Chapter 4: **Nonradiological Environmental Monitoring Program**

The purpose of the Savannah River Site (SRS) Nonradiological Environmental Monitoring Program is twofold: it confirms the Site is complying with state and federal regulations and permits, and it monitors any effects SRS has on the environment, both onsite and offsite. SRS monitors permitted point-source discharges from onsite facilities for nonradiological parameters to ensure it is complying with regulations and permit requirements. SRS collects and analyzes environmental media such as air, water, sediment, and fish for nonradiological parameters to evaluate the effect of Site operations on the environment.

2023 Highlights

Effluent Releases

- Nonradiological effluent releases for all categories except industrial wastewater met permit limits and applicable standards.
- SRS reported only two exceptions out of 2,328 analyses at SRS National Pollutant Discharge Elimination System (NPDES) industrial wastewater outfalls, a greater than 99% compliance rate.
- All SRS industrial stormwater outfalls under the South Carolina general industrial stormwater permit were compliant.

Onsite Drinking Water

All SRS drinking water systems complied with South Carolina Department of Health and Environmental Control and U.S. Environmental Protection Agency water quality standards.

Surveillance Program

- Due to SRS's high rate of compliance, industrial wastewater and industrial stormwater discharges are not significantly affecting the water quality of onsite streams and the Savannah River.
- Sediment results from SRS streams, stormwater basins, and the Savannah River were consistent with the background control locations and were comparable with historical levels.
- Samples of fish flesh were collected from the Savannah River and results were consistent with historical levels.

4.1 INTRODUCTION

Environmental monitoring programs at the Savannah River Site (SRS) examine both radiological and nonradiological constituents that Site activities could release into the environment. This chapter summarizes nonradiological monitoring at SRS. Chapter 5, *Radiological Environmental Monitoring Program,* discusses the radiological monitoring.

The SRS Nonradiological Environmental Monitoring Program collects and analyzes samples from numerous locations throughout SRS and the surrounding area. The program has two focus areas: 1) effluent monitoring, and 2) environmental surveillance. The objective of the effluent monitoring program is to demonstrate the Site is complying with permits, and the focus of the environmental surveillance program is to assess the environmental impacts of Site operations on the surrounding area. SRS determines sampling frequency and analyses based on permit-mandated monitoring requirements and federal regulations.

Chapter 4—Key Terms

Effluent *is a release to the environment of treated or untreated water or air from a pipe or a stack. Liquid effluent flows into a body of water, such as a stream or lake. Airborne effluent (also called emission) discharges into the air.*

Environmental surveillance *is the collection of samples beyond the effluent discharge points and from the surrounding environment.*

Outfall *is a place where treated or untreated water flows out of a pipe or ditch.*

SRS conducts nonradiological environmental monitoring on the following categories:

- Atmospheric (airborne emissions and precipitation with a special focus on mercury deposition)
- Water (wastewater, stormwater, sludge, onsite drinking water, and river and stream water quality)
- Sediment for rivers, streams, and stormwater basins
- Fish

Figure 4-1 shows the types and typical locations of the nonradiological sampling SRS performs. Influenced sampling media is media that Site operations could impact. Uninfluenced sampling media is media that Site operations would not likely impact, for example, sediment upriver of Site facilities.

Section 8.4, *Environmental Monitoring Program QA Activities,* and Section 8.5, *Environmental Monitoring Program QC Activities,* summarize the quality assurance (QA) and quality control (QC) practices that support the sampling and analysis reported in this chapter. Appendix Table B-1 of this document summarizes the nonradiological surveillance sampling media and frequencies.

