Chapter 4 Nonradiological Environmental Monitoring Program

The Savannah River Site (SRS) nonradiological environmental monitoring program is twofold in that it confirms that 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 compliance 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.

2016 Highlights

Effluent Releases

- Nonradiological effluent releases for all categories except industrial wastewater were below permit limits and applicable standards.
- Only 2 of approximately 3,275 analyses at SRS industrial wastewater outfalls exceeded National Pollutant Discharge Elimination System (NPDES) permit limits, a 99.9% 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. However, in December, SRS collected 7 of the required 10 samples from SRS drinking water systems. SRS notified SCDHEC of this shortage. Chapter 3, *Compliance Summary*, on Page 3-15 provides additional information.

Surveillance Program

- SRS 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 indicated the majority of measured metals were not detectable. Zinc, found in 146 (99%) of the samples, was at levels consistent with the background control location. Mercury, detected and quantified in 74 (50%) of the samples, was consistent with 5-year trends for catfish, bream, mullet, sea trout, and red drum. Mercury levels in bass were similar to results from 2014 and 2015.

4.1 INTRODUCTION

Environmental monitoring programs at SRS examine both radiological and nonradiological constituents that SRS 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 is divided into two focus areas: 1) effluent monitoring, and 2) environmental surveillance. The effluent monitoring sample results demonstrate permit compliance, as discussed in the respective sections of this chapter. The environmental surveillance sample results 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 of treated or untreated water or air from a pipe or a stack to the environment. 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. The *2016 Environmental Monitoring Data Report* (SRNS 2017a) documents all data associated with the SRS sampling this chapter describes. Appendix Table B-1 of this document summarizes the nonradiological surveillance sampling media and frequencies.

