4 NONRADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

The Savannah River Site (SRS) nonradiological environmental monitoring program confirms compliance with state and federal regulations and/or permits, as well as, monitors any effects SRS operations have on the environment both onsite and offsite. The program includes monitoring of permitted point source discharges from on Site facility operations and the collection and analysis of environmental media such as air, water, sediment, and fish. Monitoring of nonradiological parameters is required by state and federal regulations and/or permits, but is also performed to reduce public concerns about SRS operations.

2015 Highlights

Effluent Releases

Nonradiological effluent releases for all categories were below 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 discharges are not significantly affecting the water quality of onsite streams and the Savannah River.

Stream sediment results from SRS streams were consistent with the background control location and were comparable with historical levels.

Fish flesh sample results indicated the majority of measured metals were not detectable. Zinc, found in all samples, was at levels consistent with the background control location. Mercury, detected in 84 (60%) of the samples, was consistent with five-year historical trends for catfish, bream, mullet and red drum. Mercury in bass results from 2015 were similar to 2014 results but still elevated compared to the previous three years.

4.1 INTRODUCTION

Environmental monitoring programs at SRS examine both radiological and nonradiological constituents that could be released to the environment as a result of SRS activities. The radiological components of this monitoring program are discussed in Chapter 5, "Radiological Environmental Monitoring Program."

The nonradiological monitoring program involves the collection and analysis of air, water, sediment, and fish samples from numerous locations throughout SRS and the surrounding area. The nonradiological monitoring program encompasses environmental sampling both onsite and offsite. The program is divided into two focus areas: 1) effluent monitoring and 2) environmental surveillance. The effluent monitoring sample results are used to demonstrate permit compliance, as discussed in the respective sections of this chapter. The environmental surveillance sample results are used to assess the environmental impacts of Site operations on the surrounding area. Sampling frequency and analyses are determined by permit-mandated monitoring requirements and federal regulations.

SRS conducts nonradiological environmental monitoring activities for the following categories:

- Atmospheric (airborne emissions and precipitation with a special focus on mercury deposition),
- Water (wastewater, stormwater, sludge, onsite drinking water, river and stream water quality),
- Stream and river sediment, and
- Fish.

Figure 4-1 shows the types and typical locations (e.g., upstream and downstream of SRS influence) of nonradiological sampling performed at SRS.

This chapter presents a summary of the nonradiological environmental monitoring programs and data results. All data associated with the SRS sampling efforts described in this chapter are documented in the *2015 Environmental Monitoring Data Report* (SRNS 2016a). Appendix Table C-2 of this document provides a summary of the nonradiological surveillance sampling media and frequencies.

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 atmosphere.*

Effluent monitoring *is the collection of water or air data from the point at which a facility discharges liquid or gaseous releases to the environment.*

Environmental Surveillance *is the collection of water, sediment or fish data from the environment around a facility.*

