7. Quality Assurance

Quality assurance, an integral part of environmental monitoring, requires systematic control of the processes involved in sampling the environment and in analyzing the samples. To demonstrate accurate results, DOE uses the following planned and systematic controls:

- Implementing standard operating procedures for collecting and analyzing samples
- Training and qualifying surveyors and analysts
- Implementing sample tracking and chain-of-custody procedures to demonstrate traceability and integrity of samples and data
- Participating in external quality control programs
- Frequently calibrating and routinely maintaining measuring and test equipment
- Maintaining internal quality control programs
- Implementing good measurement techniques and good laboratory practices
- Frequently assessing field sampling, measurement activities, and laboratory processes

DOE contractors conduct environmental sampling at PORTS according to state and federal regulations and DOE Orders. Contractors prepare sampling plans and procedures and choose appropriate sampling instruments or devices as recommended by US EPA, the American Society for Testing and Materials, or other authorities. Chain-of-custody forms are used to document the control of samples from the time they are collected; samples remain in the custody of the sampling group until the samples are received at the laboratory. Samples shipped to an off-site laboratory are sealed inside the shipping container to prevent tampering until they are accepted by the sample custodian at the laboratory.

Analytical data are reviewed to ensure they comply with applicable regulations and permits. Data collected at PORTS identify locations and concentrations of contaminants of concern, evaluate the rate and extent of contamination at the site, and help determine the need for remedial action. Adequate and complete documentation generated as a result of these efforts supports the quality standards established by DOE. In 2021 Fluor-BWXT Portsmouth and Mid-America Conversion Services used quality assurance project plans to ensure a consistent system was used to collect, assess, and document environmental data of known and documented quality.

Fluor-BWXT Portsmouth implements and conducts its Quality Assurance Program in compliance with the following standards and regulations:

- DOE Order 414.1D, *Quality Assurance*
- American Society of Mechanical Engineers Nuclear Quality Assurance Standards NQA-1-2008 with the NQA-1a-2009 Addenda, *QA Requirements for Nuclear Facility Applications*
- Title 10 *CFR* Part 830, Nuclear Safety Management

7.1 Field Sampling

Efforts to ensure the quality of field samples begin with planning for sampling activities and programs and continue in the field as measurements are taken and samples are collected according to the protocols specified for the specific sampling activity. The following sections describe elements crucial to field sample quality.

7.1.1 Data Quality Objectives and Sample Planning

The Fluor-BWXT Portsmouth Quality Assurance Project Plan consists of the *Sample Analysis Data Quality Assurance Project Plan* (DOE 2014), project-specific sampling and analysis plans, and their associated data quality objectives. While the data quality objectives and sampling and analysis plans apply to specific projects, the *Sample Analysis Data Quality Assurance Project Plan* is an overarching framework that ensures standardized and consistent processes are used to obtain samples, collect data, and perform laboratory services.

7.1.2 Training for Sampling Personnel

Training for personnel involved in sampling and monitoring includes a combination of classroom, online, and on-the-job training as required by environmental, health, and safety regulations and DOE contract requirements. Procedures are based on guidelines and regulations created by DOE or other regulatory agencies that have authority over PORTS activities.

7.1.3 Sampling Procedures

Data from sampling can be influenced by the methods used to collect and transport the samples. A quality assurance program includes procedures for collecting samples so that the samples represent the conditions that exist in the environment at the time of sampling. The DOE quality assurance program at PORTS mandates that personnel who collect samples comply with written sampling procedures, use clean sampling devices and containers, use approved sample preservation techniques, and collect field quality control samples. Following strict chain-of-custody procedures ensures the integrity of samples. To maintain sample integrity, samples are delivered to the laboratory as soon as is practical after collection.

7.1.4 Field Quality Control Samples

Field quality control samples that are collected and analyzed include trip blanks, field blanks, field duplicates, and equipment rinseates. Quality control samples for environmental monitoring are collected at a target rate of one per twenty environmental samples or one per analytical batch depending on the samples being collected and the analyses required. Not all types of sampling require all of the field quality control samples. Table 7.1 summarizes the uses and definitions of field quality control samples.

Analytical results for field quality control samples are evaluated to determine if the sampling activities have biased the environmental sample results. This evaluation typically occurs as part of data validation or assessment (see Section 7.3.2). The ambient air monitoring program at PORTS is an example of the successful use of quality control samples to identify bias in sampling (see Section 4.3.3). Field blank samples collected for the ambient air program contain low levels of uranium and uranium isotopes. Further investigation revealed that the filters used to collect air samples contain low levels of uranium due to the materials used to make the filters. As a result, the levels of uranium reported in ambient air may be slightly elevated.

Table 7.1. Definitions and purpose of field quality control samples

Type of sample	Definition and purpose
Trip blank	Used to evaluate contamination from volatile organic compounds during the sampling process. The trip blank is an unopened container of laboratory-grade water that accompanies environmental samples analyzed for volatile organic compounds from sample collection through laboratory analysis.
Field blank	Used to evaluate contamination during the sampling process. The field blank is a container of laboratory-grade water that is carried into the field and opened to expose the field blank to field conditions when the environmental samples are collected. The field blank is analyzed for the same analytes as the environmental samples.
Field duplicate	Used to document the precision of the sampling process and provide information on analytical variability caused by collection methods, laboratory procedures, and sample heterogeneity (the variability within the sample media). A field duplicate, or duplicate sample, is a second environmental sample collected at the same time and from the same place as the first environmental sample. The duplicate sample is analyzed for the same analytes as the first sample.
Equipment rinseate	Used to assess contamination that could be present from reusable sampling equipment, such as a bailer used at a groundwater well to collect water. The sample is collected by rinsing the cleaned equipment with laboratory-grade water. An equipment rinseate is not required when dedicated or disposable sampling equipment is used for sample collection. The equipment rinseate sample is typically analyzed for the same analytes as the associated environmental samples.