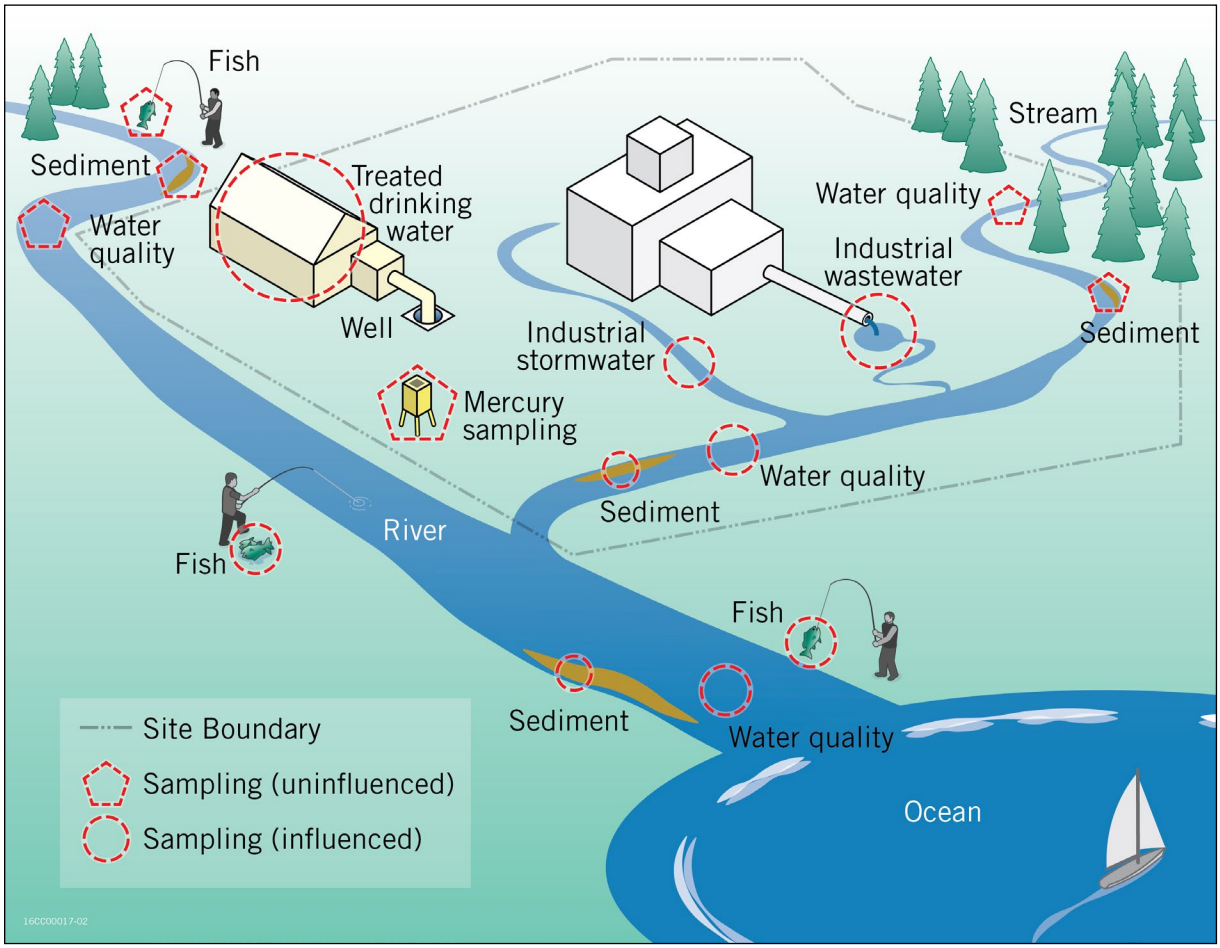

Figure 4-1 Types and Typical Locations of Nonradiological Sampling

4.2 CALCULATED AIR EMISSIONS

Airborne contaminants can present a risk to public health and the environment. Thus, identifying and quantifying these contaminants is essential to a nonradiological monitoring program. The South Carolina Department of Health and Environmental Control (SCDHEC) regulates nonradioactive air pollutant emissions from SRS sources. The regulations list pollutants, compliance limits, and the analytical methods or test procedures approved to demonstrate compliance.

SRS uses nonradioactive volatile chemicals (gasoline and toluene), fuels, and combustion products that can adversely affect the environment if released into the air in sufficient quantities. However, the Site uses most of these materials in very small quantities, and the environmental impact from their potential release is negligible. Due to the nature and quantity of potential air emissions, regulators do not require SRS to sample or monitor the ambient air for chemical pollutants. Following SCDHEC requirements, SRS uses process data to calculate emissions.

Many of the applicable regulatory standards are source-dependent, meaning they are applicable to certain types of industries, processes, or equipment. The SCDHEC-issued Title V operating permit provides the source-specific limits for operating facilities, source sampling, testing, monitoring, and

reporting frequency. SRS demonstrates it is complying with these regulations by performing air dispersion modeling and submitting to SCDHEC an emissions inventory of air pollutant emissions. SRS uses SCDHEC- and U.S. Environmental Protection Agency (EPA)-approved calculations that include source-operating parameters—such as operating hours, process throughput, and EPA-approved emission factors—to determine facility source emissions. SRS then compares the total actual annual emissions for each source to the emission limits contained in applicable permits. Chapter 3, *Compliance Summary*, Section 3.3.6.4, *Air Emissions Inventory,* discusses emissions reporting.

4.3 WATER MONITORING

SRS nonradiological water monitoring includes collecting water (wastewater, stormwater, sludge, drinking water, and surface water [river and stream]) and sediment samples as well as performing field measurements on various water sources onsite and from the Savannah River. The sample results enable SRS personnel to evaluate whether there is long-term buildup of pollutants downstream of discharge points and determine whether SRS is complying with permit requirements. SRS also collects and analyzes fish from the Savannah River to evaluate metal uptake in the flesh. This section does not discuss the results of SRS groundwater monitoring, as Chapter 7, *Groundwater Management Program,* covers this information.

4.3.1 Wastewater, Stormwater, and Sludge Monitoring

SRS monitors nonradiological liquid discharges to surface waters through the National Pollutant Discharge Elimination System (NPDES) program, as mandated by the Clean Water Act. Nonradiological surface water monitoring primarily consists of sampling discharges (industrial wastewater and industrial stormwater) associated with SRS NPDES-permitted outfalls. The NPDES permit program controls water pollution by regulating point sources that discharge pollutants into Waters of the United States.

SCDHEC administers the NPDES permit program and is responsible for permitting, compliance tracking, monitoring, and enforcing the program. The permits SCDHEC issues to SRS provide specific requirements for sampling locations, collection methods, analytes required at an individual outfall, monitoring frequency, permit limits for each analyte, and analytical and reporting methods.

SRS collects NPDES samples in the field according to 40 Code of Federal Regulations (CFR) 136, *Guidelines Establishing Test Procedures for the Analysis of Pollutants*. This document lists specific methods for sample collection and preservation and acceptable analytical methods for the type of pollutant.