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

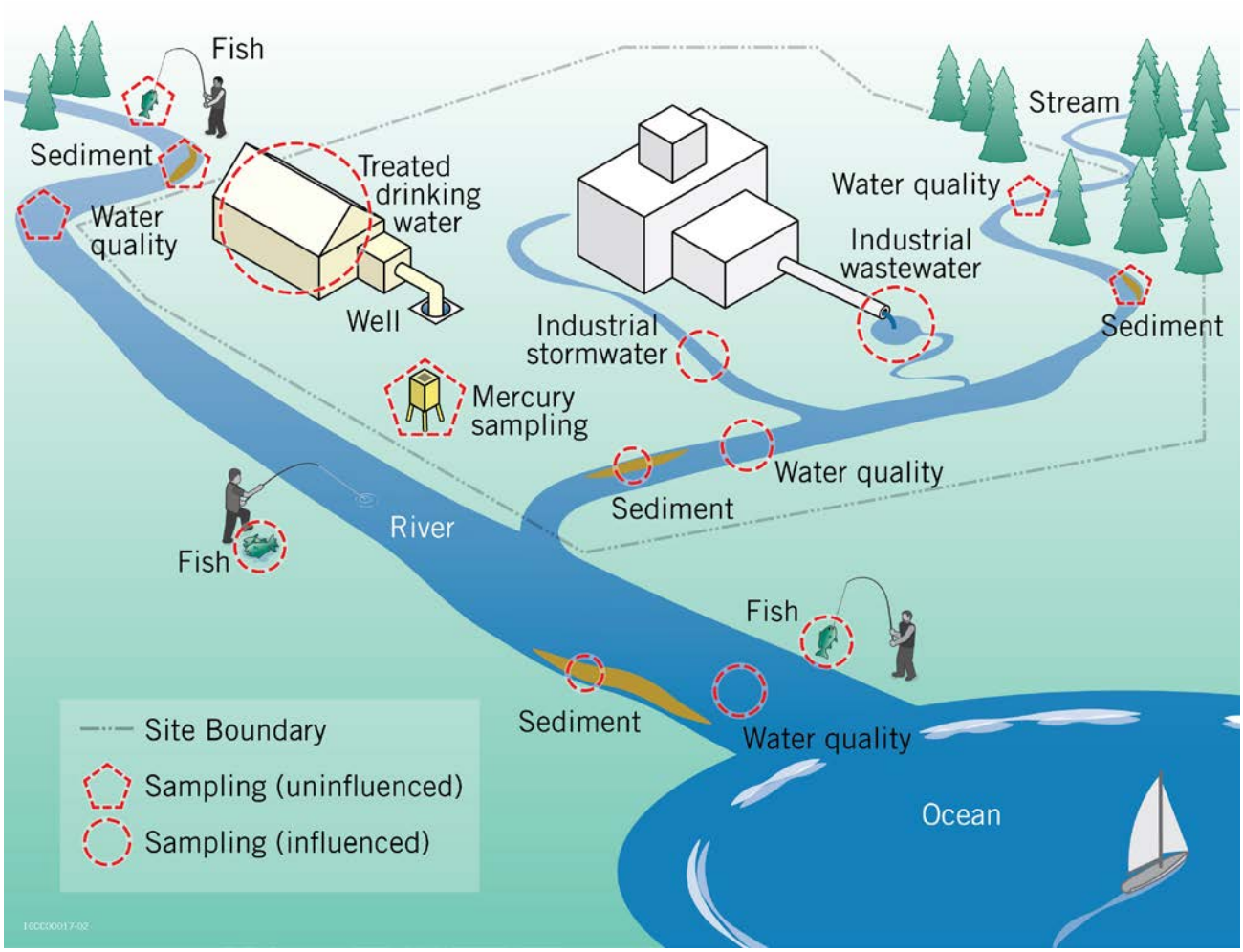

Figure 4-1 Types and Typical Locations of Nonradiological Sampling

4.2 CALCULATED AIR EMISSIONS

Airborne contaminants can present a risk to public health and the environment. Thus, identification and quantification of these contaminants is an essential component of a nonradiological monitoring program. SCDHEC regulates nonradioactive air pollutant emissions from SRS sources. The regulations provide a listing of pollutants, the compliance limits, and the methods to be used to demonstrate compliance.

SRS operations utilize a number of nonradioactive volatile chemicals, fuels, and combustion products that have the potential to adversely impact the environment, if released into the air in sufficient quantities. However, most of these materials are used in very small quantities and the potential environmental impact from their potential release is negligible. Because of the nature and quantity of potential air emissions, SRS is not required to monitor the ambient air for chemical pollutants. Using process data, SRS calculates emissions as required by SCDHEC. Table 3-1, in Chapter 3 “Compliance Summary”, shows the chemicals and the quantity emitted based on the air emissions calculations.

Many of the applicable regulatory standards are source-dependent (i.e., applicable to certain types of industries, processes, or equipment). The SCDHEC issued a Title V operating permit providing the source specific limits for facility operation, source sampling, testing, monitoring and reporting frequency as required by the regulations. SRS is required to demonstrate compliance through air dispersion modeling

and the submission of an annual emissions inventory of air pollutant emissions. Emissions from SRS sources are determined from standard calculations using source operating parameters, such as hours of operation, process throughput, and EPA-approved emission factors. 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. Information associated with these emissions is presented in Chapter 3, "Compliance Summary", Section 3.5.4, "Air Emissions Inventory."

4.3 WATER MONITORING

SRS nonradiological water monitoring includes collection of samples from various water sources, sediments, and fish living in the water sources. This monitoring supports evaluation of whether there is long-term buildup of pollutants downstream of discharge points and meeting permit requirements.

4.3.1 Wastewater & Stormwater Monitoring

Nonradiological surface water monitoring primarily consists of sampling water discharges (industrial wastewater and industrial stormwater) associated with SRS NPDES permitted outfalls. Groundwater monitoring is conducted at SRS and is discussed in Chapter 7. 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 the permitting, compliance tracking, monitoring, and enforcement activities of the program. The permits issued by SCDHEC 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 sample collection, preservation, and analytical methods acceptable for the type of pollutant.

A Field Technician Verifies Flow Rate at an Industrial Wastewater Outfall

In 2015, 28 industrial wastewater outfalls were monitored for various physical and chemical properties including flow, dissolved oxygen, pH, ammonia, biochemical oxygen demand, fecal coliform, metals, oil & grease, volatile organic compounds, and total suspended solids. These locations are shown in Figure 4-2. SRS monitored the outfalls on a frequency specified by the permits. Some locations required monitoring once a day while others are monitored once a quarter. Typically, locations are sampled once a month. As specified by permits, SRS collected either composite or grab samples. SRS reported results to SCDHEC in required monthly discharge monitoring reports.

In 2015, 37 industrial stormwater outfalls were monitored for copper, zinc, fecal coliform, pH and visual assessment (e.g., color, odor, solids, foam, oil sheen, etc.). These locations are shown in Figure 4-3. SRS monitored the outfalls on a frequency specified by the permit, varying from quarterly to annually. Grab sample techniques were used to collect the stormwater samples.

