576
Orangeburg, SC	131	0	875	9,467	631	1,022	6,892	1,147	7,274	1	27,440
Saluda, SC	95	0	160	2,501	106	105	539	61	597	1	4,165
Bulloch, GA	100	0	1,082	3,270	381	718	5,231	615	3,414	16	14,827
Burke, GA	(B)	0	113	1,355	1,750	268	927	125	900	(A)	5,438
Columbia, GA	207	(B)	2,287	6,315	640	954	5,364	946	9,242	(A)	25,955
Emmanuel, GA	(A)	(A)	157	2,326	146	281	1,195	234	1,132	(A)	5,471
Glascock,GA	(A)	0	(A)	59	13	0	41	(A)	(C)	(A)	113
Jefferson, GA	86	382	160	2,198	176	203	832	182	602	1	4,822
Jenkins, GA	12	-	45	1,295	87	71	319	59	329	-	2,217
Lincoln, GA	(B)	(A)	83	847	73	40	251	(B)	183	(A)	1,477
McDuffie, GA	(B)	(B)	370	1,806	182	134	2,028	283	1,660	(A)	6,463
Richmond, GA	261	(B)	3,884	12,435	3,255	2,827	19,481	3,752	30,433	(B)	76,328
Screven, GA	(A)	0	103	1,340	54	89	516	101	584	(A)	2,787
Warren, GA	25	(A)	1	879	25	11	144	(A)	333	0	1,418

Notes to table: (A) - 0 to 19; (B) - 20 to 99; (C) - 100 to 249; (E) - 250 to 499.

Source: *1997 County Business Patterns* (DOC 1997)

Table 4-23. Sources of Radiation Exposure to Individuals in the SRS Vicinity Unrelated to SRS Operations

Source	Effective Dose Equivalent (mrem/yr)
Natural background radiation [a]	
Cosmic radiation	27
External radiation	28
Internal terrestrial radiation	40
Radon in homes (inhaled)	200[b]
Total	295
Anthropogenic background radiation [c]	
Diagnostic x rays and nuclear medicine	53
Weapons test fallout	<1
Air travel	1
Consumer and industrial products	10
Total	65
Total	360

[a] Source: *Savannah River Site Environmental Report for 1998* (Arnett and Mamatey 1999)

[b] An average for the United States.

[c] Source: *Ionizing Radiation Exposure of the Population of the United States* (NCRP 1987).

Table 4-24. Radiation Doses to the Public from Normal SRS Operations in 1999 (Total Effective Dose Equivalent)

	Atmospheric Releases		Liquid Releases		Total	
Members of the Public	**Standard[a]**	**Actual**	**Standard[a]**	**Actual[b]**	**Standard[c]**	**Actual**
Maximally exposed individual (mrem/yr)	10	0.06[d]	4	0.22[d]	100	0.28[e]
Population within 50 mi (80 km) (person-rem/yr)[f]	None	2.6[d]	None	4.0[d]	None	6.6[e]
Average individual within 50 mi (80 km) (mrem/yr)[g]	None	3.7E-03	None	5.6E-03	None	9.3E-03

[a] The 10-mrem/yr limit from airborne emissions is required by the Clean Air Act and Regulatory Guide 4.20, and the 4-mrem/yr limit is required by the Safe Drinking Water Act; for this ER document, the 4-mrem/yr value is conservatively assumed to be the limit for the sum of doses from all liquid pathways.

[b] Conservatively includes all water pathways, not just the drinking water pathway. The population dose includes contributions to Savannah River users downstream of SRS to the Atlantic Ocean.

[c] The total dose of 100 mrem/yr is the limit for all pathways combined (10 CFR Part 20, Subpart D).

[d] Source: SRS GSAR (WSRC 1999a).

[e] Calculated as the sum of the dose due to atmospheric releases and the dose due to liquid releases.

[f] About 708,450 (see Table 4-2) in 2000. For liquid releases, an additional 85,000 water users in Port Wentworth, Georgia, and Beaufort, South Carolina (about 98 mi [160 km] downstream), are included in the assessment.

[g] Obtained by dividing the population dose by the number of people living within 50 mi (80 km) of the site for atmospheric releases; for liquid releases the number of people includes water users who live more than 50 mi (80 km) downstream of the site.

Source: *Savannah River Site Environmental Report for 1998* (Arnett and Mamatey 1999).

Table 4-25. Radiation Doses to Workers from Normal SRS Operations (Total Effective Dose Equivalent)

	Onsite Releases and Direct Radiation	
Occupational Personnel	**Standard** [a]	**Actual**
Average radiation worker (mrem/yr)	5,000	46[b]
Total workers (person-rem/yr) [c]	NA	625[d]

R1

[a] The radiological limit for an individual worker is 5,000 mrem/yr (10 CFR Part 835). However, DOE's goal is to maintain radiological exposure as low as reasonably achievable. It has therefore established an administrative control level of 2,000 mrem/yr (DOE 1994b); DOE must make reasonable attempts to maintain worker doses below this level.

[b] Source: DOE, 1999e. DOE/EH-629, *DOE Occupational Radiation Exposure 1999 Report,* Exhibit 3-17, Collective TEDE and Number of Individuals with Measurable TEDE by site. R1

[c] About 13,590 in 2002.

[d] Calculated as average worker dose times total number of workers receiving a measurable TEDE. R1

Table 4-26. Existing Infrastructure in the Vicinity of the MFFF Site

Resource	F-Area Usage	F-Area Capacity	SRS Usage	SRS Capacity
Electricity Consumption (MWh/yr)	63,000	700,800	370,000	4,400,000
Electricity peak load (MW)	10	64	60	500
Domestic Water (mill L/yr)	378	890	1,440	11,166
Natural gas (m^3/yr)	0	0	0	0

Source: SPD EIS (DOE 1999c), Tables 3-48 and 3-49

R1

Table 4-27. Waste Generation Rates and Inventories at SRS

Waste Type	Generation Rate (yd^3/yr)	Inventory (m^3)	Projected 2002 Generation Rate (m^3/yr)
TRU[a]			616
Contact handled	83	14,400	
Remotely handled	0	1	
LLW	10,615	12,000	10,000
Mixed LLW			46
RCRA	22	2500	
TSCA	0	30	
Hazardous	37	174[b]	90
Nonhazardous			
Liquid[c] (gal/yr)	90,867,868	NA[e]	Not available
Solid[d]	40,000	NA[e]	Not available

[a] Includes mixed TRU wastes.
[b] Information represents FY2001 generation/inventory.
[c] This includes only sanitary wastewater, not process wastewater.
[d] Waste volumes as delivered to the sanitary landfill.
[e] Generally, nonhazardous wastes are not held in long-term storage.

R1 R1 R1

Key: LLW, low-level radioactive waste; NA, not applicable; RCRA, Resource Conservation and Recovery Act; TRU, transuranic; TSCA, Toxic Substances Control Act.

Source: *Integrated Data Base Report - 1995: U.S. Spent Nuclear Fuel and Radioactive Waste Inventories, Projections, and Characteristics* (DOE 1996a), except for hazardous and nonhazardous solid waste (DOE 1996b) and nonhazardous liquid waste (Sessions 1997b), 2001 projections (Mottel 2000).