A Refrigerated Sampler Allows for Remote Temperature Verification.

4.3.1.1 Wastewater

SRS monitored 21 industrial wastewater outfalls in 2023 for physical and chemical properties, including flow, dissolved oxygen, acidity (pH), temperature, ammonia, biochemical oxygen demand, fecal coliform, metals, oil and grease, volatile organic compounds, and total suspended solids (TSS). Figure 4-2 shows these locations. The permit specifies how often SRS is to monitor the outfalls; the type of process water and its treatment determine the frequency (daily, weekly, monthly, or quarterly). SRS collected either grab samples (individual samples collected all at one time) or composite samples (samples collected over a specific period, typically 24 hours). The permit states how SRS is to operate when collecting samples to guarantee the integrity of the sample, and results of the samples are expected to not exceed minimum and maximum values. If an analytes result is lower than the permitted minimum value, or higher than the permitted maximum value, a permit limit exceedance occurs. An exceedance could potentially result in a Notice of Violation (NOV), which is a formal response from the state requiring certain steps to correct the violations. Also, the permit specifies how samples are to be collected, and if SRS deviates from those methods i.e. equipment failure, water treatment failure, etc. a permit violation can occur. To improve sample collection methods and mitigate potential permit infractions, SRS has continued to utilize new technology to more efficiently collect samples and improve QA and QC methods. For example, a refrigerated sampler coupled with a modem has allowed personnel to verify the sample temperature and communicate with the equipment by remote control. In addition, SRS collected QC samples as an internal check to ensure representative data. Section 8.5, *Environmental Monitoring Program QC Activities,* summarizes the QC sample results.

SCDHEC assesses the SRS NPDES Industrial Wastewater program during Comprehensive Evaluation Inspections or Comprehensive Sample Inspections. The evaluation includes discharge sampling; records and procedures review; personnel interviews; and outfall, treatment facility, and land application site inspections. SCDHEC did not conduct any inspections in 2023.

4.3.1.1.1 Wastewater Results Summary

SRS reports NPDES industrial wastewater analytical results to SCDHEC through monthly Discharge Monitoring Reports (DMR). The Site reported only two permit exceptions for the 2,328 analyses performed during 2023, a 99.9% compliance rate. One exception was due to a maximum flow exceedance at outfall K-12 from heavy rains, and the other was for not conducting Whole Effluent Toxicity sampling, for which SRS received an NOV. SRS conducted the sampling and reported the results in its October DMR. SRS also completed corrective actions to prevent reoccurrence.

