9. Quality Assurance

Setting

The overall goal of a well-designed and well-implemented sampling and analysis program is to measure accurately what is really there. Environmental decisions are made on the assumption that analytical results are, within known limits of accuracy and precision, representative of site conditions. Many sources of error exist that could affect the analytical results. Factors to consider as sources of error include improper sample collection, handling, preservation, and transport; inadequate personnel training; and poor analytical methods, data reporting, and record keeping. A quality assurance (QA) program is designed to minimize these sources of error and to control all phases of the monitoring process.

9.1 INTRODUCTION

The application of a quality assurance/quality control (QA/QC) program for environmental monitoring activities at the ORR is essential for generating data of known and defensible quality. Each aspect of the 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 standard operating procedures (SOPs) for sample collection and analysis;
- use of chain-of-custody and sample-identification procedures;
- instrument standardization, calibration, and verification;
- technician and analyst training;
- sample preservation, handling, and decontamination; and
- use of QC samples, such as field and trip blanks, duplicates, and equipment rinses.

Because of changing technologies and regulatory protocols, training of field personnel is a continuing process. To ensure that qualified personnel are available for the array of sampling tasks to be accomplished, training programs by the EPA and by private contractors have been used to supplement internal training. Examples of topics addressed include the following:

- planning, preparation, and record keeping for field sampling;
- well construction and groundwater sampling;
- surface water, leachate, and sediment sampling;
- soil sampling;
- stack sampling;
- decontamination procedures; and
- health and safety considerations.

9.3 ANALYTICAL QUALITY ASSURANCE

The contract analytical laboratories have well-established QA/QC programs, well-trained and highly qualified staff, and excellent equipment and facilities. Current, approved analytical methodologies employing good laboratory and measurement control practices are used routinely to ensure analytical reliability. The analytical laboratories conduct extensive internal QC programs with a high degree of accuracy, participate in several external QA programs, and use statistics to evaluate and to continuously improve performance. Thus, QA and QC are daily responsibilities of all employees.

9.3.1 Internal Quality Control

Analytical 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), EPA, or other DOE sources are used for such work. The laboratories operate under specific QA/QC criteria at each installation. Additionally, separate QA/QC documents relating to analysis of environmental samples associated with regulatory requirements are developed.

QA/QC measurement control programs external to the sample analysis groups have single-blind control samples submitted to the analytical laboratories to monitor performance. The results of such periodic measurement programs are statistically evaluated and reported to the laboratories and their customers. Most reports are issued quarterly, and some laboratories compile annual summary reports. These reports assist in evaluating the adequacy of analytical support programs and procedures. If serious deviations are noted by the QA/QC groups, the operating laboratories are promptly notified so that corrective actions can be initiated and problems can be resolved. QC data are stored in an easily retrievable manner so that they can be related to the analytical results they support.

9.3.2 External Quality Assurance

In addition to the internal programs, all contract analytical laboratories are directed by DOE and are expected by EPA to participate in external QA programs. The QA programs generate data that are readily recognizable as objective packets of results. The external QA programs typically consist of the contract laboratories analyzing a sample of unknown composition provided by various DOE- or EPA-approved proficiency-testing supplier organizations. The organizations know the true composition of the sample and provide the contract laboratories with a data report on their analytical performance. The sources of these programs are laboratories within DOE and the commercial sector. The following sections describe the external QA programs.

9.3.2.1 EPA Contract Laboratory Program

The Contract Laboratory Program (CLP) is an EPA-administered QA element used to evaluate laboratory analytical proficiency in comparison with an analyte and the current statement of work in support of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The program operates from the EPA Contract Laboratory Analytical Services Support office at Alexandria, Virginia, in cooperation with the EPA regional offices. This program evaluates laboratories for the determination of organic and inorganic contaminants in aqueous and solid hazardous waste materials and enforces stringent QA/QC requirements to ensure comparable data. This program scores on additional criteria other than an “acceptable-unacceptable” evaluation of the measurement result. By the CLP scoring algorithm, performance of 75% or better indicates acceptable performance. Values below this score indicate that deficiencies exist and that the participant has failed to demonstrate the capability to meet the contract requirements.

9.3.2.2 EPA Water Pollution and Water Supply Performance Studies

This 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.

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

9.3.2.3 American Industrial Hygiene Association Proficiency Analytical Testing Program

The American Industrial Hygiene Association (AIHA) administers the Proficiency Analytical Testing Program as part of its AIHA accreditation process for laboratories performing analyses of industrial hygiene air samples.

9.3.2.4 Intercomparison Radionuclide Control Program

The EPA Intercomparison Radionuclide Control Program administered by the National Exposure Research Laboratory at Las Vegas has been replaced by a vendor-supplied program approved by EPA. Samples are composed of a water matrix. The state of Tennessee requires participation for drinking water certification of radionuclide analysis. This program is also used by other states as part of their laboratory certification process.

9.3.2.5 AIHA Environmental Lead Proficiency Analytical Testing Program

The Environmental Lead Proficiency Analytical Testing Program is administered by AIHA. It was established by AIHA in 1992 to evaluate analysis of environmental lead samples in different matrices. The matrices evaluated are paint, soil, and dust wipes. The participating laboratory can analyze each matrix at four levels. In addition, a laboratory may request to become accredited for lead analysis in this program.

9.3.2.6 DOE Mixed Analyte Performance Evaluation Program

The Mixed Analyte Performance Evaluation Program (MAPEP) is a program 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. MAPEP is evaluated by Argonne National Laboratory. Participation is required by DOE for laboratories that perform environmental analytical measurements in support of environmental management (EM) activities.

