Chapter 4: **Nonradiological Environmental Monitoring Program**

The purpose of the Savannah River Site (SRS) nonradiological environmental monitoring program is twofold in that 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.

2018 Highlights

Effluent Releases

- Nonradiological effluent releases for all categories met permit limits and applicable standards.
- All SRS industrial wastewater outfalls, under the National Pollutant Discharge Elimination System (NPDES) permit, achieved a 100% compliance rate.
- All SRS industrial stormwater outfalls under the NPDES permit were compliant.

Onsite Drinking Water

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

Surveillance Program

- SRS 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.
- Fish flesh sample results were consistent with historical levels.

4.1 INTRODUCTION

Environmental monitoring programs at SRS examine both radiological and nonradiological constituents that Site activities could release into the environment. Chapter 5, *Radiological Environmental Monitoring Program,* discusses the radiological components of this monitoring program.

The nonradiological monitoring program collects and analyzes air, water, sediment, and fish samples from numerous locations throughout SRS and the surrounding area. The program consists of 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.*

Effluent monitoring *is the collection of samples or data from the point a facility discharges liquids or releases gases.*

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)
- Stream and river sediment
- Fish

Figure 4-1 shows the types and typical locations (for example, upstream and downstream of SRS influence) of the nonradiological sampling SRS performs.

This chapter summarizes the nonradiological environmental monitoring programs and data results. Section 8.4, *Environmental Monitoring Program QA Activities,* and Section 8.5, *Environmental Monitoring Program QC Activities,* summarize the quality assurance and quality control 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.