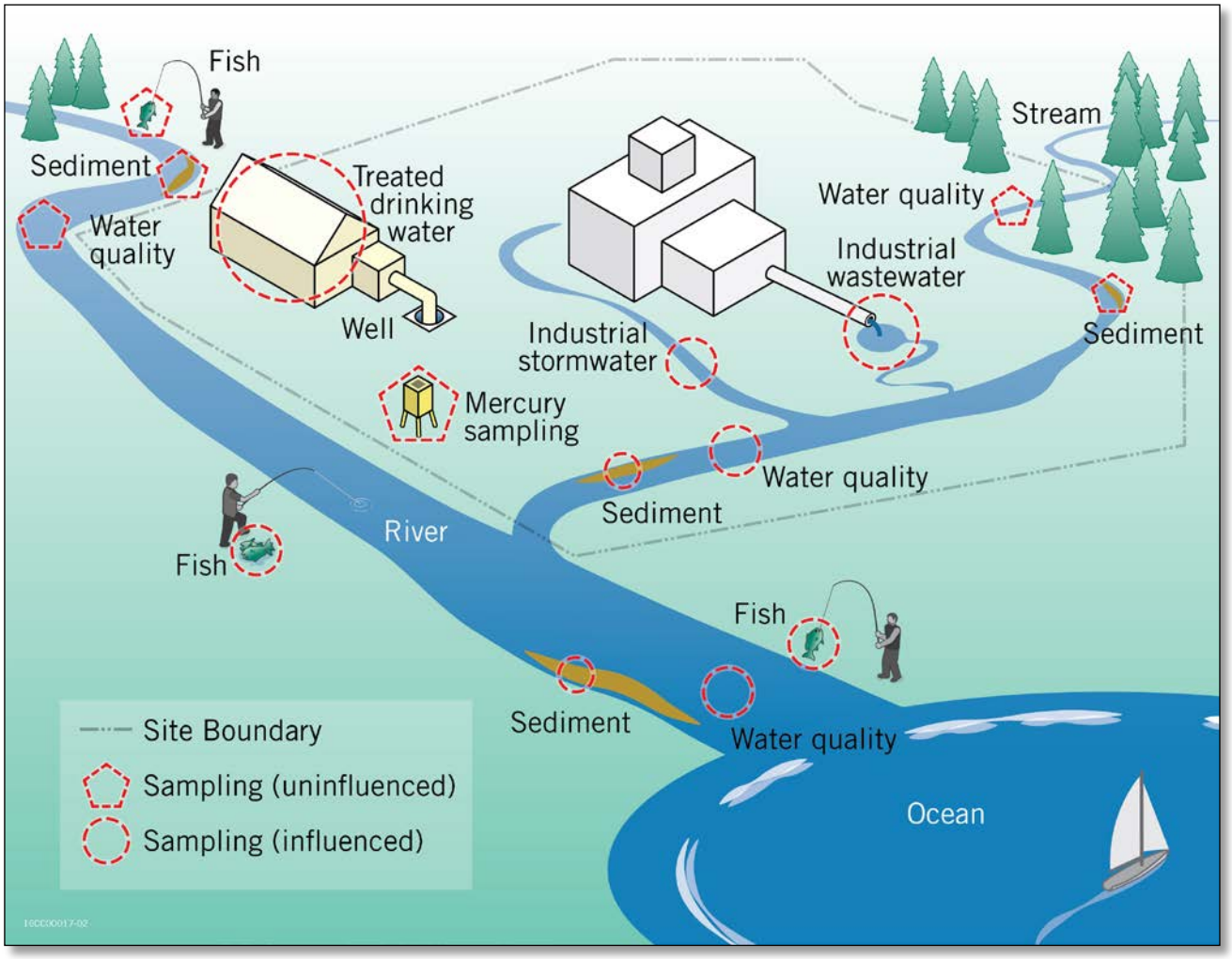

Figure 4-1 Types and Typical Locations of Nonradiological Sampling

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 to use to demonstrate compliance.

SRS uses nonradioactive volatile chemicals, fuels, and combustion products that can adversely impact 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

an annual emissions inventory of air pollutant emissions. SRS uses standard calculations using source-operating parameters, such as hours of operation, process throughput, and EPA-approved emission factors to determine emissions. However, many of the SRS processes are unique sources requiring nonstandard, complex calculations. SRS compares the hourly and total actual annual emissions for each source against their respective permit limitations. 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 from various water sources onsite and from the Savannah River. The analysis performed from the sample collection evaluates whether there is long-term buildup of pollutants downstream of discharge points and 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 conducts groundwater monitoring as is discussed in Chapter 7, *Groundwater Management Program*.

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.

A Technician Measures the Amount of Dissolved Oxygen in a Water Sample

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, parameters to be tested, monitoring frequency, and analytical and reporting methods.

NPDES samples are collected 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 analytical methods acceptable for the type of pollutant.

In 2016, SRS monitored 28 industrial wastewater outfalls for various physical and chemical properties including flow, dissolved oxygen, 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 the outfalls are to be monitored. Typically, SRS took samples at the locations once a month, although some locations require 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.

