Chapter 8: **Quality Assurance**

The Savannah River Site (SRS) Quality Assurance (QA)/Quality Control (QC) program objectives verify 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.

2019 Highlights

Analytical Laboratory Quality Assurance—SRS continued to use South Carolina Department of Health and Environmental Control (SCDHEC)-certified laboratories to analyze environmental monitoring samples that 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 2019, 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.

Annually, the DOECAP audits facilities that provide service to DOE. In 2019, DOECAP audited one treatment, storage, and disposal facility (TSDF) and determined this facility to be 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 (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 completion 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 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 to 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. 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 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. The DOECAP focuses on assessing specific QA/QC program elements.

8.2 BACKGROUND

DOE Order 414.1D, *Quality Assurance*, requires an integrated system of management 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 to the monitoring program. The QA efforts associated with the Environmental Monitoring Program that lead to program improvements are as follows:

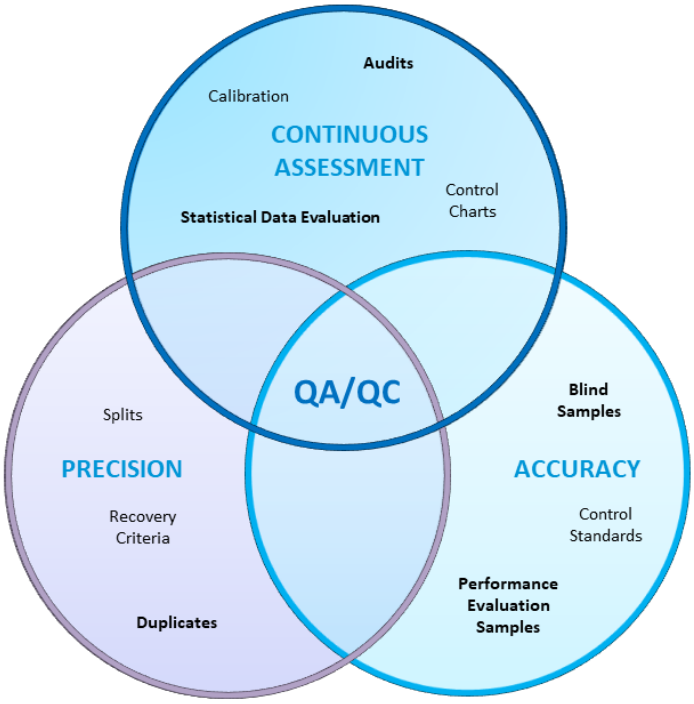

Figure 8-1 Interrelationship between QA/QC Activities

- Implement monitoring program changes
- Perform DOECAP audits of commercial TSDFs SRS waste generators used
- Ensure 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:

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

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 2019, SRS implemented the following quality improvements:

- Ambient Gamma Surveillance—SRS replaced thermoluminescent dosimeters (TLDs) with optically stimulated luminescence dosimeters (OSLDs) in 2019 (See Chapter 5, *Radiological Environmental Monitoring Program*, Section 5.3.4, *Ambient Gamma Surveillance,* of this report). OSLDs have the following advantages: 1) They have a higher detection sensitivity so fewer devices have to be placed into the field; 2) They are more accurate than TLDs; 3) They absorb approximately 20% more ambient gamma radiation than TLDs, based on a comparison of ambient gamma radiation monitoring between the first and second quarters of 2019, which favors a much more conservative exposure rate; and 4) OSLDs can be reanalyzed for confirmation of results. OSLDs are read using light, while TLDs are read by using heat.
- Dosimetric Calculation—In August 2019, EPA published age-specific dose coefficients for air submersion, water immersion, soil exposure pathways, etc. SRS subsequently updated the dose calculations to incorporate the age-specific dose coefficients for all applicable SRS environmental dosimetry models.
- Environmental Monitoring Program—In 2019, SRS began replacing its existing environmental database with a new database solution that when online will enhance managing and visualizing the data and sample results. SRS placed the historical data into an industry-standard format to allow for import into the new database.
- Air Surveillance—In 2019, SRS added 2 portable air stations to the existing network of 14 permanent air stations. These portable air stations will support flexibility in air monitoring in cases of increased emissions or inadvertent releases. SRS will be able to place these portable air stations along the path of potential maximum exposure, based on real-time evaluation of wind patterns, and gather real-time air samples. Additionally, the mobile nature of the portable stations allows in-field quality assurance checks of the permanent air stations.
- Stream Surveillance Monitoring Program—SRS upgraded and installed flowmeters at six stream surveillance locations to support upgrades to the wireless service that allows communication with the equipment. Additionally, the Site upgraded portable samplers at 16 river and stream locations during the year.
- Stream Surveillance Monitoring Program—EMP and SRNL updated the stream gage height and stream flow relationship (the rating curve) at all flow monitoring locations. This update gives ongoing confidence in input data for calculating the tritium values reported in Section 5.4.5, *Tritium Transport in Streams and Savannah River Surveillance*.

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 2019, 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 2019, SRS provided three auditors that participated in the DOECAP audit of one commercial TSDF. A review of the final audit report of the commercial TSDF indicated that there were no significant findings that would cause SRS waste generators to discontinue using the commercial TSDF.

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.

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. Twenty-four blind sample results were within the acceptable limit of less than

0.4 standard unit difference between the original and blind samples. Analysis of blind samples tests the analyst's proficiency in performing the specified analysis.

During intra-laboratory 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. 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 (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 blind and duplicate sample analyses associated with the river and stream water quality program, 3) both the nonradiological and radiological blind and duplicate sample analyses for river, stream, and basin sediment programs, and 4) the number of impacted analytes per program and sample type. This table addresses analyses both SRS and offsite subcontracted laboratories conduct. Processing duplicate samples evaluates the accuracy of the analytical and measurement methods the laboratories use. Ninety-six percent of the blind samples, 98% of the NPDES duplicate samples, 92% of the water quality duplicate samples, 79% of the nonradiological sediment duplicate samples, and 95% of the radiological sediment duplicate samples met the acceptable difference limit. 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.

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

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	200	192	8	2
NPDES Duplicate	222	218	4	1
Water Quality River/Stream Duplicate	1,080	1,040	40	6
Nonradiological River/Stream/Basin Sediment Duplicate	96	76	20	7
Radiological River/Stream/Basin Sediment Duplicate	42	40	2	1

indicate that in 2019 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 8-2 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	10	10

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-testing providers that SCDHEC approved.

During 2019, 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 90% 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, if any. 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 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 two SRS contracted laboratories continue 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 2019. Both MAPEP studies included soil, vegetation, water, air filter, and unknown matrix test samples. The SRS Environmental Laboratory participated in the two studies, receiving 99% acceptable results in both MAPEP 40 and MAPEP 41 studies. One of two unacceptable values for the year, U-238 in MAPEP 40, was due to a transcription error, which would not impact normal samples. The second was a false positive result.

Two SRS subcontracted laboratories also participated in the MAPEP 40 studies, receiving 100% acceptable results for both water and soil matrices. Only one SRS subcontracted laboratory participated in the MAPEP 41 study, receiving 99% acceptable results for both water and soil matrices. SRS sent all applicable environmental samples to the subcontracted laboratory, 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 *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.