7.2 Analytical Quality Assurance

The following sections describe the methods and procedures that ensure the laboratory analysis of samples meets quality standards, as well as the criteria for selecting off-site laboratories to analyze samples from PORTS.

7.2.1 Analytical Procedures

When available and appropriate for the sample matrix, methods approved by US EPA are used to analyze samples. When US EPA-approved methods are not available, PORTS uses other nationally recognized methods such as those developed by DOE and American Society for Testing and Materials. A statement of work for laboratory services identifies the analytical methods to be used for a set of samples. Analytical laboratories follow chain-of-custody procedures and document the steps they use for handling and analyzing samples and reporting results.

7.2.2 Laboratory Quality Control

In 2021, samples collected for DOE environmental monitoring programs at PORTS were sent to analytical laboratories that participated in DOE programs to ensure data quality. DOE contractors at PORTS only use analytical laboratories that demonstrate compliance in the following areas by participating in independent audits and surveillance programs:

- Compliance with federal waste disposal regulations
- Data quality
- Materials management

- Sample control
- Data management
- Electronic data management
- Implementation of a laboratory quality assurance plan
- Review of external and internal performance evaluation program

7.2.3 Independent Quality Control

PORTS is required by DOE, Ohio EPA, and US EPA to participate in independent quality control programs. PORTS also participates in voluntary independent programs to improve analytical quality control. These programs, which are conducted by US EPA, DOE, and commercial laboratories, generate data that are recognized as objective measures and allow participating laboratories and government agencies to review their performance. Data that do not meet acceptable criteria are investigated and documented according to formal procedures. Although participation in certain programs is mandatory, the degree of participation is voluntary, so that each laboratory can select parameters of particular interest to that facility.

7.2.4 Laboratory Audits and Accreditation

The DOE Consolidated Audit Program conducts annual performance qualification audits of environmental laboratories, and the DOE Mixed-Analyte Performance Evaluation Program provides semiannual performance testing and evaluation of analytical laboratories. These programs ensure that the laboratories comply with the appropriate regulations, methods, and procedures.

Analytical laboratories used by Fluor-BWXT Portsmouth, Mid-America Conversion Services, or Centrus in 2021 to analyze the environmental samples discussed in this report include Alloway, ALS, ARS Aleut Analytical, LLC, ETT Environmental, Inc., Eurofins, GEL Laboratories, LLC, and Portsmouth Analytical Laboratory.

The DOE Consolidated Audit Program also audits commercial treatment, storage, and disposal facilities used by PORTS to dispose of RCRA hazardous waste and mixed waste (a combination of RCRA hazardous waste and low-level radioactive waste). Facilities used by PORTS for disposal of RCRA hazardous and mixed waste in 2021 include Perma-Fix (Diversified Scientific Solutions), US Ecology, Energy*Solutions*, and the Nevada National Security Site.

7.3 Data Management

Data must be managed properly so users can retrieve it easily and rely on its integrity. The following sections identify the databases that PORTS relies on to house critical data, and describe the systems and methods used to screen, validate, verify, and assess data from environmental sampling.

7.3.1 Project Environmental Measurements System

The data generated from sampling events are stored in the Project Environmental Measurements System, a consolidated site system for tracking and managing data. This system is used to manage field-generated data, import laboratory-generated data, input data qualifiers identified during data validation, and transfer data to the PORTS Oak Ridge Environmental Information System (OREIS) database.

7.3.2 PORTS OREIS

The PORTS OREIS database consolidates data from the Project Environmental Measurements System for long-term storage. Environmental data from PORTS OREIS is loaded periodically in the PPPO Environmental Geographic Analytical Spatial Information System (PEGASIS).

7.3.3 PEGASIS

PEGASIS provides dynamic mapping and displays of environmental monitoring data. It allows members of the public to access environmental monitoring data and displays the data on a local map to show where the data were collected. Public access to PEGASIS is available here.

7.3.4 Data Verification, Validation, and Assessment

After DOE contractors receive analytical laboratory data, the data are verified for completeness, correctness, consistency, and compliance with written analytical specifications. Selected data are independently evaluated using a systematic process that compares the data to established quality assurance and quality control criteria. An independent data validator checks documentation produced by the analytical laboratory to verify that the laboratory has provided data that meet the established criteria.

Data verification is the systematic process of checking data for completeness, correctness, consistency, and compliance with written analytical specifications. The verification process compares the laboratory data package to requirements associated with the project, and documents requirements that were and were not met. All data collected for environmental monitoring programs are verified.

Data validation for a specific data set is performed by a qualified individual who has not been involved in sampling, laboratory, project management, or other decision making for that project. Data validation evaluates the laboratory's adherence to the requirements of analytical methods to determine the technical reliability of the reported results. Data are qualified as acceptable, estimated, or rejected. These validation qualifiers are stored in the Project Environmental Measurements System and transferred with the data to the PORTS OREIS. Typically, at least 10 percent of analytical data associated with the environmental sampling programs are validated.

Data assessment is conducted by trained technical personnel in conjunction with other project team members. Data are reviewed for compliance with applicable standards or limits. Current analytical results are also compared to previous results for the sampling location. Data may be analyzed for trends or summary statistics such as average, median, or data range may be calculated.