Stormwater sampling can be conducted only during a qualifying rain event. In order to collect a sample: 1) at least 72 hours must have elapsed since the previous flow event and 2) the sample must be collected during the first 30 minutes of the initial flow. SRS continued the use of wireless notification technology that includes immediate text notifications of rain events and wireless startup of automated samplers at specific locations. This allows SRS to comply with the SCDHEC permit requirements of sampling within 30 minutes of rain flow.

Sludge from the sanitary wastewater treatment facilities is managed under the requirements contained in the land application permit issued by SCDHEC. SRS transfers sludge generated at the sanitary wastewater treatment facilities from the sludge thickener to the drying beds. The air-dried sludge removed from the drying beds is then stored in a shed until it is spread on land. Approximately 151 cubic yards of the dried sludge was applied from October 19 through October 23, 2015. All sample results were within permit limits for metals and nutrients.

SCDHEC assesses the SRS NPDES program during compliance evaluation inspections. The evaluation includes records and procedures reviews; personnel interviews; and outfall, treatment facility, and land application site inspections. SCDHEC did not perform a compliance evaluation inspection in 2015. The last compliance evaluation inspection was conducted in August 2014. At that time SCDHEC issued a satisfactory rating, the highest grade possible.

4.3.2 Wastewater & Stormwater Results Summary

SRS reports NPDES industrial wastewater analytical results to SCDHEC through monthly discharge monitoring reports. All of the approximately 3,260 sample analyses performed during 2015 were within the NPDES permit limits, a 100% compliance rate.

SRS monitored all industrial stormwater outfalls per the requirements of the permit. Sample results demonstrated compliance with permit requirements.