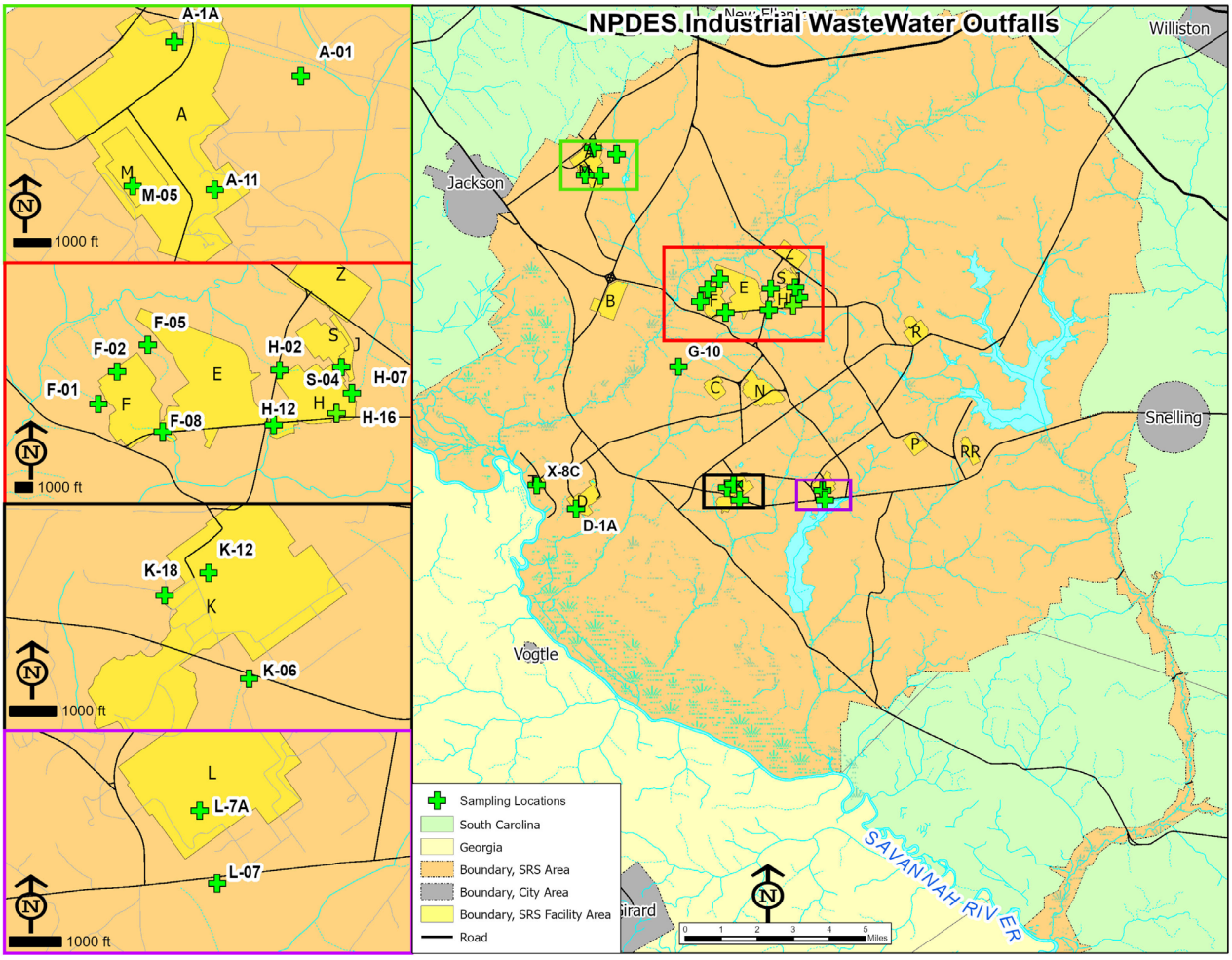

Figure 4-2 NPDES Industrial Wastewater Outfall Sampling Locations

4.3.1.2 Stormwater

SCDHEC issued a new five-year Industrial Stormwater General Permit, effective July 2022. SRS has 33 outfalls under this permit, as illustrated in Figure 4-3. Industrial stormwater monitoring consists of four components: effluent limitations guidelines monitoring, impaired waters monitoring, benchmark monitoring, and visual assessment.

SRS typically collects stormwater samples during qualifying rain (flow) events, characterized by two conditions: 1) at least 72 hours have elapsed since the previous flow event, and 2) the sample collection should occur during the first 30 minutes of the flow event. For benchmark samples, SRS continues to use wireless technology to send immediate text notifications of rain events and to start automated samplers. For visual assessments, SRS uses sample bottles installed in some outfalls that fill when the flow reaches the bottle inlet. These practices allow SRS to comply with the SCDHEC permit requirement of sampling within 30 minutes of stormwater flow. SRS collects grab samples in a few locations where automated installations are not possible due to the construction of the outfall.

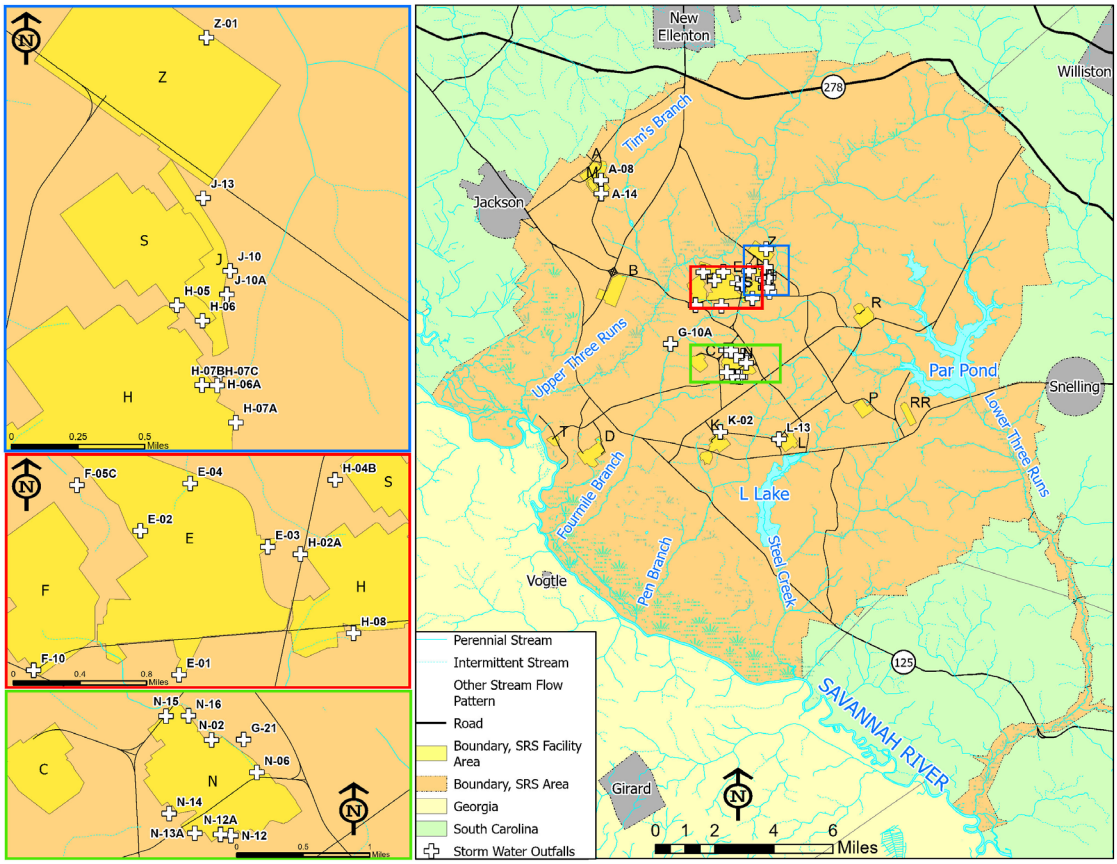

Figure 4-3 NPDES Industrial Stormwater Outfall Sampling Locations

Effluent Limitations Guidelines Monitoring—The EPA develops effluent limitations guidelines on an industry-by-industry basis. In the SCDHEC Industrial Stormwater General Permit, certain outfall sectors have these specific limitations imposed. SRS has one outfall, H-07B, that falls in a regulated sector. The outfall's watershed includes a coal storage pile area at a decommissioned steam electric-generating facility. The stormwater runoff collects into a basin that was designed for at least a 10-year/24-hour rainfall event. Although the outfall has not discharged since 1991, if it does discharge, SRS will sample for pH. SRS submits an annual report to SCDHEC that indicates the outfall has not discharged in the previous 12 months.