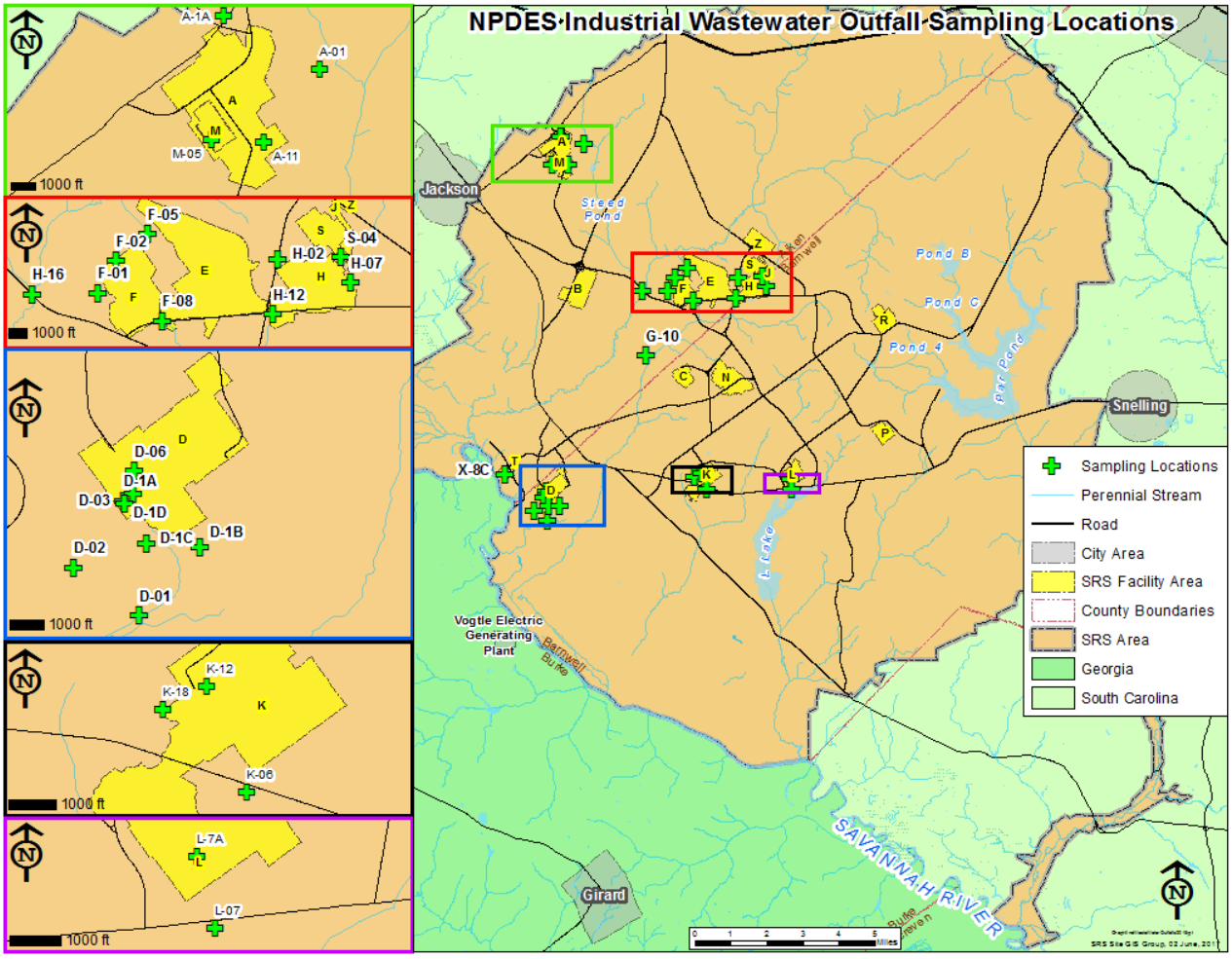

Figure 4-2 NPDES Industrial Wastewater Outfall Sampling Locations

In 2016, SRS monitored 35 industrial stormwater outfalls for copper, zinc, fecal coliform, and pH. In addition, sampling personnel visually assessed the water in these outfalls for color, odor, 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 can collect stormwater samples only during a qualifying rain event. In order to collect a sample, two conditions must be met: 1) At least 72 hours must have elapsed