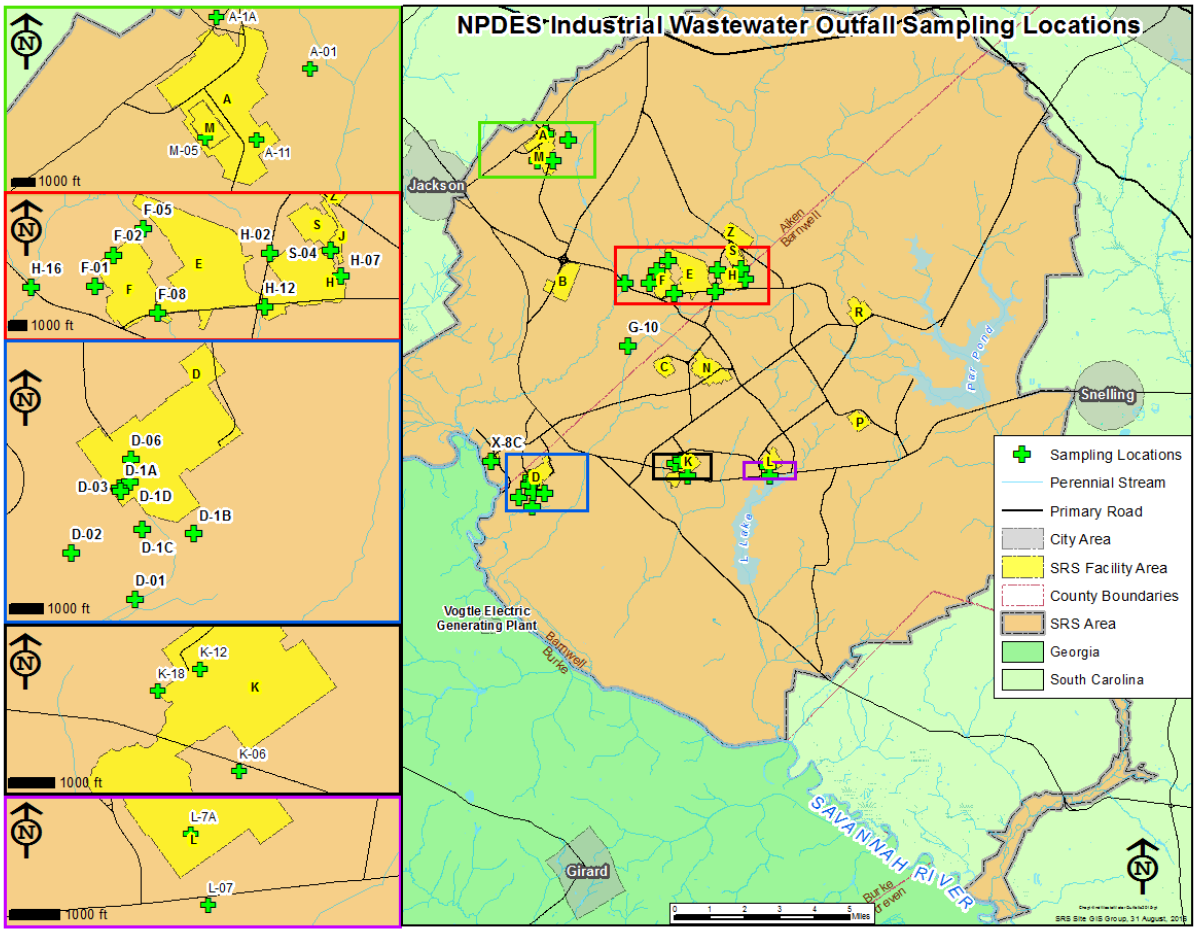

Figure 4-2 NPDES Industrial Wastewater Outfall Sampling Locations

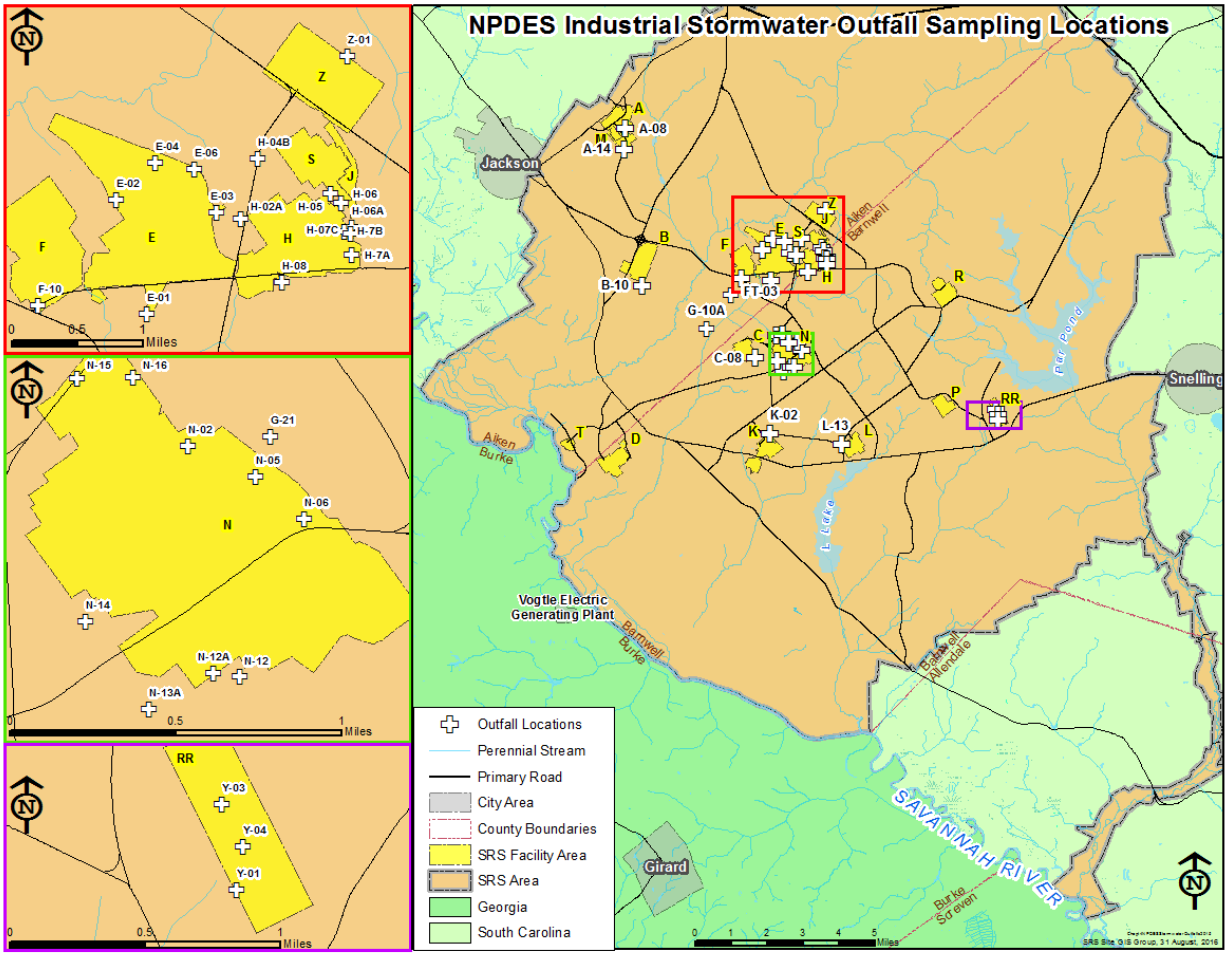

Figure 4-3 NPDES Industrial Stormwater Outfall Sampling Locations

4.3.3 Onsite Drinking Water Monitoring

SRS uses groundwater sources to supply onsite drinking water facilities. The treatment plant in A Area supplies most of the drinking water at SRS. The Site also has four smaller drinking water facilities, each of which serves populations of fewer than 25 people.

SRS collects and analyzes samples from the A Area treatment plant to ensure that domestic water from that system meets SCDHEC and EPA bacteriological drinking water quality standards. Samples are collected, analyzed and reported to SCDHEC monthly. All samples collected in 2015 met those standards. The Safe Drinking Water Act section of Chapter 3, "Compliance Summary" provides additional information regarding sampling and analyses performed by SCDHEC on SRS domestic water systems.

4.3.4 River and Stream Water Quality Surveillance

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

- 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; and
- Industrial and agricultural uses.

