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 the program collects accurately represent SRS discharges and the conditions of the surrounding environment. The Environmental Monitoring Program has multiple QA requirements for collecting samples, analyses 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.

2016 Highlights

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

The DOE Consolidated Audit Program (DOECAP) audited three SRS subcontracted laboratories and six 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.

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.

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.

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 integrated testing to ensure the integrity of analyses SRS and offsite laboratories perform. 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 2016, QA efforts associated with the Environmental Monitoring Program that led to program improvements were as follows:

- Implemented monitoring program changes
- Performed DOECAP audits of laboratories SRS used and audits of commercial treatment, storage, and disposal facilities (TSDFs) SRS waste generators used

QC activities are the tests and checks that ensure SRS is complying with defined standards. In 2016, the QC activities associated with the environmental monitoring program included the following:

- Participated in the Mixed Analyte Performance Evaluation Program (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

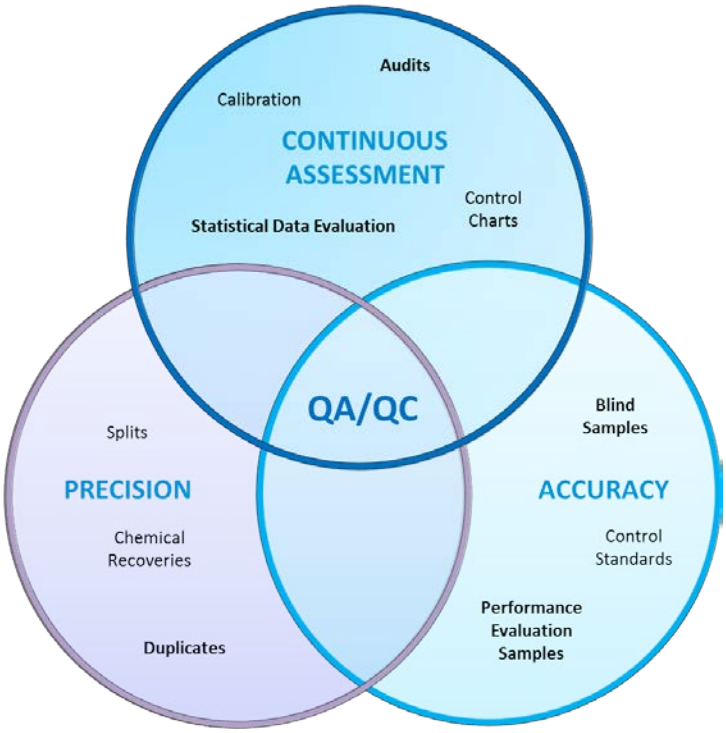

Figure 8-1 Interrelationship between QA/QC Activities

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 2016, SRS implemented the following improvements:

- Air Effluent—Increased the accuracy of sample results by compositing two airborne effluent samples. The compositing reduced the minimum detectable concentrations (MDCs) in airborne effluent samples. SRS initiated this approach at two sources to evaluate for potential expansion to other air effluent sources within the program. Results support expanding this method within the Air Effluent Program.
- Wildlife Monitoring—Increased the accuracy of field measurements by upgrading the existing monitoring system. The new system yielded a lower MDC and improved correlating field measurements and laboratory data. *Improvements to the Hunter Dose Tracking System* (Aucott et al. 2017) documents the improvements made to the system.

- Liquid Surveillance—Updated flow equations for all liquid surveillance locations. This update maintains the accuracy for calibration parameters used for estimating flow volumes from wireless ultrasonic readings.
- Savannah River Surveillance—Improved representativeness of sampling by relocating a sample location so that it is more indicative of river flow during low river levels.
- Sediment Surveillance—Implemented composite sampling. The result was a more representative sample than the previous grab-sample method.
- Reporting Improvements—Improved the method of reporting in both the *Annual Site Environmental Report* to improve readability for the lay reader and the *Monthly Radioactive Releases Report* to incorporate new information from a subtier document.

Technician collecting sediment samples using composite method

Other quality improvements included the following:

- Rainwater Surveillance Program—SRS discontinued collecting rain ion column samples in the field. The basis for this decision was that data trend analyses showed decreasing levels of radionuclides in deposition samples over the past 10 years. Also, a lower-cost alternative for deposition monitoring is available, if needed, and this data is not used in the dose modeling.
- Groundwater Monitoring Program—SRS optimized the groundwater monitoring for Georgia wells. Data trend analyses of 15 years of data from 44 wells showed no results above the maximum concentration level for tritium (20 pCi/mL).
- Environmental Monitoring Program—SRS began a notification process reminding sample collection personnel to order sampling materials that have a short shelf-life. A shortage of silica gel onsite, a backorder with the subcontracted supplier, and a possible delay in sampling, led to setting up a system to ensure the needed materials are always on hand to support the Environmental Monitoring Program sampling schedule.

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

DOECAP audits annually each subcontracted laboratory SRS uses to ensure the laboratories demonstrate technical capability and proficiency and comply with DOE QA requirements. The audit evaluates 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 the use of control charts, control standards, chemical recoveries, performance evaluation samples, and laboratory procedures.

Priority Definitions

A Priority I finding documents a deficiency that is of sufficient magnitude to potentially render the audited facility unacceptable to provide the affected service to DOE.

A Priority II finding documents a deficiency that is not of sufficient magnitude to render the audited facility unacceptable to provide services to DOE. Each affected laboratory submits corrective action responses to DOECAP that auditors review and approve prior to the next year's audit.

