

# Chapter 8: Quality Assurance

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**T**he Savannah River Site (SRS) quality assurance (QA) and quality control (QC) program objectives verify that SRS products and services meet or exceed customers' requirements and expectations. The Environmental Monitoring Program (EMP) 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.

## 2023 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 and the U.S. Environmental Protection Agency.

The U.S. Department of Energy Consolidated Audit Program (DOECAP) requires the analytical laboratories providing service to DOE have accreditation through the program. In 2023, 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 2023, SRS participated in one DOECAP audit of a treatment, storage, and disposal facility (TSDF) and reviewed DOECAP audit reports of other TSDFs. The audits indicated that there were no significant findings that would cause SRS waste generators to discontinue using the commercial TSDFs.

### 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

The Savannah River Site (SRS) implements and conducts its quality assurance (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 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 South Carolina Department of Health and Environmental Control (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 (QC) program requirements.

The SRS radiological Environmental Monitoring Program (EMP) uses and disseminates high-quality data to promote environmental stewardship and support other Site missions. The environmental monitoring QA and 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 and 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.

Some elements of the QA and QC program are inherent within environmental monitoring standard procedures and practices. SRS evaluates these elements as part of the continuous assessment process. The Department of Energy Consolidated Audit Program (DOECAP) focuses on assessing specific QA and QC program elements.

## 8.2 BACKGROUND

DOE Order 414.1D, *Quality Assurance*, requires an integrated management system, ensuring that the results of the EMP 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.

### 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.

### 8.3 QUALITY ASSURANCE PROGRAM SUMMARY

The SRS Environmental Monitoring QA and 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 EMP to identify and implement improvements. The EMP QA efforts that lead to recurring or one-time program improvements include the following:

- Implementing EMP enhancements
- Improving data quality in the laboratory and field
- Recertifying one of the SRS onsite laboratories
- Performing DOECAP audits of commercial treatment, storage, and disposal facility (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. Ongoing QC associated with the EMP 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

These specific checks identify instances when defects can occur in SRS processes and ensure that when addressed through planning and improving, quality data is produced.

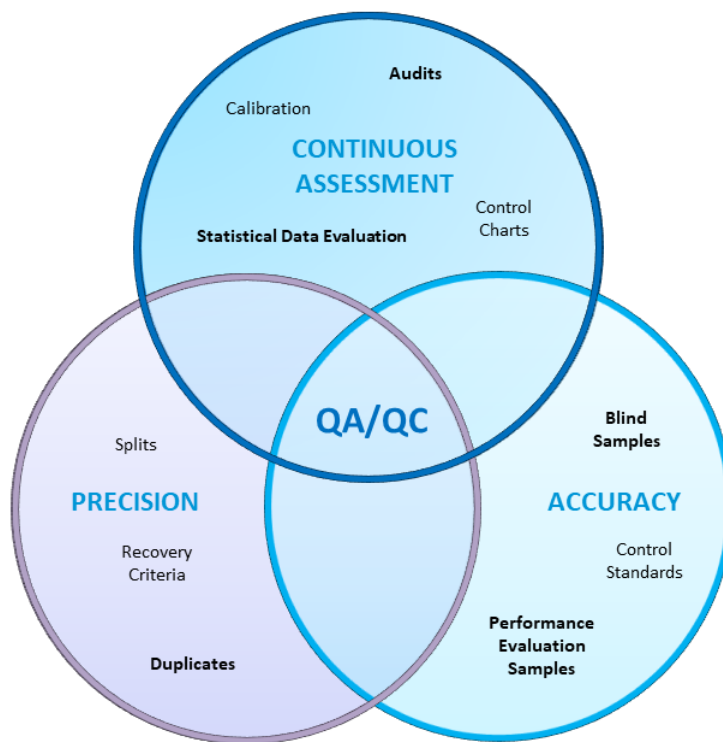


Figure 8-1 Interrelationship between QA and QC Activities

## 8.4 ENVIRONMENTAL MONITORING PROGRAM QA ACTIVITIES

SRS repeatedly assesses the EMP to identify and implement continuous improvements and minimize the potential for errors. During 2023, SRS implemented the following quality improvements:

- Radiological Liquid Effluent Program—SRS added a new outfall location and removed a basin location.
- Radiological Liquid Surveillance Program—SRS added niobium-94 (Nb-94) and radium-226 (Ra-226) to the radionuclide analytical list.
- Air Effluent Program—SRS added two new airborne effluent monitoring locations in H-Tank Farm.
- Comprehensive Environmental Data Management System (CEDMS)—SRS transitioned to a new comprehensive environmental database system, which replaced a suite of existing applications, systems, and databases. The application programming interface enables SRS to load and extract data from a consolidated data storage system.
- Industrial Stormwater Program—SRS installed oyster shells at check dams in a stormwater ditch to adsorb metals.
- Surface water sampling equipment—SRS installed modems and cameras at basin locations for remote programming and to confirm discharge, a new refrigerated sampler at an NPDES outfall, and a new staff gauge at a liquid surveillance sampling location.