SCDHEC Personnel Collect a Sample at an Industrial Wastewater Outfall

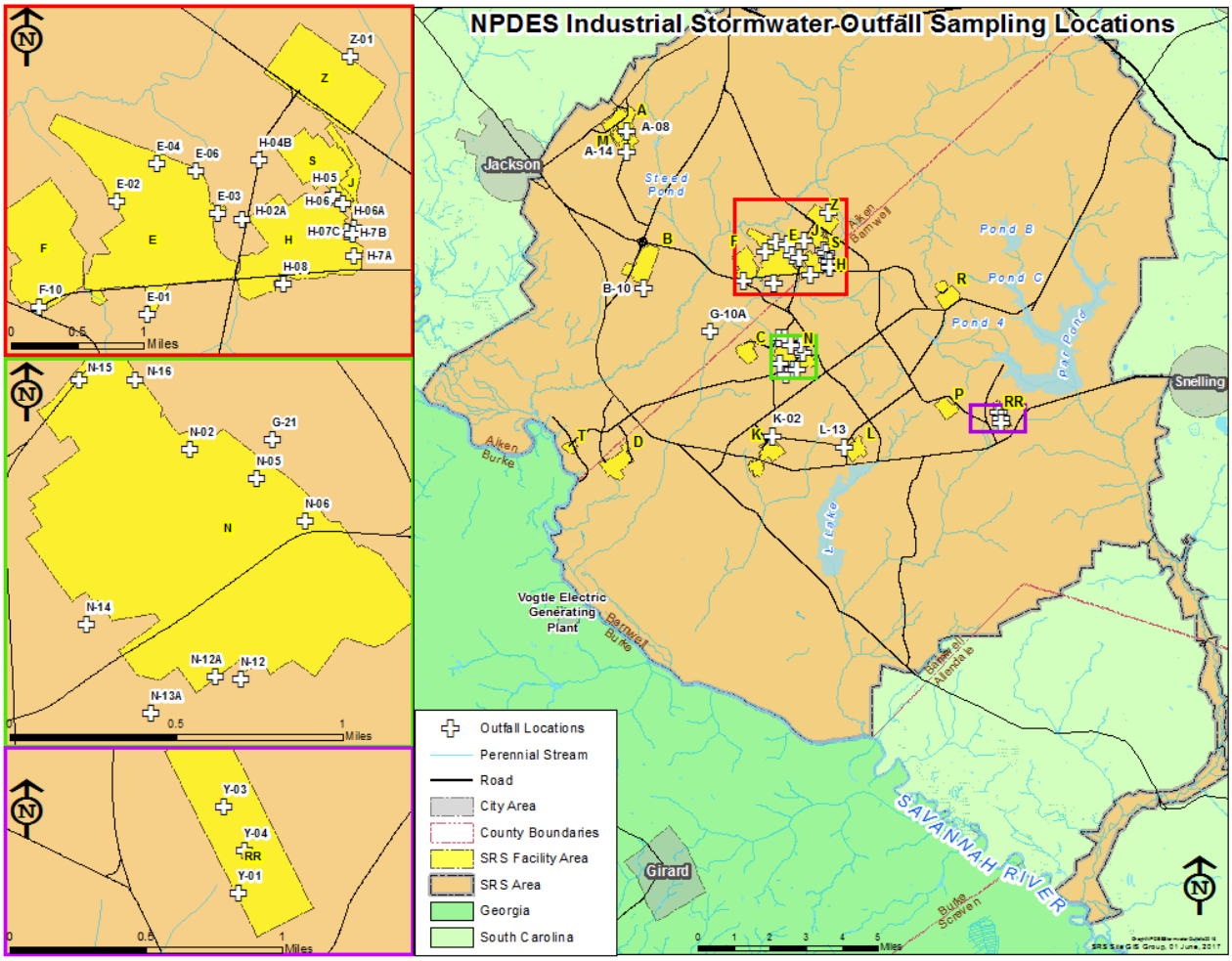

Figure 4-3 NPDES Industrial Stormwater Outfall Sampling Locations

since the previous flow event and 2) The sample should be collected during the first 30 minutes of the initial flow. SRS continued to use wireless technology to send immediate text notifications of rain events and to start automated samplers at specific locations. This allows SRS to comply with the SCDHEC permit requirements of sampling within 30 minutes of rain flow.

4.3.1.1 Wastewater and Stormwater Results Summary

SRS reports NPDES industrial wastewater analytical results to SCDHEC through monthly discharge monitoring reports. Only 2 of the approximately 3,275 analyses performed during 2016 exceeded NPDES permit limits, a 99.9% compliance rate. SRS had one permit limit exceedance for monthly average of TSS at D-01C Outfall and one permit limit exceedance for daily maximum flow at K-12 Outfall (due to 7 inches of recorded rainfall). The sample for TSS was collected at D-01C on August 4 during dewatering for the closure of the 488-1D ash basin. The TSS result was above the monthly average permit limit but below the daily maximum permit limit. There were no impacts to Waters of the State. The water with the elevated TSS would have had to travel roughly an additional 1,000 feet to reach Waters of the State. SRS collected another TSS sample from the basin about two weeks later for permit applications, and results were significantly lower (seven times below the monthly average permit limit). On August 9, SRS collected a TSS sample for the water-quality program at location river mile (RM) 150.4. This location is downstream of the

D-01C sampling location. The results at RM 150.4 were seven times below the monthly average permit limit. While the August 4 result was above permit conditions, subsequent sampling at that location and downstream indicates this was an isolated event. On December 9, SCDHEC issued a Notice of Violation (NOV) for the TSS exceedance but did not assess a penalty. Chapter 3, *Compliance Summary*, Section 3.3.7.1.1, *National Pollutant Discharge Elimination System*, provides additional information regarding the NOV.

SRS monitored all industrial stormwater outfalls according to the requirements of the permit. Sample results demonstrated the outfalls complied with permit requirements.

4.3.2 Onsite Drinking Water Monitoring

SRS uses groundwater sources to supply onsite drinking water facilities. The A-Area treatment plant supplies most of the drinking water at SRS. The Site also has four smaller drinking water facilities, each of which serves fewer than 25 people. These systems are not required to be sampled for lead and copper due to their small populations.

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. These samples consistently meet SCDHEC and EPA drinking water quality standards, confirming the absence of harmful bacteria.

In December, SRS collected 7 samples instead of the required 10. SRS has begun corrective actions to ensure that all samples are being collected as scheduled. Results from each of the seven samples were within drinking water quality standards.

SRS samples domestic water systems for lead and copper on a three-year, rotating cycle. It sampled the A-Area water system for lead and copper in 2016. Sample results met SCDHEC water-quality standards for lead and copper and were in the 90th percentile. The A-Area water system is not due for lead and copper sampling again until 2019. Chapter 3, *Compliance Summary*, Section 3.3.7.2, *Safe Drinking Water Act*, provides additional information regarding the omission of the December samples.

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 attributed to the water discharges regulated by Site NPDES permits, and 2) materials that may be released inadvertently from sources other than routine release points.

SRS samples 10 streams onsite and 5 Savannah River locations for various physical and chemical properties, including dissolved oxygen, pH, temperature, hardness, metals, pesticides and herbicides, and total organic carbon. Figure 4-4 illustrates the sampling locations. River and stream sampling sites are upstream, adjacent to, and downstream from the Site to compare the SRS contribution of pollutants with background levels of chemicals from natural sources and from contaminants produced by municipal sewage plants, medical facilities, and other upstream industrial facilities. The water quality locations are sampled at monthly and quarterly frequencies by the conventional grab-collection technique. 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.