Impaired Waters Monitoring—A waterbody is impaired if it has been identified as not meeting applicable state water quality standards. There are two segments of streams impaired due to *Escherichia coli* (*E. coli*) that occur within SRS. However, since SRS industrial activities do not contribute to the impairment, no sampling is required.

Benchmark Monitoring—Benchmark outfalls are divided into groups with substantially identical effluents. Substantially identical outfalls are two or more outfalls that have discharges of effluents based upon similarities that include the following:

- General industrial activities and control measures
- Exposed materials that may significantly contribute pollutants to stormwater
- Runoff coefficients of the drainage areas

Each year, one outfall is selected from each group to be the designated representative outfall for the required quarterly sampling. The representative outfall in each group rotates annually so that each outfall is the representative outfall at least once during the five-year permit time period.

SRS must monitor for any benchmark parameter (for example, ammonia, arsenic, cadmium, chemical oxygen demand, copper, cyanide, *E. coli*, lead, mercury, nitrate-nitrite as N, selenium, silver, total suspended solids [TSS], and zinc) specified for the outfall's assigned industrial sector(s). Not all outfalls require benchmark monitoring. For those outfalls that do, benchmark sampling for an analyte must be performed until the average of four consecutive quarters meets the analyte's benchmark limit. The requirement is then met until the fourth year of the five-year permit, when it must be repeated. During 2023, all but two outfalls that were sampled satisfied this requirement.

Visual Assessment—Visual assessment outfalls are also divided into groups with substantially identical effluents; one outfall is selected from each group each year to be the designated representative outfall for the required quarterly sampling. Trained Site employees collect samples and inspect them for color, odor, clarity, solids (floating, settled, suspended), foam, oil sheen, and other indicators of stormwater pollution. The inspector completes visual assessment forms to document the assessment results.

A Teledyne ISCO Sampler Jug is Removed Before Being Taken to the Lab for Analysis.

4.3.1.2.1 Stormwater Results Summary

SRS monitored all industrial stormwater outfalls according to permit requirements.

Effluent Limitations Guidelines Monitoring—SRS did not perform sampling at the one outfall (H-07B) that required effluent sampling because there was no discharge in 2023. SRS reported results to SCDHEC in a required annual Discharge Monitoring Report.

Benchmark Monitoring—SRS met benchmark sampling requirements at all but two outfalls sampled in 2023. Although they fulfilled benchmark sampling requirements for other analytes, N-06 and N-12A did not meet the benchmark limits for zinc and copper, respectively. However, corrective measures (oyster shells and bone char installation) implemented in 2017, 2018, 2022, and 2023 are expected to be effective for several years. Oyster shells and bone char adsorb metals to reduce concentrations in the stormwater. Benchmark sampling at Outfalls G-10A and Z-01 was not performed because these outfalls did not discharge in 2023.

Visual Assessment—For visual assessment sampling, SRS grouped substantially identical outfalls—27 of the 33 outfalls in 8 groupings—and designated one outfall to represent their group for 2023. SRS sampled the remaining six outfalls individually and not in groups. In 2023, Site personnel visually assessed the water of these outfalls for indicators of stormwater pollution. Visual assessments identified no industrial impacts.

4.3.1.3 Sludge

SRS disposes of sludge from the Central Sanitary Wastewater Treatment Facility according to the requirements in the SCDHEC-issued NPDES land application permit. In doing so, the Site must sample the sludge to confirm it has met the permit's standards before applying the sludge to the designated pine forest land. SRS did not perform sludge land application from the Central Sanitary Wastewater Treatment Facility in 2023.

4.3.2 Onsite Drinking Water Monitoring

SRS uses groundwater sources to supply drinking water to onsite facilities. The A-Area treatment plant supplies most of SRS's drinking water. The Site also has four smaller drinking water facilities regulated by SCDHEC, each serving fewer than 25 people.

SCDHEC requires SRS to collect 10 bacteriological samples each month from the A-Area Domestic Water Distribution System to ensure that domestic water meets SCDHEC and EPA bacteriological drinking water quality standards. SRS surpasses this requirement by collecting at least 15 samples each month from various locations throughout the system.

4.3.2.1 Onsite Drinking Water Results Summary

All drinking water bacteriological samples that SRS collected in 2023 met the state and federal drinking water quality standards.

4.3.3 Surface (River and Stream) Water Quality Surveillance

South Carolina Regulation 61-69, *Classified Waters,* classifies SRS streams and the Savannah River as "freshwaters." Freshwaters, as defined in Regulation 61-68, *Water Classifications and Standards,* (SCDHEC 2014), support the following:

- Primary and secondary contact recreation and as a drinking water source after conventional treatment in accordance with SCDHEC requirements
- Fishing and the survival and propagation of a balanced indigenous aquatic community of fauna and flora
- Industrial and agricultural uses

SRS surveys river and stream water quality to identify: 1) any degradation that could be attributable to the water discharges NPDES permits regulate, and 2) materials coming from inadvertent releases from sources other than routine release points.

