Chapter 8: **Quality Assurance**

The Savannah River Site (SRS) Quality Assurance (QA)/Quality Control (QC) program objectives verify that SRS products and services meet or exceed customers' requirements and expectations. The Environmental Monitoring Program has multiple QA requirements for collecting samples, analyzing and reporting data, and managing records. 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.

2021 Highlights

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

The U.S. Department of Energy (DOE) Consolidated Audit Program (DOECAP) requires the analytical laboratories providing service to DOE have accreditation through the program. In 2021, three SRS subcontract laboratories that analyzed the environmental samples reported in this document continued to maintain their accreditation, as required to provide analytical services to SRS.

DOECAP audits facilities that provide service to DOE. In 2021, DOECAP conducted four virtual audits of four treatment, storage, and disposal facilities (TSDFs). The audits determined that the facilities were in good standing and eligible to continue to provide services to DOE.

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) DOE Order 414.1D, *Quality Assurance*, 2) American Society of Mechanical Engineers Nuclear Quality Assurance (NQA) standards NQA-1-2008 with the NQA-1a-2009 Addenda, *QA Requirements for Nuclear Facility Applications*, and 3) the Code of Federal Regulations (CFR) in 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 Completion Projects, the U.S. Environmental Protection Agency (EPA) and SCDHEC 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 both onsite and subcontracted offsite

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 promote environmental stewardship and support other Site missions. The Environmental Monitoring QA/QC Program improves 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. Through an ongoing process, the results of activities in one area provide input into assessments or checks conducted in the other two areas. 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. Appendix F, *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 through 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 that 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 an entity is doing the right things, the right way; quality control makes sure these results are what the entity 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. DOECAP focuses on assessing specific QA/QC program elements.

8.2 BACKGROUND

DOE Order 414.1D, *Quality Assurance*, requires an integrated management system ensuring 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. Together, these quality measures ensure that the resulting data representatively reflects 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. SRS continuously evaluates the Environmental Monitoring Program to identify and implement improvements. The Environmental Monitoring Program QA efforts that lead to program improvements include the following:

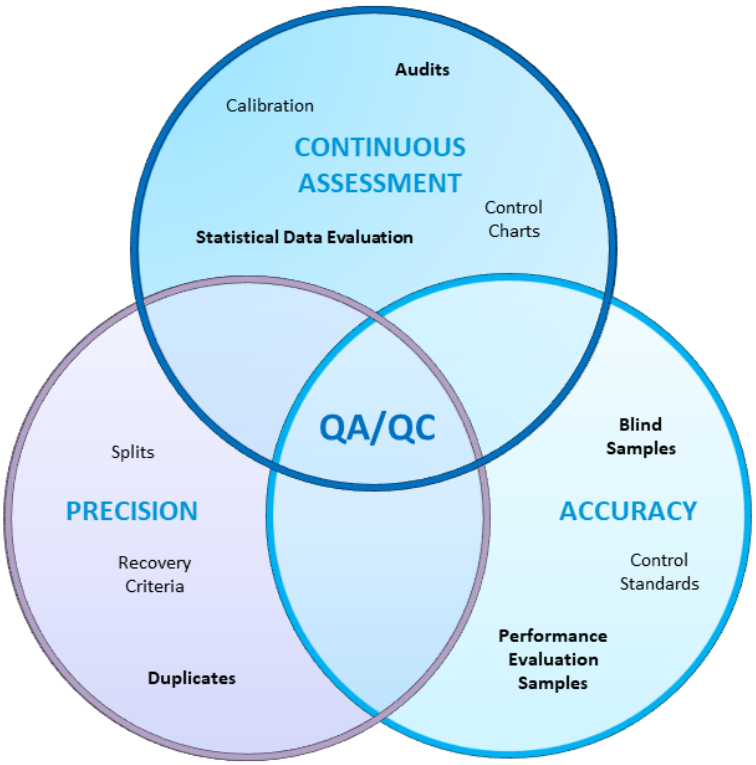

Figure 8-1 Interrelationship between QA/QC Activities

- Implementing Environmental Monitoring Program enhancements
- Improving data quality in the laboratory and field
- Performing DOECAP audits of commercial TSDFs that SRS waste generators use
- Ensuring commercial analytical laboratories maintain DOECAP accreditation