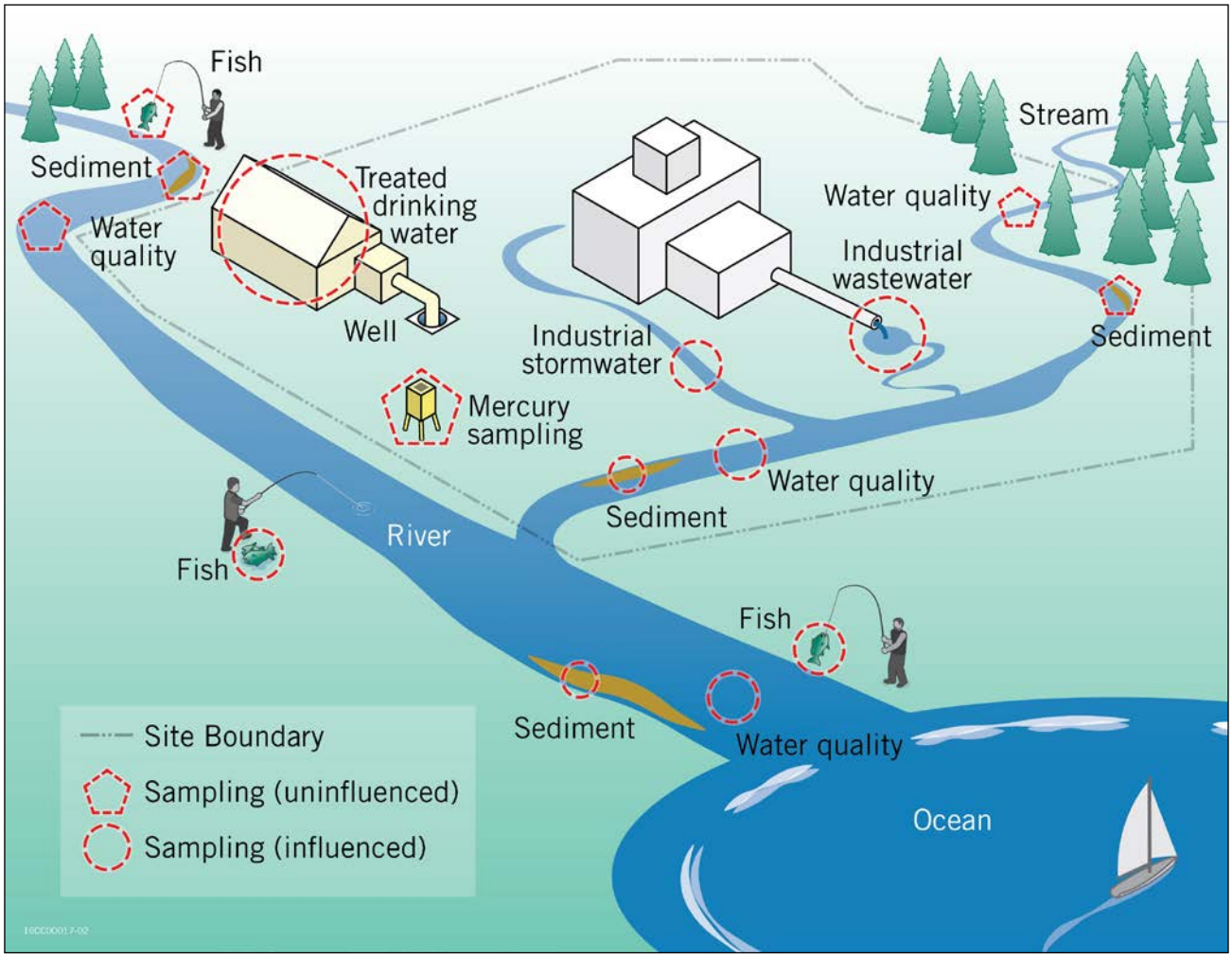

Figure 4-1 Types and Typical Locations of Nonradiological Sampling

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. SCDHEC regulates nonradioactive air pollutant emissions from SRS sources. The regulations list pollutants, compliance limits, and methods that demonstrate compliance.

SRS uses nonradioactive volatile chemicals (for example, gasoline, 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. Because of the nature and quantity of potential air emissions, SRS is not required 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 (that is, applicable to certain types of industries, processes, or equipment). The SCDHEC-issued Title V operating permit provides the source-

specific limits for facility operation, 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 EPA-approved calculations that include source-operating parameters—such as hours of operation, 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 and sediment samples and performing 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. SRS monitors groundwater, as Chapter 7, *Groundwater Management Program,* discusses.

4.3.1 Wastewater and Stormwater Monitoring

Nonradiological surface water monitoring primarily consists of sampling water discharges (industrial wastewater and industrial stormwater) associated with SRS NPDES-permitted outfalls. SRS monitors nonradiological liquid discharges to surface waters through the NPDES program, as mandated by the Clean Water Act. 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, monitoring frequency, permit limits for each analyte, and analytical and reporting methods.

SRS collects NPDES samples in the field according to 40 CFR 136, *Guidelines Establishing Test Procedures for the Analysis of Pollutants*. This document lists specific methods for sample collecting, preserving, and acceptable analytical methods for the type of pollutant.

In 2018, SRS monitored 28 industrial wastewater outfalls for physical and chemical properties, including flow, dissolved oxygen, potential hydrogen (pH), 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 permits specify how often SRS is to monitor the outfalls. Typically, SRS took samples at the locations once a month, although some locations required monitoring as frequently as once a day and others as infrequently as once a quarter. As specified by permits, SRS collected either composite or grab samples. SRS reported results to SCDHEC in required monthly discharge monitoring reports. In addition, SRS collected quality control samples as an internal check to ensure representative data. Section 8-5, *Environmental Monitoring Program QC Activities,* summarizes the quality control sample results.