In 2016, DOECAP audited three SRS subcontracted laboratories that analyze the environmental samples documented in this annual report. The audits determined there was nothing of sufficient magnitude that would make the audited facilities unacceptable to provide service to DOE or SRS. Table 8-1 summarizes the number of Priority I and II findings and the status of their resolution. In 2016, there were 2 Priority I and 32 Priority II findings. None of the findings affected either SRS samples or analyses SRS requested in 2016. To close the open item, the audit team verified that the laboratory implemented corrective actions that were satisfactory. Any corrective actions that did not satisfy the requirement remain open until the 2017 audit.

8.4.1.2 DOECAP TSDF Audits

DOECAP performs annual audits of the commercial TSDFs SRS uses to treat and dispose of 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, waste operations, safety and industrial hygiene, and transportation.

In 2016, DOECAP audited six TSDFs that SRS waste generators used. 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.

Table 8-1 summarizes the one Priority I finding and 30 Priority II findings. The Priority I finding was a previous Priority II finding that was elevated to Priority I due to the TSDF not implementing sufficient corrective actions in a timely manner. The reason it was elevated to a Priority I finding was that some individual sites do not have an approved QA plan and have a less-than-robust comprehensive QA program. The Priority I finding is for the QA program for one contractor at multiple facilities. The facilities' corporate offices issued policies and procedures that the vendor has not fully implemented at all of its sites. DOECAP noted the issue several years ago. DOECAP management has been working with the vendor to implement

company-wide policies and procedures to use at all of its offices and sites. SRS DOECAP subject-matter experts will track the corrective actions from implementation through closure.

Four out of the 30 Priority II findings remain open while the vendors implement corrective actions. The remaining open Priority II findings are programmatic in nature and do not impact the quality of services the vendor is providing SRS. Auditors will address these open findings during the 2017 audits.

Table 8-1 2016 DOECAP Audits for SRS Subcontracts

Program Audit Types	Number of Audits Conducted in 2016	2016 Priority I Findings	2016 Priority II Findings	Closed 2015 Priority I Findings	Closed 2015 Priority II Findings	Open 2015 Priority I Findings	Open 2015 Priority II Findings
Laboratory	3	2	32	0	42	0	5
TSDF	6	1	30	0	26	0	4

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 pH to assess the quality and reliability of field data measurements. For 2016, all 24 blind sample analyses 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 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.

The relative percent difference (RPD) between each sample and its blind or duplicate (comparing only when both values are at least five times above the detection limit) should be 20% or less. Table 8-2 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. All of the blind samples, 98% of the NPDES duplicate samples, and 97% of the water quality duplicate samples met the acceptable difference limit. The two NPDES duplicate samples with a difference greater than 20% represent one analyte. Reasons for duplicate results differing for both NPDES and water quality include analytical uncertainties associated with the measurements, such as the precision of the analytical instruments and detection limits of the analytical instruments.

Table 8-2 Summary of Laboratory Blind and Duplicate Sample Analyses

Program and Sample Type	Number of Samples Analyzed	Number of Samples within Acceptable Limits (RPD between results < 20%)	Number of Samples Outside Acceptable Limits (RPD between results ≥ 20%)
NPDES Blind	102	102	0
NPDES Duplicate	113	111	2
Water Quality River/Stream Duplicate	648	626	22

Though results indicate there were some differences between duplicates, they did not impact conclusions made with the data. The results indicate that in 2016 there were no consistent problems with either sample collection or laboratory analysis techniques.

Table 8-3 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 8-3 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	52	52
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 2016, onsite and subcontracted laboratories participated in water pollution and water supply performance evaluation studies, and each reported proficiency greater than 99% for the parameters tested for NPDES and drinking water laboratories. Therefore, 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 radioactive materials that perform environmental analytical measurements to support DOE Environmental Management activities are required to participate in the Mixed Analyte Performance Evaluation Program (MAPEP), a laboratory comparison program that tracks performance accuracy and tests the quality of environmental data reported to DOE. One SRS laboratory continues to participate in MAPEP, analyzing MAPEP performance evaluation samples including water, soil, air filter, and vegetation matrices, all with environmentally important stable inorganic, organic, and radioactive constituents.

MAPEP offered two separate studies in 2016: 1) an oily tar sample in the MAPEP Session 34, and 2) a large soil sample in MAPEP Session 35. The SRS Environmental Laboratory participated in the two studies, receiving 97.4% acceptable results in MAPEP 34 and 93.7% in MAPEP 35. All unacceptable measurements were related to minor errors in offline chemist spreadsheet calculations used to meet MAPEP nonroutine reporting requirements for gamma isotopes (for example, cobalt-60, cesium-137), not method quality. MAPEP results for SRS subcontracted laboratories were also satisfactory, with an average percent of passing parameters of 99% for water matrix and 97% for soil matrix. The laboratories developed corrective actions for the failed analyses to prevent a reoccurrence. These corrective actions included modifying procedures for preparing and analyzing samples. The underlying reasons for the unacceptable measurements did not affect the analyses provided to SRS in support of the Environmental Monitoring Program.

8.6 RECORDS MANAGEMENT

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

In addition to the Annual Environmental Report, the Site 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 general public. SRS maintains the documents and records generated as part of the SRS Environmental Monitoring Program in accordance with SRS records management procedures.