Chapter 8: **Quality Assurance**

The Savannah River Site (SRS) Quality Assurance (QA)/Quality Control (QC) program objectives ensure SRS products and services meet or exceed customers' requirements and expectations. SRS QA/QC objectives associated with the Environmental Monitoring Program ensure the environmental data accurately represents SRS discharges and the conditions of the surrounding environment. The Environmental Monitoring Program has multiple QA requirements for collecting samples, analyzing and reporting, data management, and records management. It is important to confirm the accuracy of sample results so SRS can confidently assess the impacts Site activities may have on human health and the environment.

2018 Highlights

Analytical Laboratory Quality Assurance—SRS uses South Carolina Department of Health and Environmental Control (SCDHEC)-certified laboratories to analyze environmental monitoring samples that it reports to SCDHEC.

The DOE Consolidated Audit Program (DOECAP) in 2018 began requiring analytical laboratories providing service to DOE be accredited. Therefore, the three SRS subcontract laboratories that analyzed the environmental samples reported in this document obtained their accreditation, enabling them to continue to provide service to SRS.

The DOECAP audited three treatment, storage, and disposal facilities (TSDFs). The audits determined that each facility provided services that were of sufficient quality to warrant DOE continuing to use them.

Quality Control Activities—QC samples identified no defects affecting the analytical results of the surveillance and monitoring programs. Onsite and subcontracted laboratories reported acceptable proficiency and maintained SCDHEC certification for all analyses.

8.1 INTRODUCTION

SRS implements and conducts its QA program to comply with the following regulations: 1) U.S. Department of Energy (DOE) Order 414.1D, *Quality Assurance*, 2) American Society of Mechanical Engineers (ASME) Nuclear Quality Assurance (NQA) standards NQA-1-2008 with the NQA-1a-2009 Addenda, *QA Requirements for Nuclear Facility Applications*, and 3) 10 CFR 830, *Nuclear Safety Management*. In addition, specific programs may have other QA requirements from outside organizations. For example, under the tank closure program and area closure projects, the U.S. Environmental Protection

Agency (EPA) and the State of South Carolina require DOE to develop and follow a project-specific sampling and analysis plan and a QA program plan. DOE has QA programs to verify the integrity of analyses from onsite and subcontracted offsite environmental laboratories, and to ensure it is complying with the quality-control program requirements.

The SRS Environmental Monitoring Program uses and disseminates high-quality data to further environmental stewardship and support other Site missions. The environmental monitoring QA/QC program is designed to improve the methods and techniques used to both collect and analyze the environmental data and to prevent errors in generating the data. The QA/QC program includes continuous assessments, precision checks, and accuracy checks, as Figure 8-1 shows. The results of activities in one area provide input to assessments or checks conducted in the other two areas in an ongoing process. The result is high-quality data. By combining continuous assessment of field, laboratory, and data management performance with checks for accuracy and precision, SRS ensures that all monitoring and surveillance data accurately represent conditions at SRS. The glossary contains definitions for each term Figure 8-1 presents.

Chapter 8—Key Terms

Quality assurance *is an integrated system of management activities involving planning, implementing, documenting, assessing, reporting, and improving quality to ensure quality in the processes by which products are developed. The goal of QA is to improve processes so that defects do not arise when the product is produced. It is proactive.*

Quality control *is a set of activities to ensure quality in products by identifying defects in the actual products. The goal of QC is to identify and correct defects in the finished product before it is made available to the customer. QC is a reactive process.*

In summary, quality assurance makes sure you are doing the right things, the right way; quality control makes sure the results of what you have done are what you expected.

Some elements of the QA/QC program are inherent within environmental monitoring standard procedures and practices. SRS personnel evaluate these elements as part of the continuous assessment process. The DOECAP focuses on assessing specific QA/QC program elements. Figure 8-1 shows the QA/QC elements discussed in this chapter in bold text.