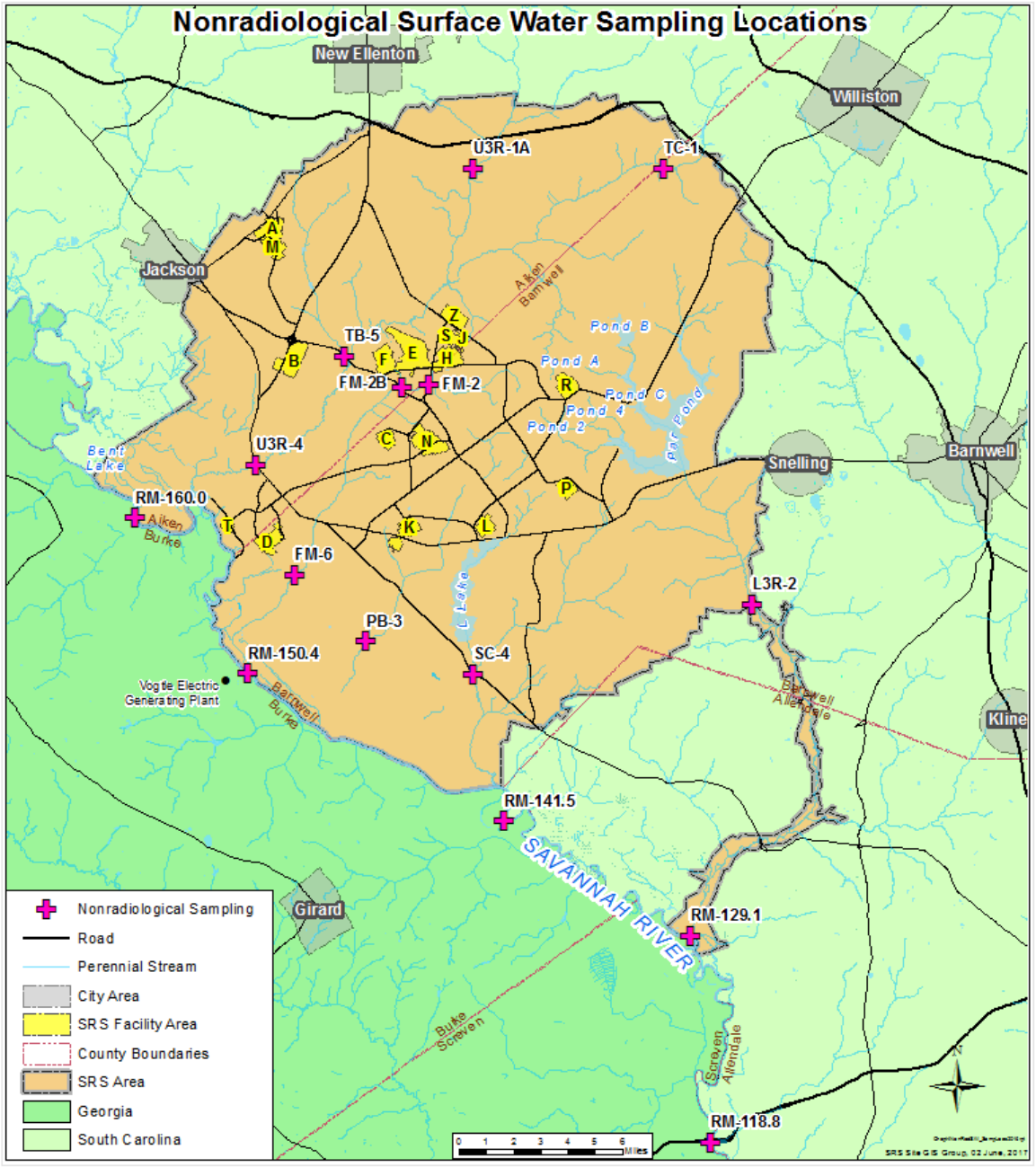

Figure 4-4 Nonradiological Surface Water Sampling Locations

4.3.3.1 River and Stream Water Quality Results Summary

SRS performed 5,400 individual analyses on samples collected from the 15 stream- and river-water quality locations during 2016. Rain events that occurred during January resulted in river water levels deemed unsafe for SRS personnel to collect water samples at five river locations. Instead, SRS collected samples at alternate locations. Metals, such as iron and zinc, were detected in at least one sample at each location. The herbicide Silvex was detected at stream location FM-2B in October. Its origin is unknown. Silvex has never been used onsite, according to the records. No other sample results showed detectable levels of pesticides, herbicides, or polychlorinated biphenyls (PCBs). 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 provides a method to determine nonradiological contaminants that are deposited and accumulate in stormwater basins, stream systems, and in the Savannah River. One of the important contaminants measured is mercury. Mercury is a contaminant that could pose a health exposure risk to humans through various pathways, including drinking water and eating fish. Mercury enters bodies of water naturally through volcanic activity and mineral weathering of rocks over time, as well as through industrial and urban sources such as coal-burning power plants. Mercury that is released into the air may eventually settle into or be washed into water, where it deposits onto streambeds and wetlands.