A Field Technician Collects a Water Quality Sample

SRS conducts river and stream water quality surveillance to identify any degradation that could be attributed to the water discharges regulated by Site NPDES permits and materials that may be released inadvertently from sources other than routine release points.

Under the SRS water quality surveillance program, ten SRS stream and five Savannah River locations are sampled for various physical and chemical properties including dissolved oxygen, pH, temperature, hardness, metals, pesticides/herbicides, and total organic carbon. Figure 4-4 illustrates the sampling locations. River and stream sampling sites are located to provide data 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.

4.3.4.1 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 2015. Metals were detected in at least one sample at each location. No sample results showed detectable levels of pesticides, herbicides, or polychlorinated biphenyls (PCBs). Appendix Table D-1 presents a summary of 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.

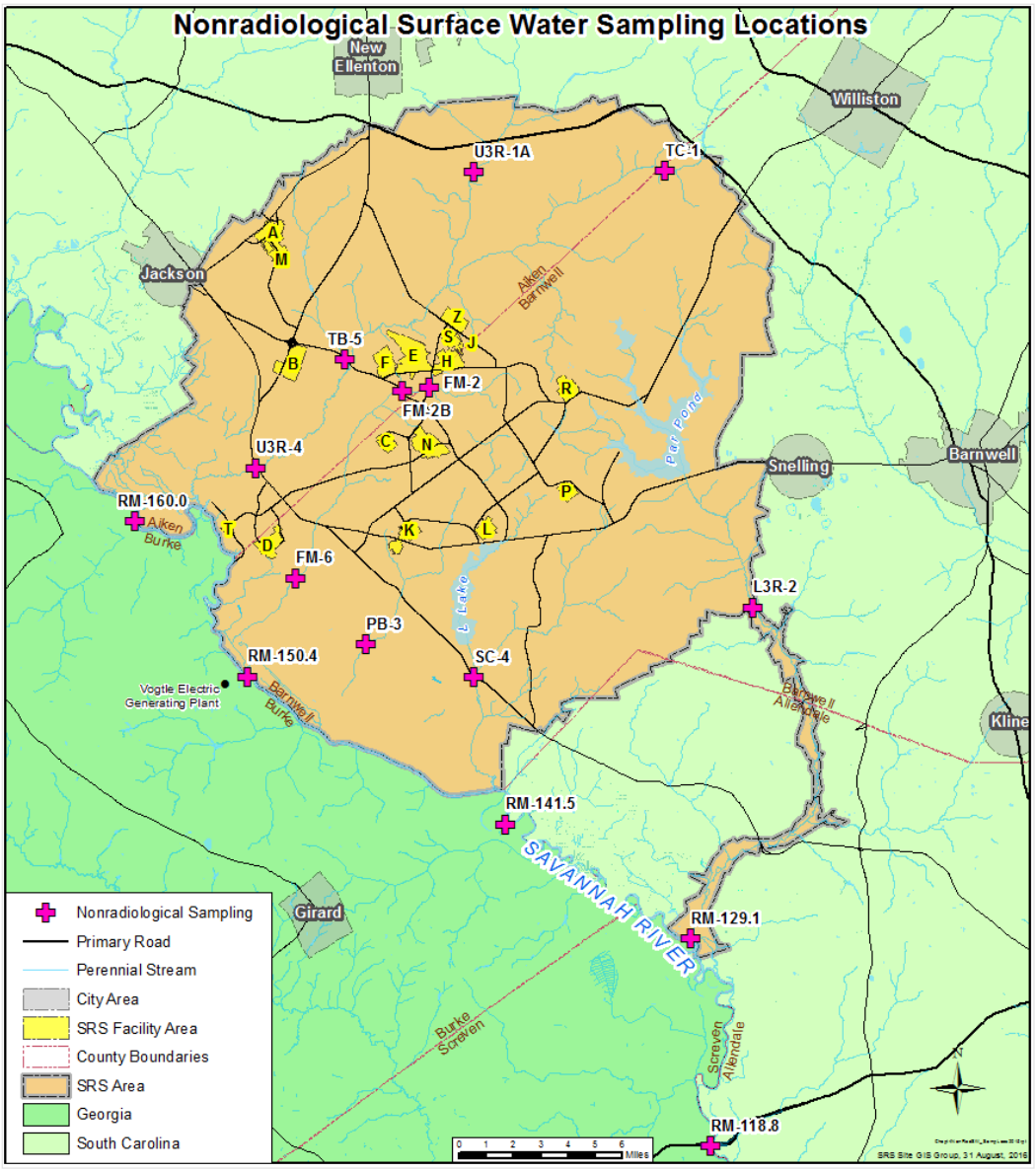

Figure 4-4 Nonradiological Surface Water Sampling Locations

4.3.5 Streams and River Sediment Monitoring

SRS's nonradiological sediment surveillance program provides a method to determine the deposition and accumulation of nonradiological contaminants in stream systems and 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 fish. Mercury enters waterbodies 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, 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. In 2015, SRS sampled 13 onsite stream locations, four basin locations, and nine Savannah River locations.