SRS sampled 10 onsite streams and 5 Savannah River locations for various physical and chemical properties, including temperature, hardness, dissolved oxygen, pH, metals, nitrate, nitrite, phosphorus,

total organic carbon, and TSS. The river and stream sampling locations (shown in Figure 4-4) are upstream from, adjacent to, and downstream from the Site. SRS compares results to background levels of chemicals from natural sources and from contaminants produced by municipal sewage plants, medical facilities, and other upstream industrial facilities to assess the environmental impacts of Site operations on the

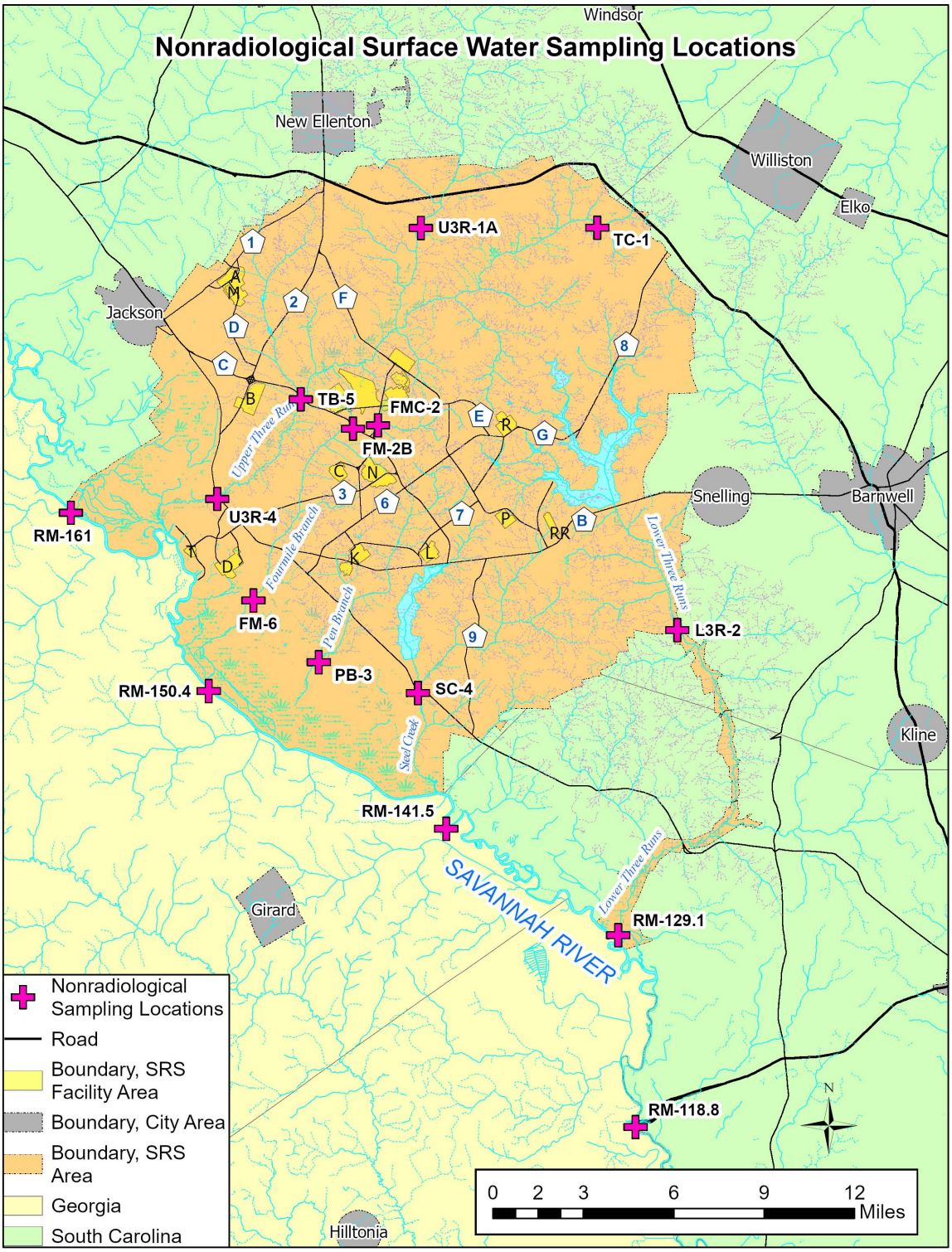

Figure 4-4 Nonradiological Surface Water Sampling Locations

surrounding area. SRS samples the water quality locations monthly by the conventional grab collection technique. SCDHEC also collects samples at several onsite stream locations as a QC check of the SRS program. SRS collects quality control samples throughout the year, as documented in Section 8.5, *Environmental Monitoring Program QC Activities,* of this document.

4.3.3.1 Surface (River and Stream) Water Quality Results Summary

SRS analyzed 3,717 individual analytes (177 samples) collected from the 15 stream and river water quality locations during 2023. Samples were not collected in October, November, or December at RM-141.5 due to unsafe low river water levels; the other four river location samples were collected at substitute locations. In 2023, 2,724 of 3,009 (90.5%) met South Carolina Freshwater Quality Standards, as available. (Not all analytes sampled have a standard.) All samples met standards for beryllium, cadmium, chromium, nickel, nitrite, temperature, and thallium. Averages for each river and stream location met standards for copper, mercury, nitrate, zinc, and dissolved oxygen. Additionally, all locations met pH maximum standards. These results (summarized in Table C-1) continue to indicate that SRS discharges are not markedly affecting the water quality of onsite streams or the Savannah River.