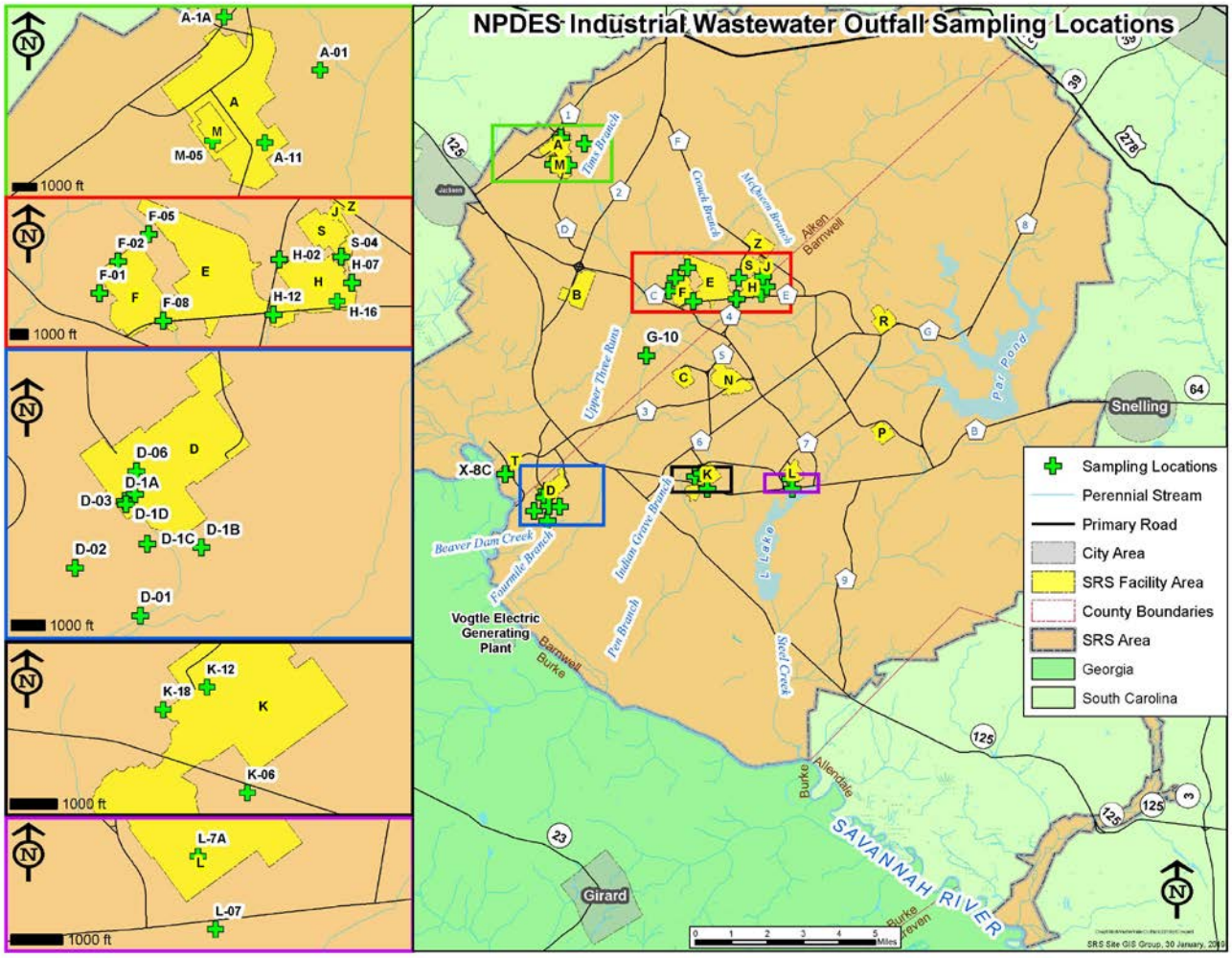

Figure 4-2 NPDES Industrial Wastewater Outfall Sampling Locations

In 2018, SRS monitored 39 industrial stormwater outfalls for ammonia, chemical oxygen demand, cyanide, Escherichia coli (E. coli), metals, nitrite, nitrate, pH, and TSS. In addition, personnel visually assessed the water in these outfalls for color, odor, clarity, solids, foam, and oil sheen. Figure 4-3 shows these locations. SRS monitored the outfalls on the frequency the permit specified, varying from quarterly to annually. It used grab-sample techniques to collect the stormwater samples.

SRS eliminated impaired water sampling—20 outfalls in 11 groupings—for E. coli analysis because SRS processes do not contribute to the E. coli-impaired streams onsite.

The Site can collect stormwater samples only during a qualifying rain event. To collect a sample, two conditions must be met: 1) at least 72 hours must have elapsed since the previous flow event, and 2) the sample collection should occur during the first 30 minutes of the flow event. SRS continued to use wireless technology to send immediate text notifications of rain events and to start automated samplers at specific locations. This allowed SRS to comply with the SCDHEC permit requirements of sampling within 30 minutes of stormwater flow.