**A Refrigerated Sampler Ensures the Preservation of Samples.**

SRS uses SCDHEC-certified laboratories for those EMP parameters that are reportable to SCDHEC. SCDHEC certifies the SRS onsite laboratories and offsite subcontract laboratories for a large variety of environmental analyses. In 2023, SCDHEC performed a recertification evaluation of the Central Sanitary Wastewater Treatment Facility Laboratory. These evaluations include a review of QA and QC practices and procedures. SCDHEC renewed the certification for this onsite laboratory for another three years.

### 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 2023, the three subcontracted laboratories that analyze the environmental samples documented in the *SRS Environmental 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 treatment, storage, and disposal facility (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. DOEAP 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 2023, SRS provided one auditor who participated in one of these audits (virtual and onsite) of a commercial TSDF. Additionally, SRS reviewed all final DOECAP audit reports of each TSDF that SRS has contracts with. The reviews 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

As an important part of SRS Environmental Monitoring Program QC activities is to ensure Site personnel collect and analyze samples to the highest standard and without analysis errors. All laboratories analyzing samples for the SRS EMP 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 routinely analyzes 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. Samples are tested and expected to be 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. Results in this table address both SRS and offsite subcontracted laboratory analyses.

Processing duplicate samples evaluates the accuracy of the analytical and measurement methods the laboratories use. One hundred percent of the NPDES pH blind samples, 98% percent of the NPDES blind samples, 99% of the NPDES duplicate samples, 97% of the water-quality duplicate samples, 69% of the nonradiological sediment duplicate samples, and 93% 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.

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

Program and Sample Type	Number of Comparisons	Number of (%) Comparisons within Acceptable Limits (RPD between Results $\leq$ 20%)		Number of (%) Comparisons Outside Acceptable Limits (RPD between Results $>$ 20%)		Number of Impacted Analytes
NPDES pH Blind	24	24	(100%)	0	(0%)	0
NPDES Blind	90	88	(98%)	2	(2%)	2
NPDES Duplicate	96	95	(99%)	1	(1%)	1
River/Stream Water Quality Duplicate	414	403	(97%)	11	(3%)	5
Nonradiological River/Stream/Basin Sediment Duplicate	48	33	(69%)	15	(31%)	8
Radiological River/Stream/Basin Sediment Duplicate	30	28	(93%)	2	(7%)	2

Note:

RPD = relative percent difference

NPDES = National Pollutant Discharge Elimination System

Although results indicate there were some differences between the QC samples and their corresponding compliance samples, they did not impact conclusions made with the data. The results indicate that in 2023 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 industrial wastewater program. A field blank determines whether the field sampling and sample processing environments have contaminated the sample. A trip blank documents contamination associated with shipping and field-handling procedures. All 2023 field blank and trip blank results were nondetect, indicating neither sampling nor shipping techniques contributed to contaminants 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	30	30
NPDES Field Blank	10	10

Note:

NPDES = National Pollutant Discharge Elimination System

## 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 ensure 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 2023, 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 97% 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 performing environmental analytical measurements in support of DOE's Environmental Management (DOE-EM) activities must participate in Mixed Analyte Performance Evaluation Program (MAPEP). This intercomparison program is an integral component of the DOE-EM Laboratory Management Division's QA program, ensuring laboratories provide DOE-EM with defensible, accurate data. The Radiological and Environmental Sciences Library twice a year prepares, characterizes, and distributes MAPEP proficiency samples, which contain environmentally important and compliance-required constituents in representative matrices. The samples include air filter, soil, vegetation, and water matrices with stable inorganic, organic, and radioactive elements representative of those found at DOE sites. The MAPEP rounds conducted during 2023 were MAPEP 48 and 49. The SRS Environmental Laboratory participated in the two MAPEP studies, receiving acceptable results for 100% of results on MAPEP Series 48 and 97% acceptable results for water, air, vegetation, and soil analytes in MAPEP Series 49.

One SRS subcontracted laboratory participated in MAPEP Series 48 and had acceptable results in 97% of the water and soil matrices. SRS sent all applicable environmental samples to the subcontracted laboratory, which continued to successfully participate in the MAPEP program.

In the case of less than 100% reported proficiency, laboratories develop corrective actions for failed analyses. These corrective actions may include modifying procedures for preparing and analyzing samples.

### **8.6 RECORDS MANAGEMENT**

EMP documentation is an important part of the SRS Environmental Program. The *SRS Environmental Report* is the public record of EMP's annual performance. SRS compiles the report every year following guidelines in DOE Order 231.1B, *Environment, Safety, and Health Reporting*.

The *SRS Environmental Report* communicates EMP's results and those of the Groundwater Management Program and Environmental Compliance programs to government agencies and the public. In addition to this 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 EMP, in accordance with SRS records management procedures.