QC activities are the tests and checks that ensure SRS is complying with defined standards. The ongoing QC associated with the Environmental Monitoring Program includes the following:

- Participating in MAPEP by laboratories that perform analytical measurements on SRS samples
- Participating in proficiency testing by laboratories performing National Pollutant Discharge Elimination System (NPDES) and drinking water analyses
- Collecting and analyzing QC samples (duplicates and blind samples) associated with field sampling
- Analyzing QC samples (blanks, laboratory control samples, duplicates, spikes, and others) associated with laboratory analyses

8.4 ENVIRONMENTAL MONITORING PROGRAM QA ACTIVITIES

SRS continuously assesses the Environmental Monitoring Program to identify and implement continuous improvements and minimize the potential for errors. During 2021, SRS implemented the following quality improvements:

The Portable Refrigerated Sampler Allows for Remote Automation and Calibration Checks.

- Air Surveillance—SRS added an air surveillance station to the network to improve efficiency.
- Radiological Liquid and Air Effluent Programs—SRS incorporated updated dose factors into the monthly radioactive release reports.
- Comprehensive Environmental Data Management System—SRS continued transitioning into a new comprehensive environmental database system. The new system will replace a suite of existing applications, systems, and databases. The application programming interface will enable SRS to load and extract data from a consolidated data storage system.
- NPDES Industrial Wastewater Program—SRS evaluated using a portable refrigerated sampler, flowmeter with modem communication, and camera technology for automation and calibration checks that can be controlled remotely from a desktop computer or a cellphone. SRS also installed audio/visual sensors and a modem to measure real-time flows at an NPDES outfall.
- Wildlife Hunts—SRS improved the programming code for the Hunter Dose Tracking System. Also, because the Site cancelled the 2021 deer hunts due to COVID-19 concerns, SRS estimated the sportsman dose by collecting flesh samples and other relevant data from hogs that the U.S. Forest Service trapped onsite.

8.4.1 Department of Energy Consolidated Audit Program (DOECAP)

DOECAP is a comprehensive program that audits contract and subcontracted laboratories, providing analytical services to DOE Operations and Field Offices. 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

The DOECAP laboratory audit program is a formal accreditation program that DOE requires of commercial laboratories that perform analyses for the DOE Complex. A DOECAP-approved third-party accreditation body must assess a laboratory for it to receive and maintain DOECAP accreditation. The DOECAP-approved accreditation bodies evaluate laboratories based on technical capability and competence, along with their proficiency in complying with DOE QA requirements. The accreditation bodies assess how well the laboratories 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 how the laboratories use control charts, control standards, chemical recoveries, performance evaluation samples, and laboratory procedures.

In 2021, the three subcontracted laboratories that analyze the environmental samples documented in this annual report maintained their accreditation and continued to provide service to DOE and 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 2021, SRS provided five auditors who participated in four virtual DOECAP audits of commercial TSDFs. A review of the final audit reports of each TSDF indicated that there were no significant findings that would cause SRS waste generators to discontinue using the commercial TSDFs.

8.5 ENVIRONMENTAL MONITORING PROGRAM QC ACTIVITIES

An important part of SRS Environmental Monitoring Program QC activities is to ensure that personnel collect and analyze samples to the highest standard and without 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 directs.

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.

To assess the quality and reliability of field data measurements, SRS personnel routinely analyze blind samples to measure hydrogen ion activity (pH). A blind sample contains a composition known to the submitter but not known to the analyst. Analysis of blind samples also tests the analyst's proficiency in performing the specified analysis. Twenty-four blind sample results were within the acceptable limit of less than 0.4 standard unit difference between the original and blind samples.