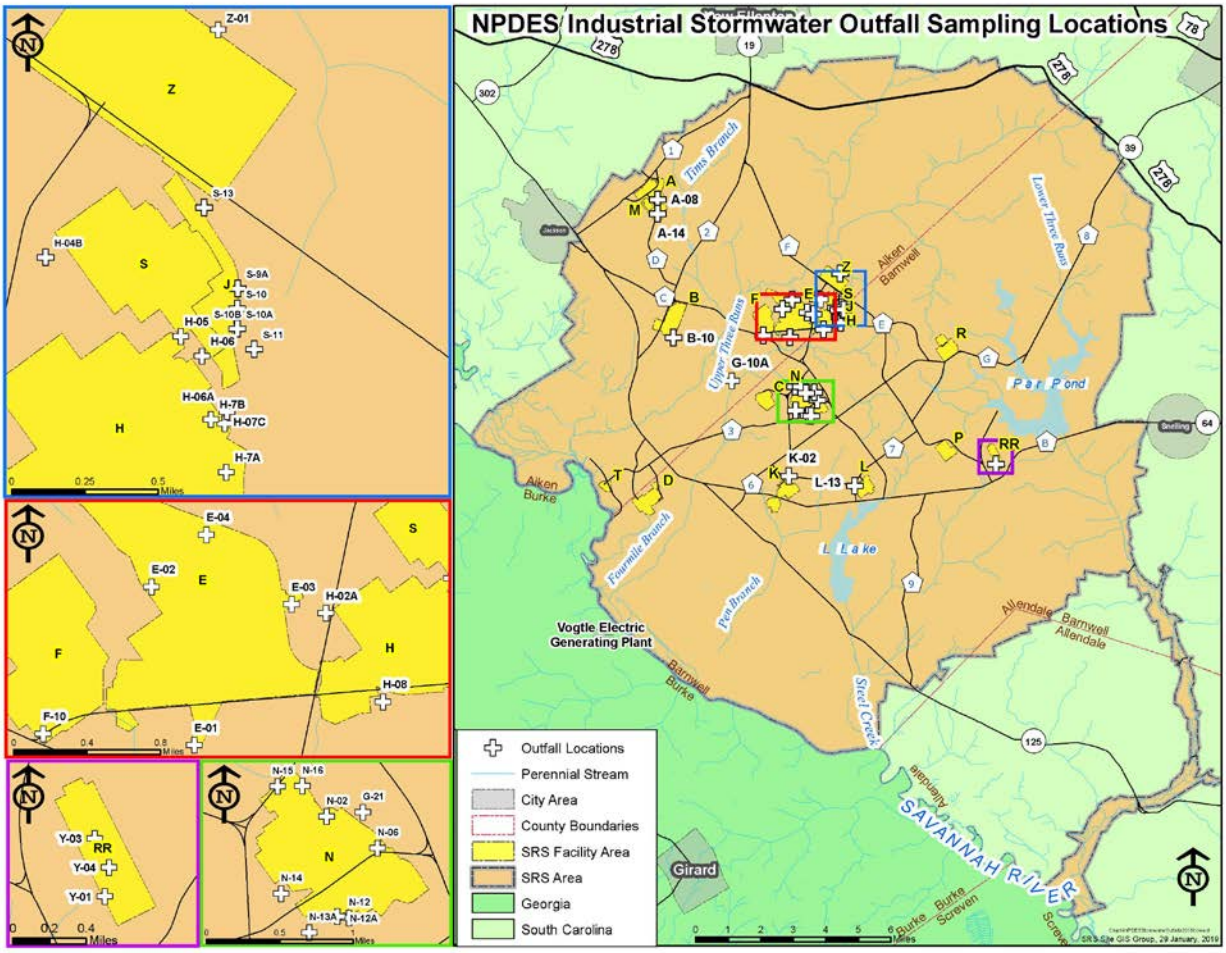

Figure 4-3 NPDES Industrial Stormwater Outfall Sampling Locations

4.3.1.1 Wastewater and Stormwater Results Summary

SRS reports NPDES industrial wastewater analytical results to SCDHEC through monthly discharge monitoring reports. All the approximately 2,610 analyses performed during 2018 were within NPDES permit limits, a 100% compliance rate.

SRS monitored all industrial stormwater outfalls according to permit requirements. The copper average at Outfall N-12A exceeded benchmark limits, triggering corrective actions. To absorb the metals, in October SRS installed bone charcoal on the upstream side of small check dams in the stormwater ditches leading to Outfall N-12A. SRS uses the monitoring results to evaluate and optimize the performance of this treatment method.

