9. Quality Assurance

Environmental decisions on the ORR are made on the assumption that analytical results are representative of site conditions. Many factors can potentially affect the results of environmental data collection activities, including sampling personnel, methods, and procedures; field conditions; sample handling, preservation, and transport; personnel training; analytical methods; data reporting; and record keeping. Quality assurance programs are designed to minimize these sources of variability and to control all phases of the monitoring process.

9.1 Introduction

The application of quality assurance/quality control (QA/QC) programs for environmental monitoring activities on the ORR is essential for generating data of known and defensible quality. Each aspect of an environmental monitoring program, from sample collection to data management, must address and meet applicable quality standards.

9.2 Field Sampling Quality Assurance

Field sampling QA encompasses many practices that minimize error and evaluate sampling performance. Some key quality practices include the following:

- use of work control processes and standard operating procedures for sample collection and analysis;
- use of chain-of-custody and sample-identification procedures;
- instrument standardization, calibration, and verification;
- sample technician and laboratory analyst training;
- sample preservation, handling, and decontamination; and
- use of QC samples, such as field and trip blanks, duplicates, and equipment rinses.

9.3 Analytical Quality Assurance

The contract analytical laboratories that perform the analyses of environmental samples from the ORR environmental monitoring programs are required to have documented QA/QC programs, well-trained and qualified staff, appropriately maintained equipment and facilities, and applicable certifications. The analytical laboratories conduct extensive internal QC programs, participate in external QA programs, and use statistics to evaluate and continuously improve performance.

9.3.1 Internal Quality Assurance/ Quality Control

Analytical results may be affected by a large number of factors inherent to the measurement process. Laboratories that support ORR environmental monitoring programs employ internal QA/QC programs to ensure the early detection of problems that may arise from contamination, inadequate calibrations, calculation errors, or improper procedure performance. Internal laboratory QA/QC programs include routine calibrations of counting instruments, yield determinations, frequent use of check sources and background counts, replicate and spiked sample analyses, matrix and reagent blanks, and maintenance of control charts to indicate analytical deficiencies. These activities are supported by the use of standard materials or reference materials (e.g., materials of known composition that are used in the calibration of instruments, methods standardization, spike additions for recovery tests, and other practices). Certified standards traceable to the National Institute of Standards and Technology (NIST), DOE sources, or EPA are used (when available) for such work.

Other internal practices employed to ensure that laboratory results are representative of actual conditions include staff training and management, adequacy of the laboratory environment, safety, the storage, integrity and identity of samples, record keeping, the maintenance and calibration of instruments, and the use of technically validated and properly documented methods.

9.3.2 External Quality Assurance/ Quality Control

Contract analytical laboratories also participate in external QA/QC programs to ensure reported results are within required levels of precision and accuracy. External QA/QC programs typically involve laboratories analyzing samples of unknown composition supplied by customers or by DOE- or EPA-approved proficiency-testing supplier organizations. These samples may be single-blind control samples that are identified to the laboratory as performance evaluation samples or double-blind control samples that have the characteristics of routine samples and are provided to the laboratory without being identified as control samples. The supplying organizations know the true composition of the samples and provide the contract laboratories with data reports on their analytical performance. The following sections describe other external QA/QC programs in which analytical laboratories may participate.

9.3.2.1 EPA Water Pollution and Water Supply Performance Studies

Participation in the EPA Water Pollution Program and the EPA Water Supply Program studies is required by most states for laboratories performing analyses of water samples for regulatory programs. The EPA Water Supply Program is used by the state of Tennessee to certify laboratories for drinking water analysis. To maintain a certification, a laboratory must meet a specified set of criteria relating to technical personnel, equipment, work areas, QA/QC operating procedures, and successful analysis of QA samples. This program is also used by other states as part of their certification programs. Participation in the Water Pollution Program satisfies the EPA and NPDES program requirement that laboratories performing CWA analyses participate in a Discharge Monitoring Report Quality Assurance Program.

Since October 24, 1999, all water pollution and water supply studies except whole effluent toxicity testing have been performed by commercial vendors. NIST certifies non-EPA proficiency testing providers to prepare performance evaluation samples and to evaluate laboratory performance. EPA continues to issue standard operating procedures for use in the water supply and water pollution programs.

9.3.2.2 DOE Mixed Analyte Performance Evaluation Program

The Mixed Analyte Performance Evaluation Program is set up by the DOE Radiological and Environmental Sciences Laboratory in conjunction with the Laboratory Management Division of the Office of Technology Development to evaluate analysis of mixed-waste samples. Participation is required by DOE for laboratories that perform environmental analytical measurements in support of environmental management activities. Various matrices, such as soil, water, air filters, and vegetation, are submitted semiannually for analysis for a variety of radioactive isotopes as well as metals and organic parameters. A statistical report is issued for each study.

9.3.2.3 Proficiency Evaluation Testing Programs

Proficiency evaluation testing programs involve the analysis of “blind” samples supplied by approved vendors. Participating laboratories return analytical results to the sample providers, and the results are compared with results from other laboratories that use the same testing method. A “report card” is issued to the laboratory to provide a “snapshot” of a laboratory’s measurements and quality system at one point in time. Regular and frequent participation then builds up a picture over time that can help laboratory and quality managers, as well as clients, accrediting bodies, and regulators to assess a laboratory's analytical quality. Participation in proficiency evaluation testing programs may satisfy requirements for participating in NPDES discharge monitoring report QA studies in some cases.