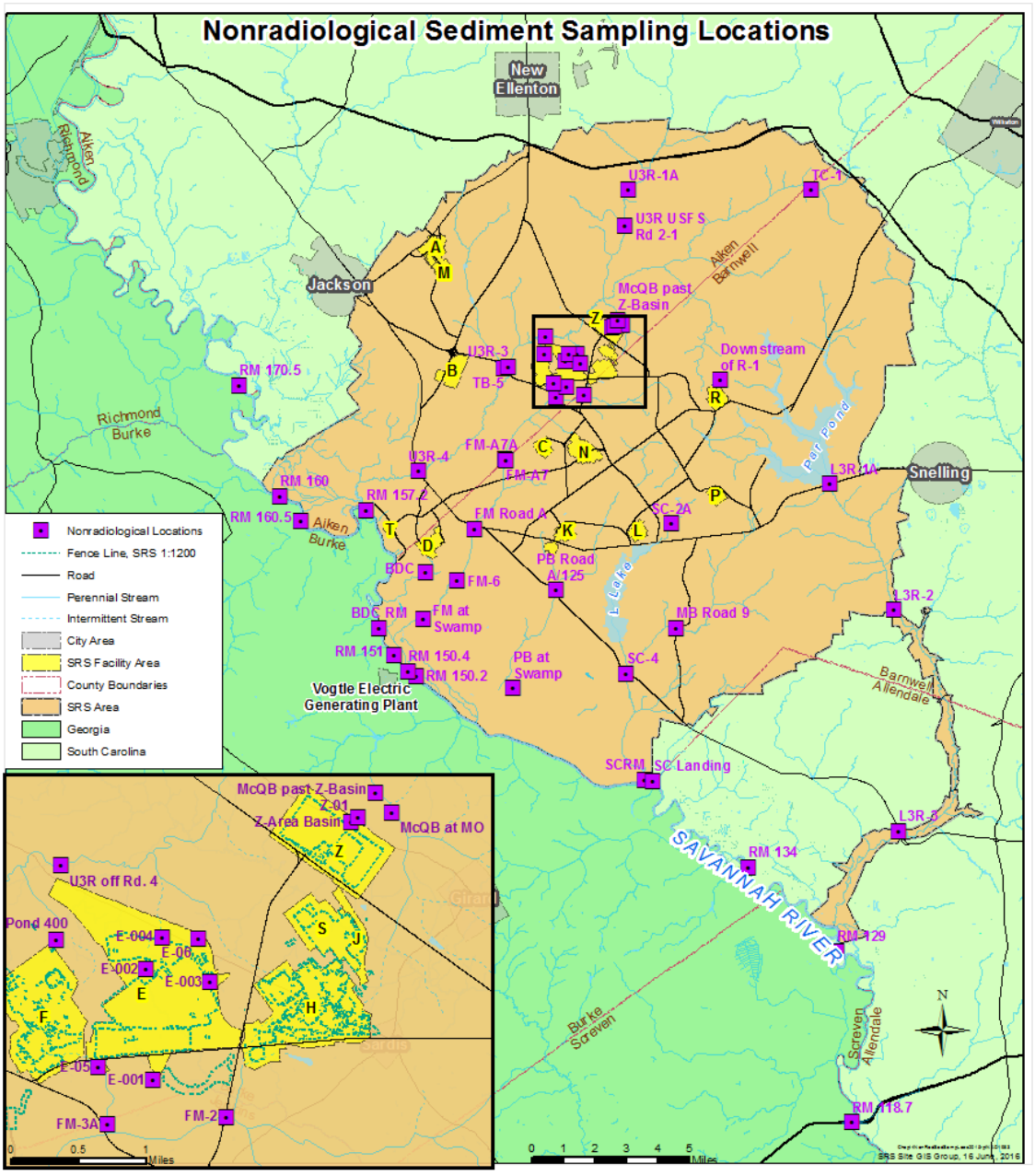

Figure 4-5 Nonradiological Sediment Sampling Locations

4.3.5.1 Stream and River Sediment Results Summary

Samples are analyzed for various inorganic contaminants, metals and cyanide to determine if there is a human health risk from exposure to sediments. The EPA has Regional Screening Levels for Residential Soil that were used for comparison.

In 2015, all mercury results for river sediment samples were below the lowest levels the laboratory can detect (practical quantitation limit). Five samples from onsite stream locations contained mercury that ranged from 0.017 mg/kg in Steel Creek to 0.33 mg/kg in Beaver Dam Creek. All mercury results were well below the EPA Regional Screening Level for resident soil (Figure 4-6).