Bone Charcoal Installed to Absorb Metals in Stormwater Runoff

Sample results from the other stormwater outfalls demonstrated compliance with permit requirements.

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, each serving fewer than 25 people.

SCDHEC requires SRS to collect 10 bacteriological samples each month from the A-Area treatment plant to ensure that domestic water from that system meets SCDHEC and EPA bacteriological drinking water quality standards. SRS exceeds this requirement by collecting 15 samples each month from various areas. All 2018 bacteriological samples for drinking water were collected and met the state and federal drinking water quality standards.

4.3.3 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 Site NPDES permits regulate, and 2) materials coming from inadvertent releases at sources other than routine release points.

SRS sampled 11 streams onsite and 5 Savannah River locations for various physical and chemical properties, including dissolved oxygen, pH, temperature, hardness, herbicides, metals, nitrate, nitrite, pesticides, phosphorus, polychlorinated biphenyls, total organic carbon, and total suspended solids. Figure 4-4 shows the sampling locations. In May 2017, sampling for the upstream location on Upper Three Runs Creek, U3R-1A, temporarily moved upstream to U3R-0. SRS changed the sample location to alleviate the potential impacts to water quality results from the planned bridgework along the stream. The river and stream sampling locations are upstream, 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 surrounding area. SRS samples the water quality locations by the conventional grab-collection technique on a monthly and quarterly basis. As discussed in Section 8.4, *Environmental Monitoring Program QA Activities,* beginning in August 2018, SRS changed the analytical method for cadmium and lead, resulting in a lower detection limit. The detection limit now aligns with comparable SCDHEC standards. SRS collects quality control samples throughout the year, as documented in Section 8.5, *Environmental Monitoring Program QC Activities*. SCDHEC also collects samples at several onsite stream locations. Most of them are co-located with SRS sample locations as a quality-control check of the SRS program.