SRS Surveys River and Stream Water Quality.

4.3.4 Stream and River Sediment Sampling

SRS's nonradiological sediment surveillance program measures the concentrations of various inorganic contaminants that the Site releases and are deposited in stormwater basins, stream systems, and the Savannah River. Once deposited, the contaminants can either accumulate or disperse.

SRS's Sediment Sampling Program Examines Metals Concentrations in Rivers, Streams, and Basins.

The nonradiological sediment program collects sediment samples annually at various Site stream, stormwater basin, and Savannah River locations (Figure 4-5). The locations vary from year to year, depending on the rotation schedule agreed upon with SCDHEC. SRS collects duplicate samples to assess QC, as Section 8.5, *Environmental Monitoring Program QC Activities,* documents. Samples are evaluated using ecological risk-based sediment and soil screening values. These values are used to refine the list of potential contaminants of concern at a site and to guide decisions regarding the need for any further site-specific investigations of ecological risk. These values, refinement screening values (RSVs), are screening values from other sources or are modifications to screening values to reflect site-specific conditions.

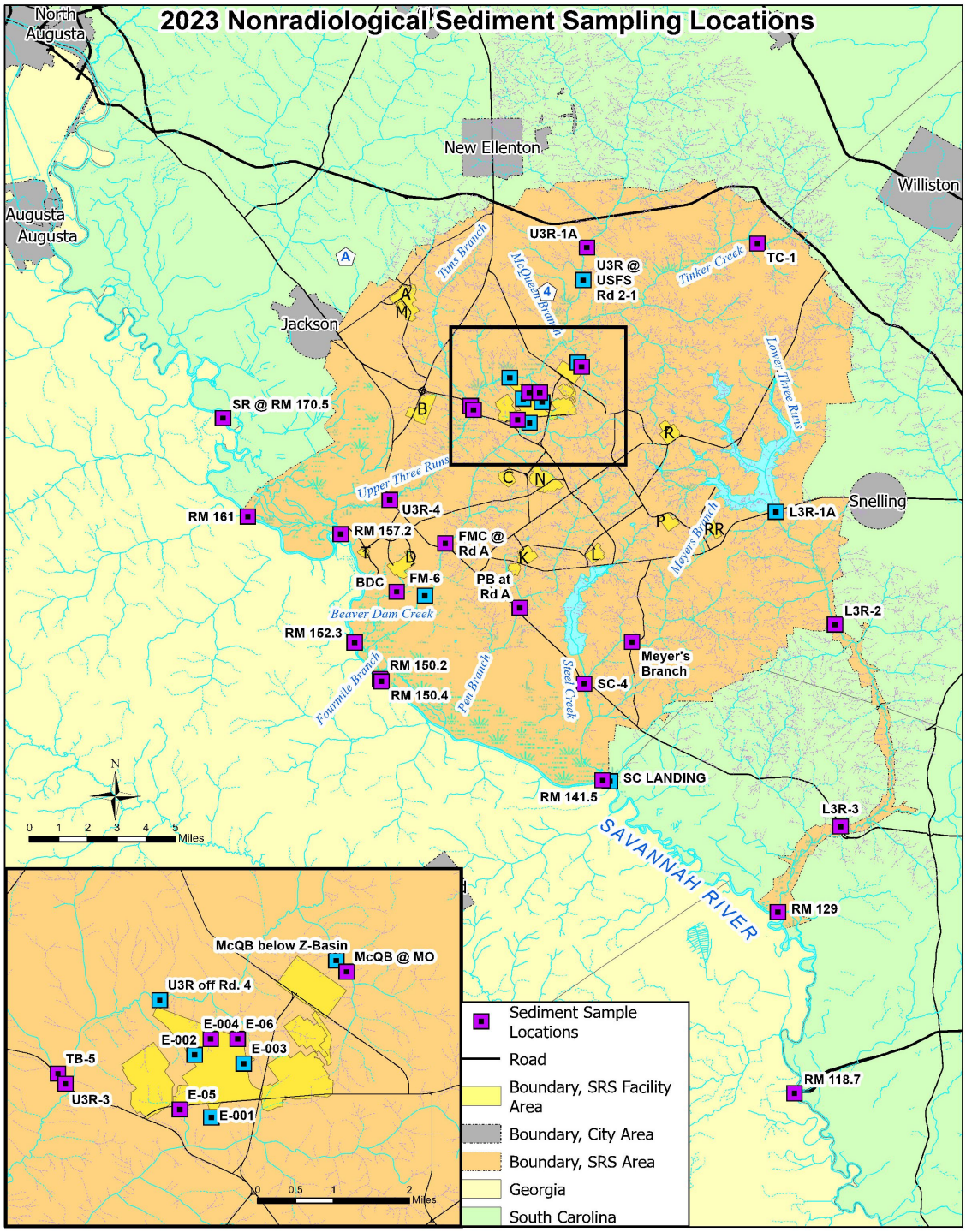

Figure 4-5 Nonradiological Sediment Sampling Locations
(Locations in purple were sampled in 2023, while locations in blue were not.)