9.3.2.7 DOE Environmental Measurements Laboratory Quality Assessment Program

Participation in the radionuclide Quality Assessment Program, administered by the DOE Environmental Measurements Laboratory (EML) in New York, is required by a DOE memorandum. Various matrices, such as soil, water, air filters, and vegetation, are submitted semiannually for analysis of a variety of radioactive isotopes. All matrices, except air filters, are actual materials obtained from the environment at a DOE facility. A statistical report is issued by EML for each study.

9.3.2.8 Proficiency Environmental Testing Program

The Proficiency Environmental Testing Program is a service purchased from an outside vendor and is used by some contract analytical laboratories to meet the need for a QA program for environmental analyses. The samples are supplied by the commercial company at concentrations that meet the EPA-established guidelines. Data from the laboratory are reported to the supplier. The commercial supplier provides a report on the evaluated data to the laboratory. The report includes a percentage recovery of the referenced value, deviation from the mean of all reported data, specific problems in a laboratory, and other statistical information.

9.3.3 Quality Assessment Program for Subcontracted Laboratories

A competitive award system has been established by the Bechtel Jacobs Company Sample Management Office (SMO) to place analytical work that may be required by Bechtel Jacobs Company. The SMO provides single-point sample

management for Bechtel Jacobs Company projects/programs and Bechtel Jacobs Company subcontractors. Commercial laboratories approved by the SMO are required to comply with the requirements set forth in the Integrated Contractor Procurement Team Basic Ordering Agreement (ICPT BOA) terms and conditions. Oversight of subcontracted commercial laboratories is performed by the DOE EM Consolidated Audit Program (EMCAP), which is supported by the SMO. DOE, the SMO, and other subcontractors from across the DOE complex work together in the EMCAP 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 Bechtel Jacobs Company projects based on the best value added to the project. Best value is a graded approach comprised of price and performance history.

Bechtel Jacobs Company manages the Integrated Performance Indicator Program (IPIP) to report quality indicators that will assess trends for commercial analytical laboratories used to support Bechtel Jacobs Company projects (and their subcontractors) within the DOE Oak Ridge Operations (ORO). The objective of the IPIP is to evaluate all analytical laboratories based upon a set of standardized performance criteria that can then be quantitatively tracked and trended. Bechtel Jacobs Company management uses these performance indicators to develop performance indicator factors (PIFs), which are used as modifier factors when evaluating cost bids. In the PIF approach, the low bidder may not win the work unless they have a favorable PIF score.

9.3.3.1 Single Blind PE Program

If applicable, laboratories must participate in several external single blind performance evaluation (PE) programs required by the Analytical Support Agreement. All results that are officially reported by the responsible agency (EPA or DOE) during the period of evaluation are used in computing the single blind PE score. Single blind PE program results are categorized into radiochemistry, organic, and inorganic methodology areas.

9.3.3.2 Double Blind PE Program

Bechtel Jacobs Company manages a double blind PE program to quantitatively evaluate the total laboratory process. Laboratories receive PE samples from the Bechtel Jacobs Company PE Sample Laboratory. Performance samples are unknown to the laboratory receiving them and are placed within a set of samples going to that laboratory. Once the project data have been received, the PE results are evaluated and scored. Double blind PE program results are categorized into radiological, organic, and inorganic methodology areas.

Single and double blind PE scores are combined to obtain a total IPIP PE score. A laboratory must score $\geq$80% to remain in good standing. A score of 64 to 79% would result in a laboratory being placed on probation.

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. Verification and validation of field and analytical data collected for environmental monitoring and restoration programs are 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.

Over the years, the environmental data verification and data validation processes used by ORR environmental programs have evolved to meet continuing regulatory changes and monitoring objectives. 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. For example, the requirements for self-monitoring of surface-water and wastewater effluents under the terms of an NPDES permit require the permittee to conduct the analyses as defined in 40 CFR 136 and to certify that the data reported in the monthly discharge monitoring report are true and accurate.

Typically, routine data verification actions alone are sufficient to document the truthfulness and accuracy of the discharge monitoring report. 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 perform a more thorough technical validation of the data as mandated by the project's data quality objectives. For example, sampling and analyses conducted as part of a remedial investigation (RI) 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 that case, the data quality objectives of the project may mandate a more thorough technical evaluation of the data against predetermined criteria. For example, EPA has established functional guidelines for validation of organic and inorganic data collected under the protocol of the EPA's CLP. These guidelines are used to offer assistance to the data user in evaluating and interpreting the data generated from monitoring activities that require CLP performance.

The validation process may result in identifying data that do not meet predetermined QC criteria (in flagging quantitative data that must be considered qualitative only) or in the ultimate rejection of data from its intended use. Typical criteria evaluated in the validation of CLP 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 RIs is a function of the Oak Ridge Environmental Information System (OREIS). OREIS is necessary to fulfill requirements prescribed in both the Federal Facility Agreement (FFA) and the Tennessee Oversight Agreement (TOA) and to support data management activities for DOE. The FFA, 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 FFA, the consolidated database is to include data generated pursuant to the FFA as well as data generated under federal and state environmental permits. The TOA 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 RI results to EPA Region 4 and TDEC/DOE-ORO. OREIS can be accessed through the internet at http://eimdb-web. bechtel jacobs.org:8080/oreis/help/oreishome.html. Using this website, the public can access and download OREIS data.