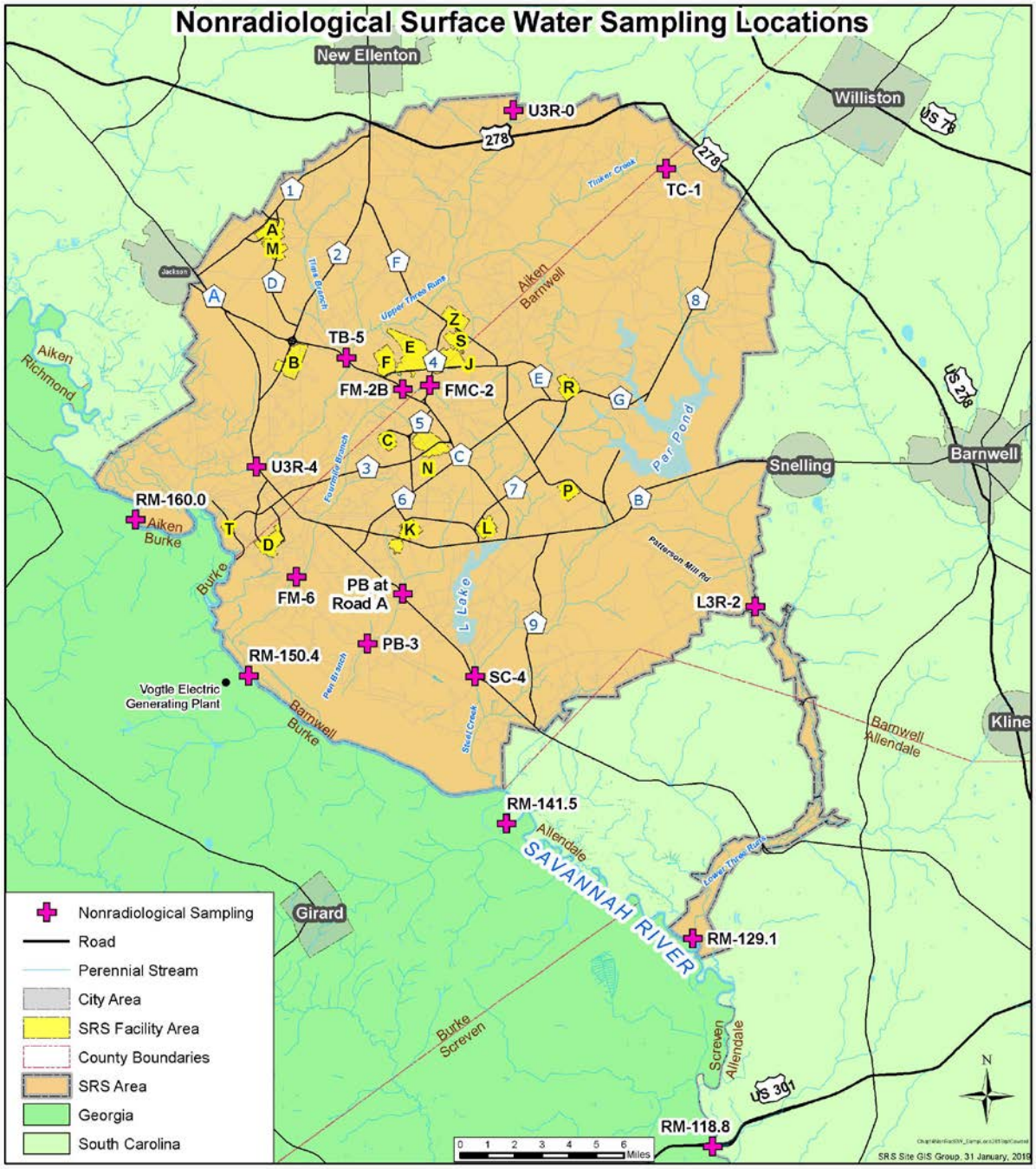

Figure 4-4 Nonradiological Surface Water Sampling Locations

4.3.3.1 River and Stream Water Quality Results Summary

SRS performed 5,760 individual analyses on samples collected from the 16 stream- and river-water quality locations during 2018, with 3,395 of 3,904 (85%) meeting South Carolina Freshwater Quality Standards, as available. Averages for each river and stream location met standards for dissolved oxygen, temperature, chromium, copper, mercury, nickel, nitrate, nitrite, zinc, pesticides, herbicides, and polychlorinated biphenyls. Appendix Table C-1 summarizes the analytical results. These results continue to indicate that SRS discharges are not significantly affecting the water quality of onsite streams or the Savannah River.

4.3.4 Sediment Sampling

SRS's nonradiological sediment surveillance program measures the nonradiological contaminant concentrations of various inorganic contaminants (metals and cyanide) that are deposited in stormwater basins, stream systems, and the Savannah River, where they accumulate or disperse.

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, which duplicates sampling at several locations onsite as a quality control check of the SRS program. SRS also collects duplicate samples to assess quality control, as documented in Section 8.5, *Environmental Monitoring Program QC Activities*.

4.3.4.1 Stream and River Sediment Results Summary

SRS conducted 425 individual analyses on sediment collected from 25 locations (14 stream, 3 stormwater basin, and 8 Savannah River). The metals measured were aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, magnesium, manganese, mercury, nickel, selenium, silver, uranium, and zinc. Many of these are trace metals that occur naturally in soils and sediments. All results were comparable to those of the previous five years and demonstrate SRS activities are not significantly affecting the metals and cyanide concentrations of onsite basins, streams, or the Savannah River. In addition, SRS compared results to EPA Region 4 Sediment Refinement Screening Values (RSV), as available. The Site uses the RSVs as a benchmark. Ninety-six percent (361 of 375 analyses) of the 2018 results met the benchmarked values. Appendix Table C-2 summarizes the analytical results.