4.3.4.1 Stream and River Sediment Results Summary

In 2023, SRS collected and analyzed 400 individual sediment analytes from 25 locations (11 from streams, 3 from stormwater basins, and 2 from the shared stream and basin background locations; and 8 from the Savannah River and 1 from the Savannah River background location). SRS measured aluminum, antimony,

arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, uranium, and zinc. Many of these are trace metals that occur naturally in soils and sediments. Of the 2023 results, 95.5% (382 of 400 analyses) met the EPA Region 4 Sediment RSVs. Barium accounted for 11 of the 18 samples that exceeded its RSV (60 mg/kg), while manganese and iron accounted for the remaining seven exceedances, with RSVs of 1,100 mg/kg and 40,000 mg/kg, respectively. SRS considers the barium exceedances as background, as evidenced by the Agency for Toxic Substances and Disease Registry 2007 Toxicological Profile for Barium, which states that, depending on the soil type, mean values for barium in the earth's crust range between 265 and 835 mg/kg. Additionally, the barium concentrations at both stream control locations have remained similar (~100 mg/kg difference or less) since 2007. Appendix Table C-2 summarizes the analytical results for all sediment analyses. All results are consistent with those of the previous five years and demonstrate SRS activities are not significantly affecting the metals concentrations of onsite basins, onsite streams, or the Savannah River.

4.3.5 Fish Monitoring

SRS samples aquatic species to identify and evaluate any effect of Site operations on contaminant levels in fish. The Site collects freshwater fish (bass, catfish, flathead catfish, and panfish) at six locations on the Savannah River from above SRS at Augusta, Georgia, to the coast at Savannah, Georgia. Freshwater fish are collected at the mouth of the streams that flow through the Site, and saltwater fish (mullet) are gathered at the Savannah River mouth near Savannah. SRS analyzes samples of the edible flesh for the uptake of metals, including antimony, arsenic, cadmium, chromium, copper, lead, manganese, mercury, nickel, and zinc.

4.3.5.1 Fish Results Summary

In 2023, SRS performed 1,750 individual analyses on 175 fish flesh samples. Five hundred sixty-seven, or 32%, of the 1,750 individual analyses were detected. Fifty-three percent of the detected results were estimated values, meaning SRS detected the analyte, but the concentration was close to the method detection limit. The analytes that had detected values were arsenic, cadmium, copper, manganese, mercury, nickel, and zinc. The remaining 1,183, or 68%, of the 1,750 individual analyses were not detected.

The 2023 data is consistent with results from the previous five years. Mercury is of particular interest in fish, and as Figure 4-6 shows, the average mercury concentration results, sorted by fish type for 2018 through 2023, has remained consistent. Appendix Tables C-3 and C-4 summarize all analytical results; however, similar trending is seen.

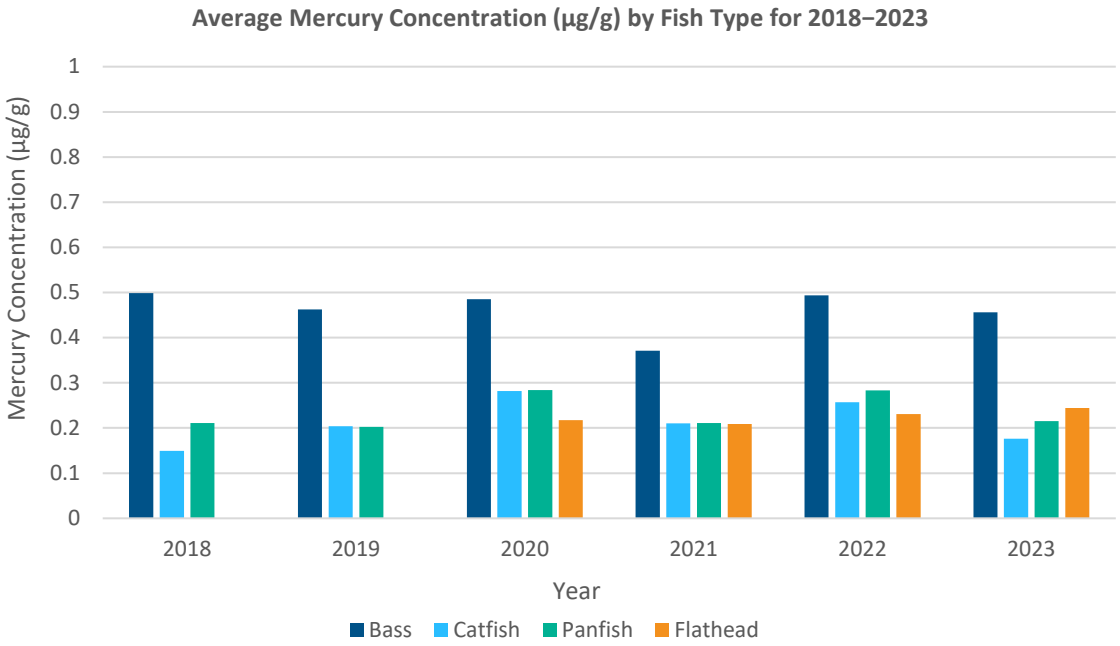

Figure 4-6 Average Mercury Concentration of Fish Species in the Savannah River, Adjacent to the Savannah River Site