The nonradiological sediment program collects sediment samples at various 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. SCDHEC performs duplicate sampling at various locations onsite as a quality control check of the SRS program.

4.3.4.1 Stream and River Sediment Results Summary

In 2016, SRS sampled 12 onsite stream locations, 3 stormwater basin locations, and 9 Savannah River locations. The laboratory analyzed the samples for various inorganic contaminants (metals and cyanide) to determine if there was a human health risk from exposure to sediments. The Site used EPA Regional Screening Levels for Residential Soil for comparison.

In 2016, all mercury results for river and stormwater basin sediment samples were below the lowest levels the laboratory could detect. Five samples from onsite stream basin locations contained mercury that ranged from 0.0125 mg/kg at L3R-2 to 0.0632 mg/kg at L3R-1A. All mercury results were well below the EPA Regional Screening Level for resident soil (Figure 4-6).

Results for metals in river, stream and stormwater basin sediments showed aluminum, arsenic, barium, chromium, copper, iron, lead, magnesium, manganese, nickel, uranium, and zinc. Levels were greater than the practical quantitation limit for 2016, but were still consistent with those seen in the background control locations (river location River Mile [RM]-160 and stream location Upper Three Runs U3R-1A) and comparable to those of the previous five years. Appendix Table C-2 summarizes the analytical results.