Technicians Collect a Sediment Sample

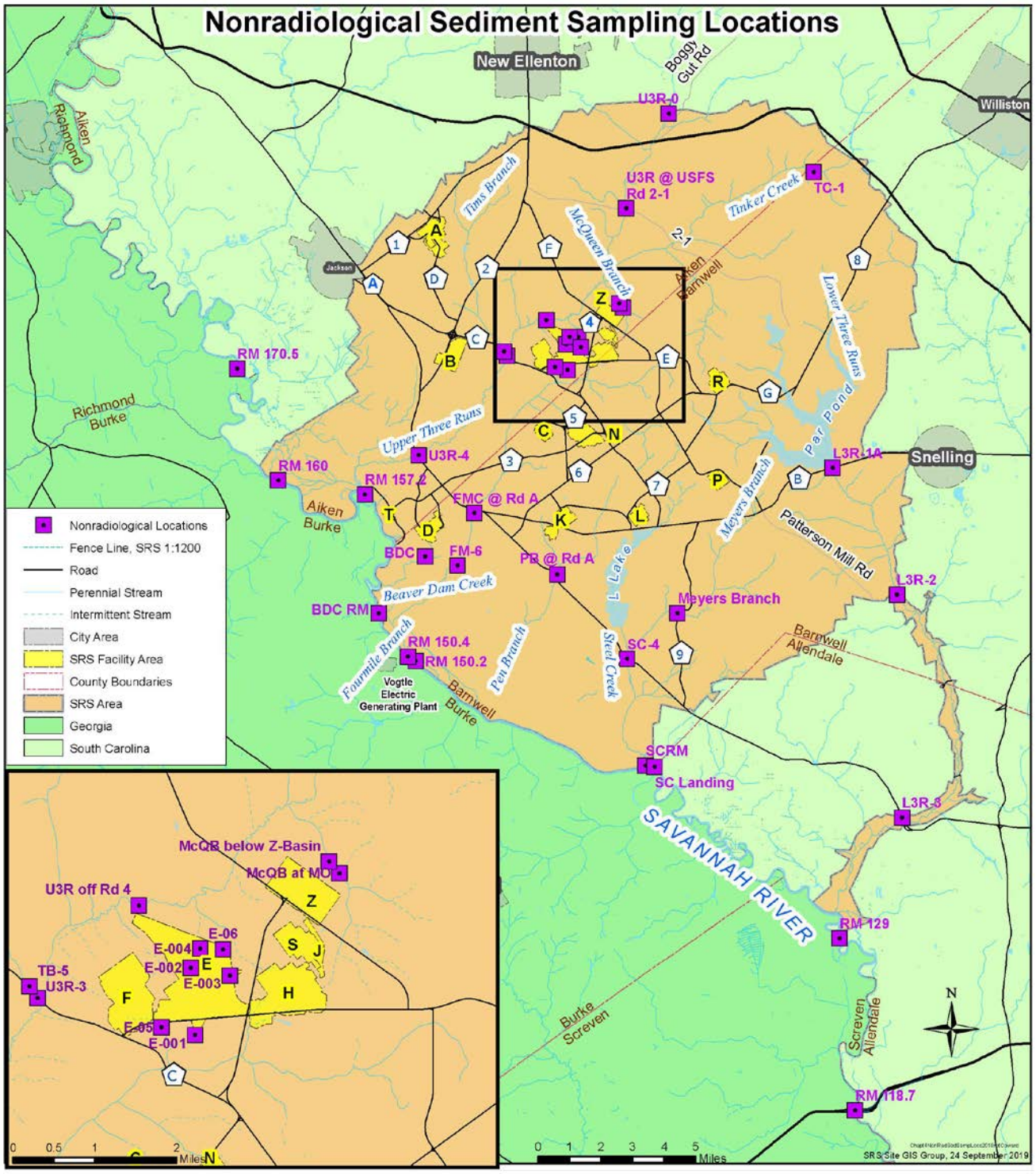

Figure 4-5 Nonradiological Sediment Sampling Locations

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, and panfish) at six locations on the Savannah River from above SRS at Augusta, Georgia to the coast of Savannah, Georgia. SRS collects freshwater fish at the mouth of the streams that flow through the Site and gathers saltwater fish (mullet) at the Savannah River mouth near Savannah. SRS analyzes samples of the edible flesh for metals uptake. SRS performs nonradiological analyses for mercury, arsenic, cadmium, chromium, copper, lead, manganese, nickel, zinc, and antimony.

Fish Sample Collected from SRS Creek Mouth

4.3.5.1 Fish Results Summary

In 2018, SRS performed 1,630 individual analyses on 133 fish flesh samples. Forty-two percent (42%) of the results were nondetected (less than the method detection limit). Appendix Tables C-3 and C-4 present summaries of the analytical results. SRS detected and quantified 12%, or 198 results of the 1,630 individual analyses, with the majority being for mercury (60) and zinc (133). The remaining 46% were estimated values, indicating SRS detected the analyte, and the concentration was close to the method detection limit. The 2018 data is comparable to the results for the previous five years. Figure 4-6 shows the average mercury results by fish type for 2014 through 2018.