During intralaboratory checks performed for the 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 duplicate samples 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 result and the result of the corresponding blind or duplicate sample (when both values are at least five times above the detection limit) should be less than or equal to 20%. Table 8-1 summarizes 1) the blind and duplicate sample analyses associated with the NPDES industrial wastewater program, 2) the duplicate sample analyses associated with the river and stream water quality program, 3) both the nonradiological and radiological duplicate sample analyses for river, stream, and basin sediment programs, and 4) the number of impacted analytes per program and sample type. Table 8-1 addresses both SRS and offsite subcontracted laboratory analyses. Processing duplicate samples evaluates the accuracy of the analytical and measurement methods the laboratories use. Ninety-nine percent of the blind samples, 98% of the NPDES duplicate samples, 98% of the water-quality duplicate samples, 100% of the nonradiological sediment duplicate samples, and 90% of the radiological sediment duplicate samples met the acceptable difference limit. Reasons for results differing between the programs include sampling uncertainties and analytical uncertainties associated with the measurements, such as the precision of the analytical instruments and detection limits of the analytical instruments.

Although 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 2021 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 techniques contributed to contaminants in the actual samples as discussed in Chapter 4, *Nonradiological Environmental Monitoring Program.*

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

Program and Sample Type	Number of Analyses	Number of Analyses within Acceptable Limits (RPD between results < 20%)	Number of Analyses Outside Acceptable Limits (RPD between results ≥ 20%)	Number of Impacted Analytes
NPDES Blind	168	166	2	1
NPDES Duplicate	214	210	4	3
Water Quality River/Stream Duplicate	1,080	1,053	27	7
Nonradiological River/Stream/Basin Sediment Duplicate	96	96	0	0
Radiological River/Stream/Basin Sediment Duplicate	60	54	6	3

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	38	38
NPDES Field Blank	12	12

8.5.2 Laboratory Proficiency Testing

8.5.2.1 Nonradiological Methods Proficiency Testing

SCDHEC Regulation 61-81, *State Environmental Laboratory Certification Program,* requires laboratory proficiency testing to assure the validity and quality of the data being generated. Proficiency testing validates a particular measurement process. It is used to evaluate a laboratory's performance against pre-established criteria by testing the same samples at other laboratories and comparing the results. SRS laboratories performing NPDES and drinking water analyses maintained state certification for all analyses after achieving acceptable results in SCDHEC-required proficiency testing.

During 2021, 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 95% for the parameters tested for NPDES and drinking water laboratories. Both onsite and subcontracted laboratories maintained SCDHEC certification for all analyses at SRS.

Laboratories develop corrective actions for failed analyses. The corrective actions are submitted to SCDHEC, along with subsequent passing proficiency testing results for those analyses. The objective of the corrective actions is to prevent a reoccurrence of failed analyses. Corrective actions may include modifying sample preparation or analysis procedures. 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 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. MAPEP standards are distributed twice a year. The standards include air filter, soil, vegetation, and water matrices for stable inorganic, organic, and radioactive elements representative of those at DOE sites. The MAPEP studies conducted during 2021 were MAPEP Series 44 and MAPEP Series 45. Three SRS laboratories and two SRS-contracted laboratories continue to participate in MAPEP. The SRS Environmental Laboratory participated in the two MAPEP studies, receiving acceptable results of 99% on MAPEP Series 44 and 100% on MAPEP Series 45.

Two SRS subcontracted laboratories participated in MAPEP Series 44 and had acceptable results in 99% of the water and soil matrices. One subcontracted laboratory participated in MAPEP Series 45 and received 95% acceptable results for both water and soil matrices. SRS sent all applicable environmental samples to the subcontracted laboratories, which continued to successfully participate in the MAPEP program.

When a laboratory fails an analysis, it 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 *SRS 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*.

The *SRS Environmental Report* communicates results of the Environmental Monitoring Program, and groundwater management and compliance programs to government agencies and the public. In addition to the *SRS Environmental Report*, SRS generates various records and reports to document SRS nonradiological and radiological environmental programs, groundwater management, and Site compliance with applicable regulations. SRS maintains these documents and the records generated as part of the SRS Environmental Monitoring Program, in accordance with SRS records management procedures.