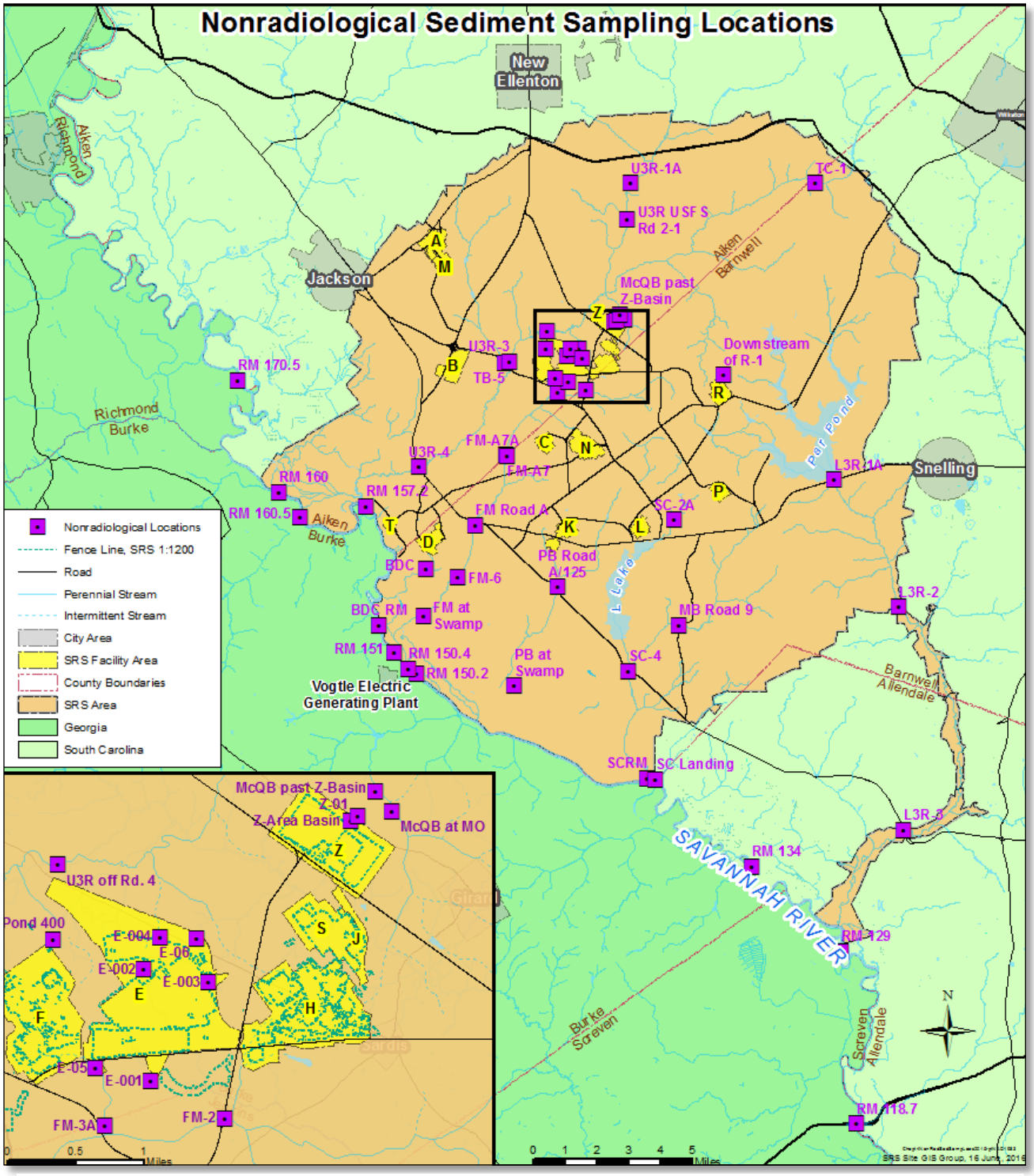

Figure 4-5 Nonradiological Sediment Sampling Locations

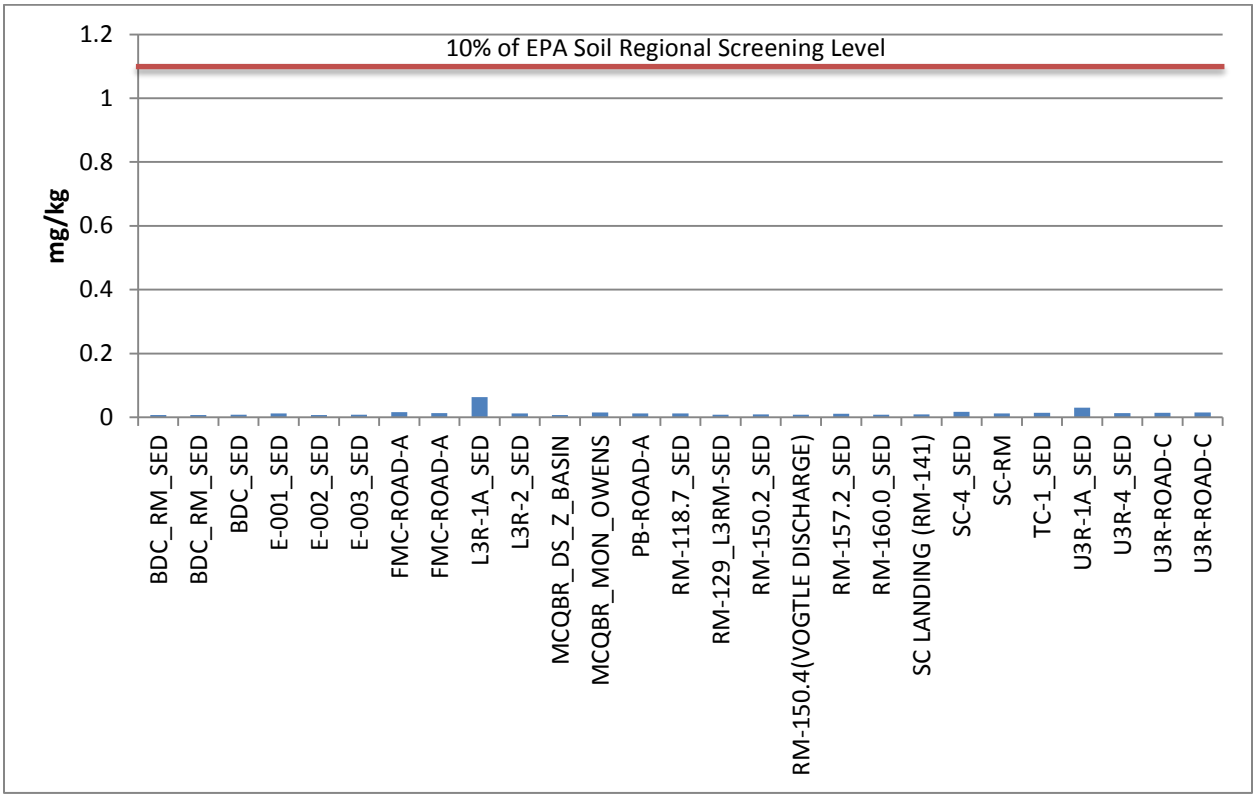

Figure 4-6 Mercury in Sediment Locations

4.3.5 Fish Monitoring

SRS samples aquatic species to identify and evaluate any impact of Site operations on contaminant levels in fish. Freshwater fish (that is, bass, catfish, and panfish) are collected at six locations on the Savannah River from above SRS at Augusta, Georgia to the coast of Savannah, Georgia. Freshwater fish are collected at the mouth of the streams that flow through the Site. Saltwater fish (red drum and mullet) are collected at the Savannah River mouth near Savannah, Georgia. 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.

4.3.5.1 Fish Results Summary

In 2016, SRS performed 1,470 individual analyses on 147 fish flesh samples (10 analyses per sample). The majority (54%) of the results were nondetected (less than the method detection limit). Appendix Tables C-3 and C-4 present summaries of the analytical results. Fifteen percent, or 217 results of the 1,470 individual analyses, were detected and quantified (15%), with the majority of these results being for mercury (68) and zinc (146).