8.2 BACKGROUND

DOE Order 414.1D, *Quality Assurance*, requires an integrated system of management activities to ensure that the results of the Environmental Monitoring Program meet the requirements of federal and state regulations and DOE Order 458.1, *Radiation Protection of the Public and the Environment*. SRS uses field and laboratory procedures to guide activities such as collecting samples, analyzing samples, evaluating data, and reporting results. SRS uses an integrated testing system to ensure the integrity of analyses SRS and offsite laboratories perform. This testing includes internal laboratory QA and QC tests and testing associated with state and national testing programs, such as the Mixed Analyte Performance Evaluation Program (MAPEP). In addition, SRS uses QA and QC procedures to verify and control environmental monitoring activities. Together, these quality measures ensure the resulting data provide a representative evaluation of SRS operational impacts on the health and safety of the public, workers, and the environment.

8.3 QUALITY ASSURANCE PROGRAM SUMMARY

The SRS environmental monitoring QA/QC program focuses on minimizing errors through ongoing assessment and control of the program components. The QA and QC activities are interdependent.

For example, QC identifies an ongoing problem with the quality of the product and alerts QA personnel that there is a problem in the process. QA determines the root cause and extent of the problem and changes the process to eliminate the problem, prevent reoccurrences, and improve product quality.

QA focuses on the processes implemented to produce the data presented in this report. In 2018, QA efforts associated with the Environmental Monitoring Program that led to program improvements were as follows:

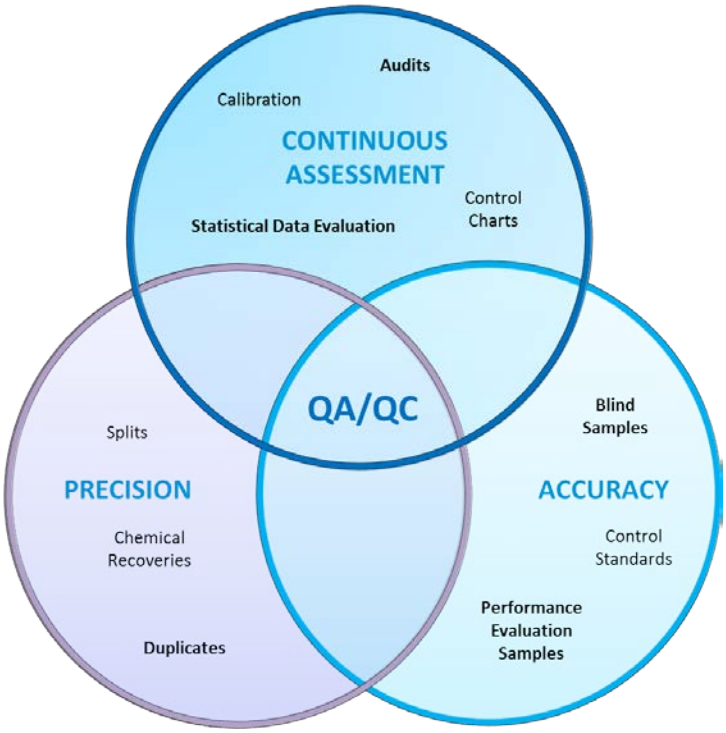

Figure 8-1 Interrelationship between QA/QC Activities

- Implemented monitoring program changes
- Performed DOECAP audits of commercial TSDFs SRS waste generators used

QC activities are the tests and checks that ensure SRS is complying with defined standards. In 2018, the QC activities associated with the environmental monitoring program included the following:

- Participated in MAPEP by laboratories that perform analytical measurements on SRS samples
- Participated in proficiency testing for laboratories performing National Pollutant Discharge Elimination System (NPDES) and drinking water analyses
- Collected and analyzed QC samples (duplicates and blind samples) associated with field sampling

8.4 ENVIRONMENTAL MONITORING PROGRAM QA ACTIVITIES

SRS continuously assesses the Environmental Monitoring Program to identify and implement continuous improvement and minimize the potential for errors. During 2018, SRS implemented the following quality improvements:

- Air Effluent—Modified the sampling and analysis to support the 235-F facility deactivation and decommissioning that commenced in July 2018. SRS discontinued compositing and analyzing two one-week samples. All radionuclide analyses for air effluent samples from this facility are now based on a one-week sample period, allowing better clarity in determining release times.