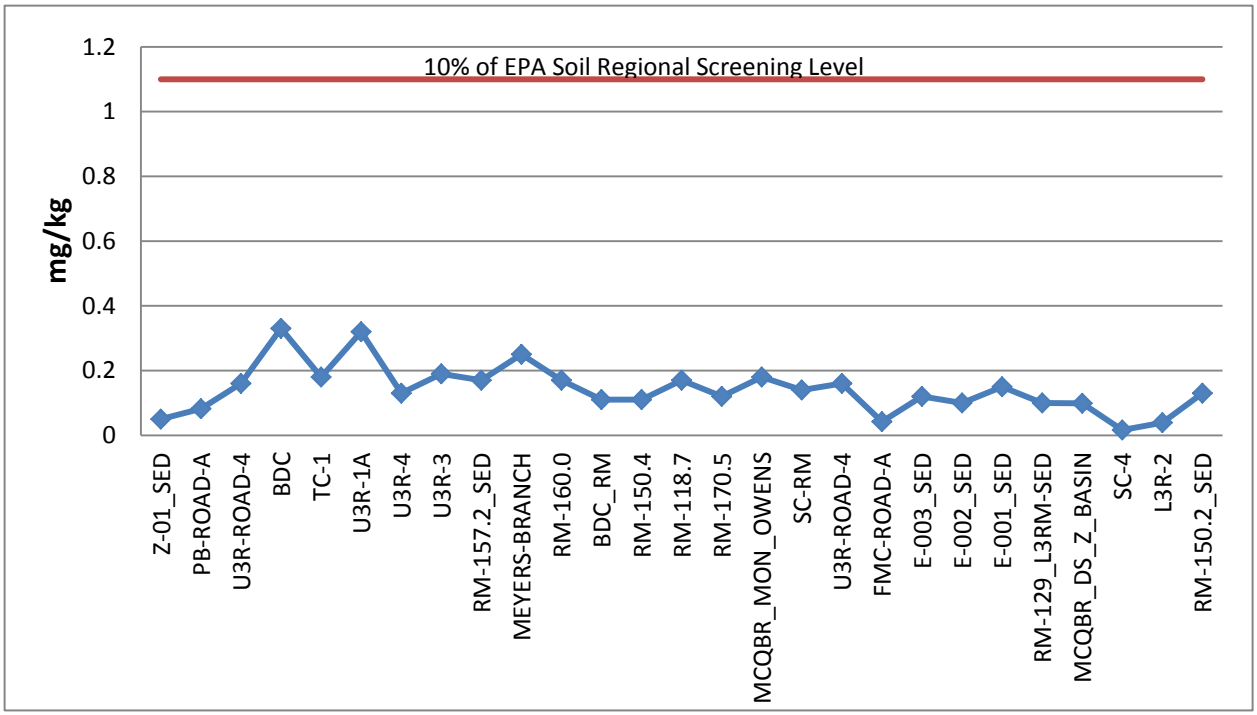

Figure 4-6 Mercury in Sediment Locations

Metals results for river and stream sediments showed some metals (aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, magnesium, manganese, nickel, selenium, uranium, and zinc) with levels greater than the practical quantitation limit for 2015, but were consistent with those seen in the background control location in Upper Three Runs and comparable to those of the previous five years.

4.3.6 Fish Monitoring

SRS collects samples of aquatic species to identify and evaluate any impact of Site operations on contaminant levels in fish. Freshwater fish (i.e., 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 (i.e., red drum and mullet) are collected at the Savannah River mouth near Savannah, Georgia. SRS analyzes samples of the edible flesh for metals uptake. Nonradiological analyses are performed for mercury, arsenic, cadmium, chromium, copper, lead, manganese, nickel, zinc, and antimony.

4.3.6.1 Fish Results Summary

In 2015, 140 fish flesh samples were collected and analyzed for a total of 1,400 individual analyses. The majority (56%) of the results were non-detected (less than the method detection limit). Appendix Tables D-2 and D-3 present summaries of the analytical results. Two hundred twenty-nine (229) results of the 1,400 individual analyses were detected and quantified (16%), with the majority of these results being for mercury (84) and zinc (140).

A Field Technician Nets a Fish for Analysis

Review of the 2015 zinc data indicate the results for the SRS creek mouths is comparable with the results for the control location at the New Savannah Bluff Lock and Dam. Review of mercury data for the period 2011 through 2015 (Figure 4-7) indicates the results from 2014 and 2015 are similar with values for bass showing higher levels during this two-year period than from 2011 through 2013. Mercury data for catfish and panfish in 2015 are consistent with the results for the five-year period (2011-2015).