Fish Collection Using Electrofishing Equipment

A review of the 2016 zinc data indicates the results for the SRS creek mouths are comparable with the results for the control location at the New Savannah Bluff Lock and Dam. Review of mercury data for the period 2012 through 2016 (Figure 4-7) indicates lower concentrations in catfish and panfish than in bass. Mercury data for bass collected in 2016 are within the expected range based on the previous four-year period (2012–2015).

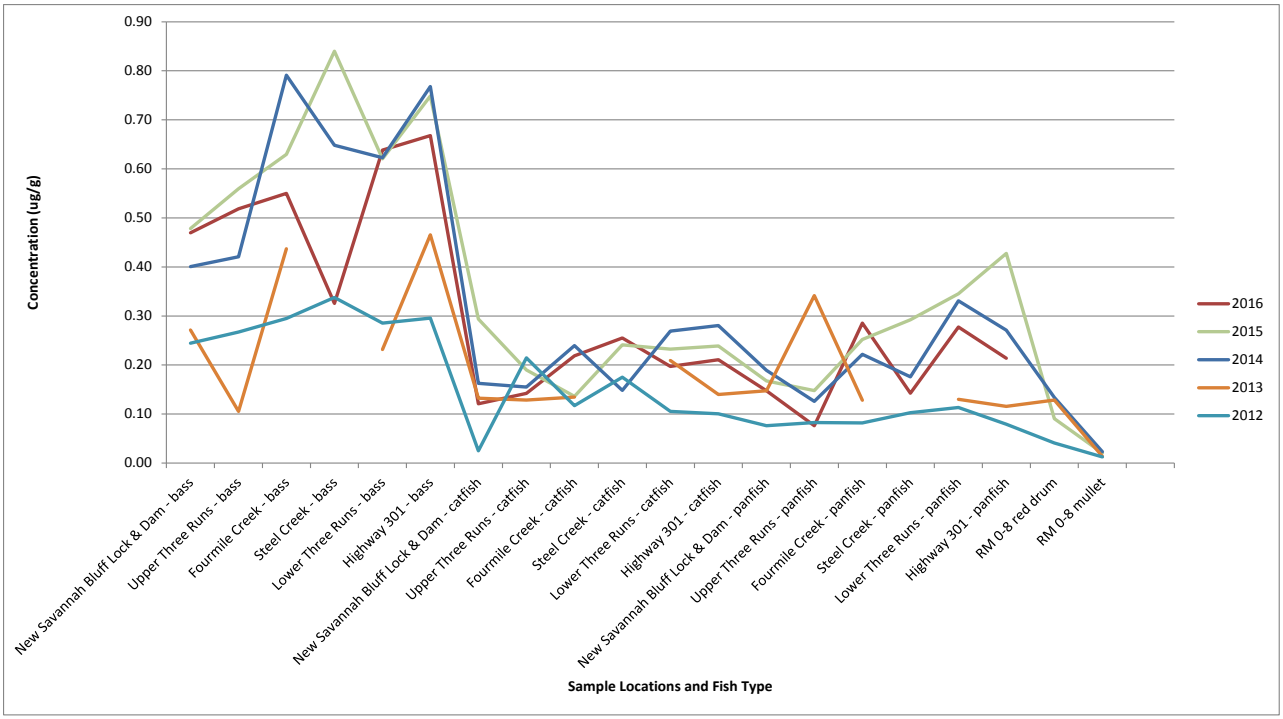

Figure 4-7 Mercury in Fish by Location and Species

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 completing analyzes of all samples from their network of collection locations. Thus, this section reports 2015 data, which is publicly available.

SRS sponsors a collection station to support the NADP. This station, located near the center of SRS at the Savannah River National Laboratory (SRNL) 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. Mercury is emitted into the atmosphere and surface waters from natural sources, including volcanoes and wildfires. It also occurs naturally in some soils. Yet most of the attention on mercury in the environment has focused 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.

4.4.1 Precipitation Chemistry and Deposition Results Summary

The 2015 average (volume-weighted) concentration of total mercury in precipitation was 8.6 ng/L, and the wet deposition rate was 11.7 µg/m^2. These observations were consistent with historical observations associated with this surveillance and are consistent with other observations from the southeastern United States. Data from 2016 will be available in the fall of 2017. The NAPD provides additional information on the MDN, as well as the location and data from surrounding stations.

In 2015, the average pH of precipitation was 5.07. Appendix Table C-5 presents the precipitation results that the NTN reported for 2015. These observations are consistent with other observations from other locations in the southeastern United States. The NAPD provides additional information on the NTN.