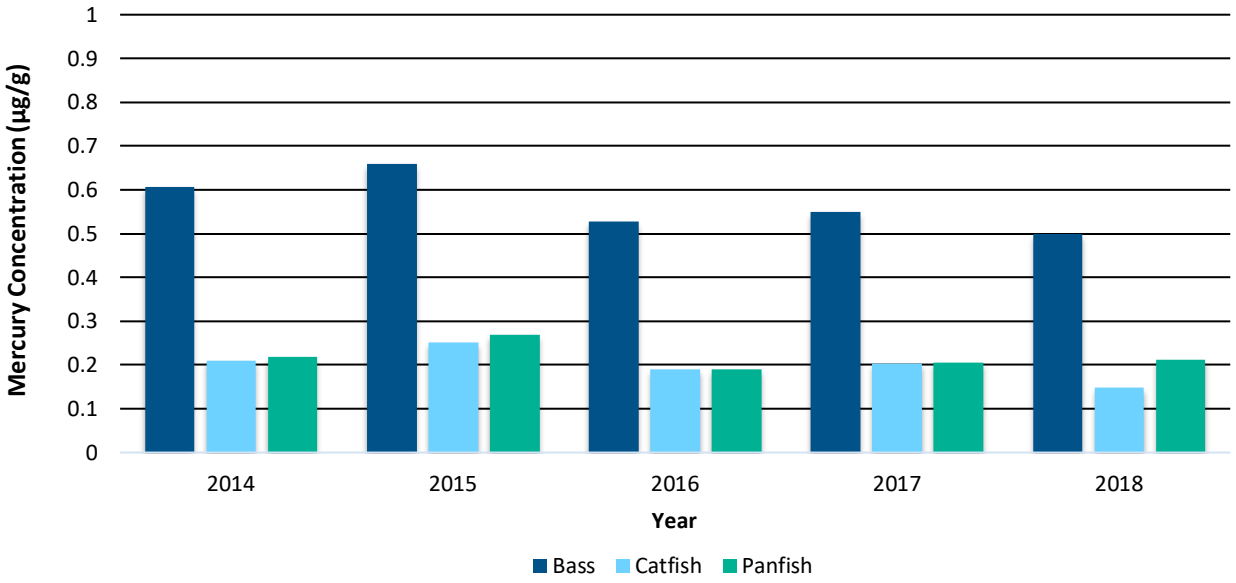

Figure 4-6 Average Mercury Concentration of Fish Species in the Savannah River Adjacent to the Savannah River Site

4.4 PRECIPITATION CHEMISTRY AND DEPOSITION

The SRS nonradiological air monitoring program includes collecting samples and data to calculate air emissions from Site sources and for the National Atmospheric Deposition Program (NADP). The NADP monitors the geographic distribution of specific airborne contaminants to better understand their effects on the environment. The NADP publishes data one year after analyzing all samples from its network of collection locations. This section would have reported 2017 data from the SRS NADP station; however, Savannah River Nuclear Solutions was not able to collect samples in 2017.

SRS sponsors a collection station to support the NADP. This station, located near the center of SRS at the Savannah River National Laboratory Central Climatology facility, collects weekly precipitation (rain, sleet, and snow) samples and submits them to NADP laboratories for chemical analysis. Since 2001, this station has been part of the Mercury Deposition Network (MDN) of the NADP. The MDN provides data on the geographic distributions and trends of mercury in precipitation. Natural sources, including volcanoes and wildfires, emit mercury into the atmosphere and surface waters. Mercury also occurs naturally in some soils, yet most of the attention on mercury in the environment focuses on anthropogenic sources: coal combustion, medical waste incineration, and chlorine production, among others. The MDN is the only network providing a long-term record of mercury concentrations in North American precipitation. All monitoring sites follow standard procedures and have uniform precipitation collectors and gauges. Beginning in 2012, the National Trends Network (NTN) added the station at SRS. This network tracks changes in acid rain.

Sample analysis associated with the NTN network includes free acidity (pH), conductivity, calcium, magnesium, sodium, potassium, sulfate, nitrate, chloride, and ammonium. In addition to supporting national-scale observations relating to trends in precipitation chemistry, results from this surveillance provide specific information related to the chemistry of precipitation at SRS.