Neptunium-237 and strontium-89/90 were added to the analysis because they are major contributors to the dose estimate. Updated the sample line collection efficiency, that is a variable in the dose calculation, to comply with requirements in the SCDHEC Construction Permit (Permit No. 0080-0041-C1).

- Air Effluent—Evaluated neptunium-237 results to optimize sampling frequency. In 2014, this analyte was added to the weekly monitoring for F- and H-Area Canyon stacks. The evaluation indicated the sampling frequency will remain weekly.
- Fish Surveillance—Discontinued collecting red drum and sea trout. This improvement is because the cesium-137 results from the past 10 years data are not detected.
- Foodstuff Monitoring—Replaced one milk sampling location that was near another milk sampling location. The replacement location provides sampling in an area that has not been sampled previously and provides the opportunity to collect goat milk. Small producers are typically the source for goat milk, which they sell locally. Due to differences in diet and digestive processes between goats and cows, both sources of milk will be included in the dairy program.
- Radiological Settleable Solids Program—Added 11 locations for total suspended solids analyses. This was based on a 2018 evaluation of current NPDES and radiological liquid effluent locations against DOE Order 458.1 requirements for monitoring settleable solids.
- River and Stream Water Quality Program—Beginning in August 2018, the analytical method for cadmium and lead changed resulting in a lower detection limit. The detection limit is now aligned with comparable SCDHEC standards.
- Savannah River Sampling—During the early summer of 2018, the Savannah River control location at River Mile (RM) 160 was moved one river mile upriver to RM 161. This was because of increased tritium levels observed at the RM 160 location. The hypothesis for these higher levels is that during high flooding events tritium from Upper Three Runs Creek flows to tributaries that are upriver of RM 160, thus, impacting results. The purpose of the control location is that it provides a measure of conditions prior to any SRS influences affecting the river water quality. Thus, it is located upriver of any SRS influence.

8.4.1 Department of Energy Consolidated Audit Program (DOECAP)

The DOECAP is a comprehensive audit program of contract and subcontracted laboratories that provide analytical services to DOE Operations and Field Offices. The DOECAP performs consolidated audits to reduce the number of audits DOE field sites conduct independently and to standardize audit methodologies, processes, and procedures. DOECAP audits commercial environmental analytical laboratories and commercial TSDFs that DOE facilities use.

8.4.1.1 DOECAP Laboratory Audits

In 2018, the DOECAP evolved from an annual audit comprised of trained volunteer auditors from across the DOE Complex to a formal Accreditation Program. To receive and maintain DOECAP Accreditation, laboratories must be assessed by a DOECAP approved third-party Accreditation Body. Laboratories continue to be evaluated on technical capability and proficiency along with complying with DOE QA requirements. Laboratories are assessed on how well they document incoming samples, calibrate instruments, adhere to analytical procedures, verify data, issue data reports, manage records, perform

nonconformance and corrective actions, perform preventative maintenance, and dispose of samples. Within these topics, auditors evaluate the use of control charts, control standards, chemical recoveries, performance evaluation samples, and laboratory procedures.

In 2018, the three SRS subcontracted laboratories that analyze the environmental samples documented in this annual report acquired their official DOECAP Accreditation. By obtaining (and maintaining) this Accreditation, it is determined that these facilities are acceptable to provide service to DOE or SRS.