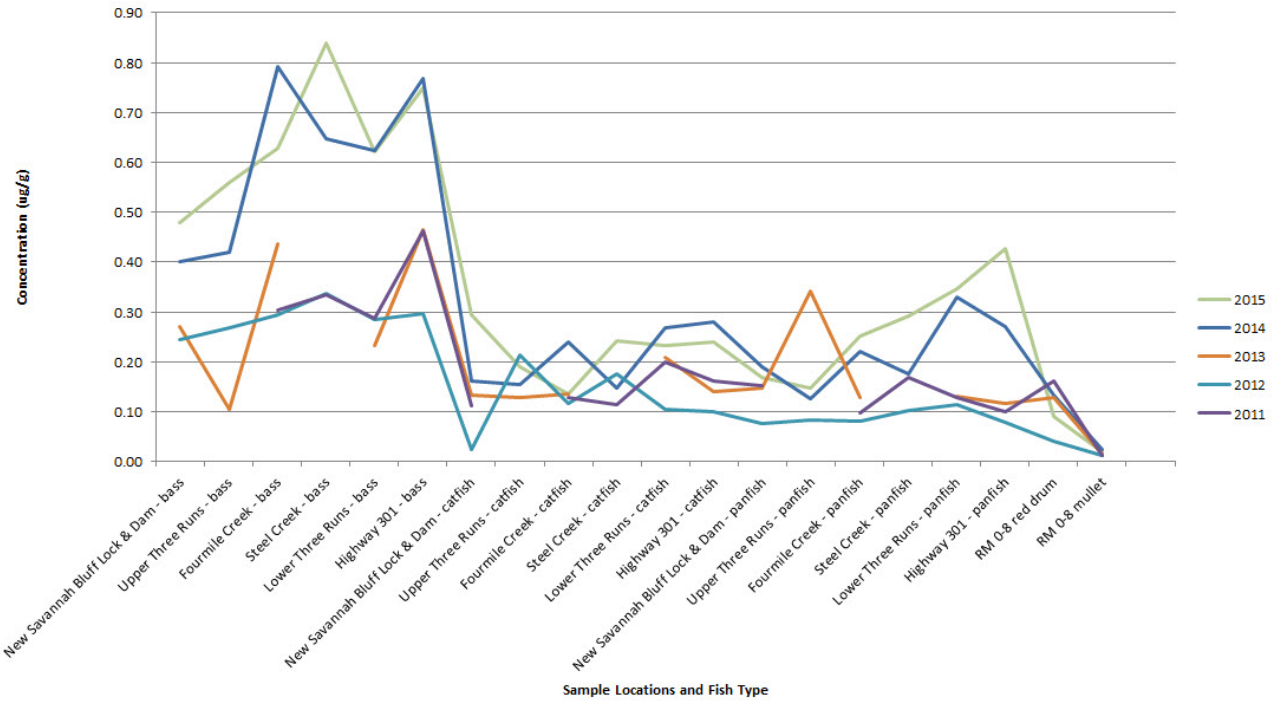

Figure 4-7 Mercury in Fish by Location and Species

4.4 SAVANNAH RIVER NATIONAL LABORATORY (SRNL) ASSESSMENT OF MERCURY IN THE SRS ENVIRONMENT

In 2012 the Agency for Toxic Substances and Disease Registry published a report on the assessment of biota exposure to mercury originating from SRS (ATSDR 2012). In an effort to address the conclusion that the mercury contribution to the Savannah River from SRS activities is not known, SRNL conducted a review of existing literature, monitoring data, and a comprehensive accounting of the mass balance of mercury usage and deposition from offsite sources to the SRS. The results are compiled in a report entitled, "2015 Assessment of Mercury in the Savannah River Site Environment and Responses to the Agency for Toxic Substances and Disease Registry 2012 Report on the Assessment of Biota Exposure to Mercury Originating from the Savannah River Site" (Kuhne et al. 2015).

SRS continues to conduct routine monitoring of biota, water, sediment and rainwater for analyses of mercury. SRS has enhanced environmental activities to address recommendations made by the Agency for Toxic Substances and Disease Registry including the identification of biota consumed by humans residing near SRS and the monitoring of those biota including alligators, rabbits, squirrels, ducks, turtles and other small animals through the Savannah River Ecology Laboratory. SRNL personnel are continuing to address contributions of mercury to the site from atmospheric deposition pathways and identifying remediation strategies for contaminated locations. Continued monitoring of sediment shows no accumulation of mercury in tributary sediments. Concentrations in freshwater fish show a downward trend in species starting from 2009 and continuing into 2013 (latest data available during preparation of the SRNL report) with levels decreasing in catfish to panfish. Measurements in a small number of alligators indicate that mercury levels are consistent with those found in freshwater fish.

4.4.1 Precipitation Chemistry and Deposition

The SRS nonradiological atmospheric monitoring program includes collection of samples and monitoring 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.

SRS sponsors a collection station in support of the NADP. This station, located near the center of the SRS at the 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 station at SRS was added to the National Trends Network (NTN). This network tracks changes in acid deposition precipitation (commonly referred to as 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 provides specific information related to the chemistry of precipitation at SRS.

4.4.1.1 Precipitation Chemistry and Deposition Results Summary

During calendar year 2014 (the last year for which data are available) the average (volume weighted) concentration of total mercury in precipitation was 9.2 ng/L and the wet deposition rate was 10.8 µg/m^2. These observations are consistent with historical observations associated with this surveillance and are consistent with other observations from the southeastern United States. Data from 2015 will not be available until the fall of 2016. Additional information on the MDN as well as the location and data from surrounding stations is accessible via the following link: http://nadp.sws.uiuc.edu/mdn/.

The results from the precipitation results for calendar year 2014 are presented in Appendix Table D-4. Additional information on the NTN is accessible via the following link: http://nadp.sws.uiuc.edu/NTN/.