9.3.3 Y-12 Analytical Chemistry Organization Scores on FY 2006 Performance Evaluation Programs

The BWXT Y-12 Analytical Chemistry Organization subscribes to a number of independent, external QA/QC programs that submit blind samples and score the quality of the results. This

is necessary to retain numerous certifications required by customers and to ensure the quality of the analyses. The Analytical Chemistry labs achieved an overall FY 2006 score of 98.58% from 54 different studies. The results compare with a national average of 94.95% among programs for which data are available. On 44 of the studies, the Analytical Chemistry Organization labs received a score of 100%.

9.3.4 Quality Assessment Programs for Subcontracted Laboratories

Competitive award systems are used by UT-Battelle and by the Bechtel Jacobs Sample Management Office to select laboratories that are contracted under basic ordering agreements to perform analytical work. Commercial laboratories approved by the Sample Management Office are required to comply with the requirements set forth in the Integrated Contractor Procurement Team Basic Ordering Agreement terms and conditions. Oversight of subcontracted commercial laboratories is performed by the DOE Environmental Management Consolidated Audit Program, which is supported by the Sample Management Office. DOE, the Sample Management Office, and other subcontractors from across the DOE complex work together in the Environmental Management Consolidated Audit Program to conduct on-site laboratory reviews and to monitor the performance of all subcontracted laboratories. Awards are made to laboratories to provide analytical support to projects based on the best value added to the project. Best value is a graded approach that comprises price and performance history.

The Sample Management Office contractor manages the Integrated Performance Indicator Program to report quality indicators that will assess trends for commercial analytical laboratories used to support Sample Management Office projects (and their subcontractors) within DOE-ORO. The objective of the Integrated Performance Indicator Program is to evaluate all analytical laboratories based on a set of standardized performance criteria that can then be quantitatively tracked and trended. The Sample Management Office contractor uses these performance indicators to monitor the performance of the laboratories.

A limited basic order agreement with commercial laboratories has been established by UT-Battelle for the procurement of analytical services to characterize environmental and waste samples. Laboratories included in the agreement are required to comply with the terms and conditions of the Integrated Contractor Procurement Team Contract, Basic Order Agreement. A statement of work for each project specifies any additional QA/QC requirements and includes detailed information, data, deliverables, turnaround times, and required methods.

9.4 Data Management, Verification, and Validation

Verification and validation of environmental data are performed as components of the data collection process, which includes planning, sampling, analysis, and data review. Some level of verification and validation of field and analytical data collected for environmental monitoring and restoration programs is necessary to ensure that data conform with applicable regulatory and contractual requirements. Validation of field and analytical data is a technical review performed to compare data with established quality criteria to ensure that data are adequate for the intended use. The extent of project data verification and validation activities is based on project-specific requirements.

For routine environmental effluent monitoring and surveillance monitoring, data verification activities may include processes of checking whether (1) data have been accurately transcribed and recorded, (2) appropriate procedures have been followed, (3) electronic and hard-copy data show one-to-one correspondence, and (4) data are consistent with expected trends. Typically, routine data verification actions alone are sufficient to document the validity and accuracy of environmental reports. For restoration projects, routine verification activities are more contractually oriented and include checks for data completeness, consistency, and compliance against a predetermined standard or contract.

Certain projects may require a more thorough technical validation of the data as mandated by the project's data quality objectives. Sampling and analyses conducted as part of a remedial investigation to support the CERCLA process may generate data that are needed to

evaluate risk to human health and the environment, to document that no further remediation is necessary, or to support a multimillion-dollar construction activity and treatment alternative. In these cases, the data quality objectives of the project may mandate a thorough technical evaluation of the data against rigorous predetermined criteria. The validation process may result in the identification of data that do not meet predetermined QC criteria or in the ultimate rejection of data for their intended use. Typical criteria evaluated in the validation of Contract Laboratory Program data include the percentage of surrogate recoveries, spike recoveries, method blanks, instrument tuning, instrument calibration, continuing calibration verifications, internal standard response, comparison of duplicate samples, and sample-holding times.

Integration of compliance-monitoring data for the ORR with sampling and analysis results from remedial investigations is a function of the Oak Ridge Environmental Information System (OREIS). OREIS is necessary to fulfill requirements prescribed in both the Federal Facility Agreement and the Tennessee Oversight Agreement and to support data management activities for DOE. The Federal Facility Agreement, a tripartite agreement among DOE, EPA Region 4, and the state of Tennessee, requires DOE to maintain one consolidated database for environmental data generated at DOE facilities on the ORR. According to the Federal Facility Agreement, the consolidated database is to include data generated pursuant to the agreement as well as data generated under federal and state environmental permits. The Tennessee Oversight Agreement further defines DOE staff obligations to develop a quality-assured, consolidated database of monitoring information that will be shared electronically on a near-real-time basis with the state staff.

OREIS is the primary component of the data management program for restoration projects, providing consolidated, consistent, and well-documented environmental data and data products to support planning, decision-making, and reporting activities. OREIS provides a direct electronic link of ORR monitoring and remedial investigation results to EPA Region 4 and the TDEC/DOE Oversight Division.