8.4.1.2 DOECAP TSDF Audits

DOECAP performs annual audits of the commercial TSDFs SRS uses to treat and dispose of mixed and hazardous waste. These reviews ensure that TSDFs are meeting contract requirements and are complying with applicable local, state, and federal regulations. DOECAP uses functional area checklists to conduct the following audits: QA, analytical data quality, environmental compliance, radiological controls, waste operations, safety and industrial hygiene, and transportation.

In 2018, SRS provided 5 auditors that participated in the DOECAP audits of three commercial TSDFs. A review of the final reports from each audit indicated there were no significant findings that would cause SRS waste generators to discontinue using the TSDFs.

8.5 ENVIRONMENTAL MONITORING PROGRAM QC ACTIVITIES

An important part of the SRS Environmental Monitoring Program QC activities is to ensure collecting and analyzing samples are performed to the highest standard and are free of errors. The Site collects quality control samples and analyzes them to identify any collection and analysis errors. All laboratories analyzing samples for the SRS Environmental Monitoring Program must participate in QC programs that either SCDHEC or DOE direct.

8.5.1 QC Sampling

SRS personnel collect and transport several types of QC samples, including blinds, field duplicates, trip blanks, and field blanks throughout the year to determine the source of any measurement error.

SRS personnel routinely analyze blind samples (a sample with a composition known to the submitter, but not to the analyst) of field measurements of potential of hydrogen (pH) to assess the quality and reliability of field data measurements. For 2018, all 24 blind sample results were within the acceptable limit of less than a 0.4 pH unit difference between the original and blind samples. Analysis of blind samples tests the analyst's proficiency in performing the specified analysis.

During intralaboratory checks performed for the National Pollutant Discharge Elimination System (NPDES) industrial wastewater program, SRS personnel collect blind and duplicate field samples for at least 10% of each outfall's required frequency. For example, if an outfall has a monthly sampling requirement, then SRS collects two blinds and two duplicates during the year. SRS onsite and subcontracted laboratories also analyze duplicate samples for the water quality (nonradiological) program. Each month, SRS collects

duplicate samples at one river and one stream location to verify analytical results. SRS also collects duplicate samples for both the radiological and nonradiological sediment samples.

The relative percent difference (RPD) between each sample and its blind or duplicate (comparing only when both values are at least 5 times above the detection limit) should be 20% or less. Table 8-1 summarizes the results of blind and duplicate sample analyses associated with the NPDES industrial wastewater program and the water quality program. This table addresses analyses both SRS and offsite subcontracted laboratories conduct. The duplicate samples test the samplers' proficiency in collecting the samples. Ninety-eight percent (98%) of the blind samples, 95% of the NPDES duplicate samples, 97% of the water quality duplicate samples, and 94% of the sediment duplicate samples met the acceptable difference limit. The 3 NPDES blind samples with a difference greater than 20% represent 3 analytes. The 5 NPDES duplicate samples with a difference greater than 20% represent 4 analytes. The 22 water quality duplicate samples with a difference greater than 20% represent 9 analytes. The 3 sediment duplicate samples with a difference greater than 20% represent 3 analytes. Reasons for results differing for the programs include analytical uncertainties associated with the measurements, such as the precision of the analytical instruments and detection limits of the analytical instruments.

Table 8-1 Summary of Laboratory Blind and Duplicate Sample Analyses

Program and Sample Type	Number of Analyses	Number of Analyzes within Acceptable Limits (RPD between results < 20%)	Number of Analyzes Outside Acceptable Limits (RPD between results ≥ 20%)
NPDES Blind	122	119	3
NPDES Duplicate	103	98	5
Water Quality River/Stream Duplicate	648	626	22
River/Stream Sediment Duplicate	53	50	3

Though results indicate there were some differences between the quality control samples and their corresponding compliance samples, they did not impact conclusions made with the data. The results indicate that in 2018 there were no consistent problems with either sample collection or laboratory analysis techniques.

Table 8-2 summarizes the results of field and trip blank analyses associated with the NPDES program. Field blanks determine whether the field sampling and sample processing environments have contaminated the sample. A trip blank documents contamination associated with shipping and field-handling procedures. The analytical results indicate neither sampling nor shipping contributed to contaminants being found in the actual samples as discussed in Chapter 4, *Nonradiological Environmental Monitoring Program.*

Table 8-2 Summary of Trip and Field Blank Sample Analyses

Program and Sample Type	Number of Samples Analyzed	Number of Samples with Results Below Detection Limits
NPDES Trip Blank	42	42
NPDES Field Blank	12	12

8.5.2 Laboratory Proficiency Testing

8.5.2.1 Nonradiological Methods Proficiency Testing

SRS laboratories performing NPDES and drinking water analyses maintained state certification for all analyses after achieving acceptable results in SCDHEC-required proficiency testing. Proficiency testing is also known as comparative testing and evaluates a laboratory's performance against pre-established criteria by testing the same samples at other laboratories and comparing the results. South Carolina state regulation 61-81, *State Environmental Laboratory Certification Program,* requires the testing. All laboratories used proficiency-tested providers that SCDHEC approved.

During 2018, onsite and subcontracted laboratories participated in water pollution and water supply performance evaluation studies. Onsite laboratories reported proficiency of 100% and subcontracted laboratories reported proficiency greater than 94% for the parameters tested for NPDES and drinking water laboratories. Both onsite and subcontracted laboratories maintained SCDHEC certification for all analyses at SRS.

The laboratories develop corrective actions for the failed analyses that they document and submit to SCDHEC, along with passing proficiency testing results for those analyses. The objective of the corrective actions is to prevent a reoccurrence of failed analyses. These corrective actions may include modifying sample preparation or analysis procedures. The underlying reasons for the unacceptable measurements did not affect the analyses provided to SRS in support of the NPDES and drinking water monitoring programs.

8.5.2.2 Radiological Methods Proficiency Testing

All laboratories with licenses to handle and analyze radioactive materials must participate in the Mixed Analyte Performance Evaluation Program (MAPEP) to support DOE's Environmental Management activities. MAPEP is a laboratory comparison program that tracks performance accuracy and tests the quality of environmental data reported to DOE. One SRS laboratory and SRS contracted laboratories continues to participate in MAPEP, analyzing MAPEP performance evaluation samples including water, soil, air filter, and vegetation matrices for stable inorganic, organic, and radioactive elements representative of those at DOE sites.

MAPEP offered two separate studies in 2018. The MAPEP studies include soil, vegetation, water, and air filter test samples. The SRS Environmental Laboratory participated in the two studies, receiving 100%

acceptable results in both MAPEP 38 and MAPEP 39. SRS subcontracted laboratories also participated in the MAPEP studies, receiving 100% acceptable results for both water and soil matrices.

When a laboratory fails an analysis, they will develop corrective actions for that failed analysis to prevent a reoccurrence. These corrective actions may include modifying procedures for preparing and analyzing samples.

8.6 RECORDS MANAGEMENT

Environmental Monitoring Program documentation is an important part of the SRS environmental program. The Annual Site Environmental Report is the public record of the SRS Environmental Monitoring Program's performance. SRS compiles it every year following guidelines in DOE Order 231.1B, *Environment, Safety, and Health Reporting*.

In addition to the Annual Site Environmental Report, SRS generates various records and reports to document SRS nonradiological and radiological environmental programs, groundwater management, and how the Site complies with applicable regulations. In addition, records and reports notify the proper officials of unusual or unforeseen occurrences and maintain an accurate and continuous record of the effects of SRS operations on the environment. This documentation also communicates results of the Environmental Monitoring Program and groundwater management and compliance programs to government agencies and the public. SRS maintains the documents and records generated as part of the SRS Environmental Monitoring Program in accordance with SRS records management procedures.