4 QUALITY ASSURANCE

4.1 INTRODUCTION

As required by DOE Order 450.1, Environmental Protection Program, BNL has established a Quality Assurance/Quality Control (QA/QC) Program to ensure that the accuracy, precision, and reliability of environmental monitoring data are consistent with the requirements of 10 CFR 830, Subpart A, Quality Assurance Requirements, and DOE Order 414.1A, *Quality Assurance*. Responsibility for quality at BNL starts with the director, who approves the policies and standard of performance governing work, and extends throughout the entire organization. The purpose of the BNL Quality Management (QM) System is to implement QM methodology throughout the various Laboratory management systems and associated processes, in order to:

- Plan and perform BNL operations in a reliable and effective manner to minimize any impact on the health and safety of the public, employees, and the environment
- Standardize processes and support continual improvement in all aspects of BNL operations
- Enable the delivery of products and services that meet customers' requirements and expectations

For environmental monitoring, QA is defined as an integrated system of management activities that include planning, implementation, control, reporting, assessment, and continual improvement. QC activities measure each process or service against the QA standards. QA/QC practices and procedures are documented in detail in manuals, plans, and a comprehensive set of standard operating procedures (SOPs) for environmental monitoring. Staff who must follow these procedures are required to document that they have reviewed and understand them.

4.2 ENVIRONMENTAL MONITORING QAP

BNL's environmental QA practices and procedures are documented in manuals and SOPss (SOPs), and govern sample collection, radiation measurements, chain-of-custody (COC) requirements, and analytical chemistry standards. Environmental samples are analyzed through contracts with five off-site analytical laboratories. General Engineering Lab (GEL) performs radiological and nonradiological analyses, H2M and Chemtex Lab perform radiological and nonradiological analyses, Severn-Trent Lab performs radiological and nonradiological analyses, and Brooks Rand performs mercury and methylmercury analyses. All five laboratories are New York State–certified for specific parameters and are periodically audited to ensure that quality standards are maintained. The labs are required to incorporate QA guidelines into their operations when performing work for BNL. GEL, STL, H2M and Brooks Rand participate in several national and/or state performance evaluation testing programs. Chemtex performs analyses that are not currently represented in PE test programs. Results of the PE tests provide information on the quality of a laboratory's results and allow comparisons to be made between labs.

BNL has established a program of internal and external audits to verify the effectiveness of the environmental sampling, analysis, and database activities. Contractor laboratories are subject to audits by DOE personnel.

4.3 Specific Groundwater and Air Monitoring QA

The BNL groundwater monitoring program, Quality Assurance Program Plan (QAPP) (BNL 1999b), describes the QA program and QC requirements followed for monitoring groundwater quality. The plan defines the project organizational structure, documentation requirements, sample custody requirements, acceptance criteria, auditing functions, corrective action provisions, and guidance on the collection of QA/QC samples. The QAPP was developed using guidance provided in EPA QA/R-5, *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations* (EPA 1998). The QAPP for radiological air emissions (2002) was developed and implemented to provide direction for collecting air samples in accordance with the ANSI/HPS N13.1-1999 standard and, where applicable, (ANSI 1999), *Sampling and Monitoring Release of Airborne Radioactive Substance from the Stacks and Ducts of Nuclear Facilities*.

4.4 Data Quality Objectives

The DQOs included in the *Environmental Monitoring Plan 2007 Update* follows the DQO process, a seven-step planning approach to develop sampling designs for data collection activities that support decision making. This process uses systematic planning and statistical hypothesis testing to differentiate between two or more clearly defined alternatives. The DQO process provides the following benefits:

- Promotes understanding of the real purpose of collecting data (i.e., why the data are needed and what questions the data may help answer)
- Provides a convenient way to document activities and decisions
- Facilitates rapid review and approval by regulators and stakeholders
- Fosters communication between interested parties
- Promotes efficient use of limited resources
- Outlines methods of assessing performance and states the consequences of decision errors

4.5 Sample Collection

Trained technicians follow procedures outlined in SOPs, which are developed using information in the media-specific DQOs. Technicians use bound logbooks and media-specific log sheets to document sample collection. COC procedures are followed to ensure that each sample is properly handled and controlled.

4.6 Data Management

Each environmental sample collected is identified with a unique number and accompanied by a COC. The sampling data are reported in electronic and hard copy formats. All electronic data are maintained in the BNL Environmental Information Management System (EIMS). The EIMS consists of an environmental data management system platform that is linked with a geographic information system (GIS). Analytical data in the EIMS can be retrieved and evaluated using custom applications, and paper records are filed for future reference.

The EIMS became the sole repository of all environmental data in 2002. Previously, the EIMS held environmental data collected only from ER activities. Compliance and environmental surveillance data from 1995 to 2002 were housed in the environmental database shared with BNLs on-site Analytical Services Laboratory (ASL). The ASL stopped operations in the first quarter of 2004. The data was then transferred to EIMS to facilitate its use as the sole repository. This transfer involved

changing the identification scheme for sampling locations. Appendix C provides a cross walk between the sampling location identifications used between 1995 and 2002, and those which have will be used from this point on. It also details the framework for assigning identification codes to newly designated sampling locations.

4.7 Electronic Data Quality Assurance

Data quality assurance steps are detailed in the EIMS Data Management Description and in applicable SOPs. When data are entered into the EIMS, completeness checks are automatically performed to ensure that analyses are provided for all samples, required data fields are not empty, and that certain fields contain only predefined legal values or formats. For analytical results from the groundwater monitoring program, outlier values are automatically flagged and project managers are notified in order to expedite evaluation of these data. For all other programs, the subject matter experts (SMEs) periodically review the data to ensure that concentrations are within typical levels.

4.8 Data Validation

Data packages received from contractor laboratories are reviewed at BNL by SMEs in either radiological analyses or analytical chemistry to ensure compliance with contract specifications. In addition, projects may require that the data packages are examined to ensure that samples do not exceed holding times, that there are no poor recoveries, that proper sampling method was used, and that field blanks were less than the Minimum Detection Limits (MDL). Nonradiological data analyzed off site are verified and validated using EPA contract laboratory protocols (EPA 1992, 1996). Radiological packages are verified and validated using both BNL and DOE guidance documents (BNL 1997, DOE 1994, DOE 1977).

4.9 Data Quality Assessment

EPA defines data quality assessment as “the scientific and statistical evaluation of data to determine if data obtained from environmental data operations are of the right type, quality, and quantity to support their intended use” (EPA 1996). The respective SME reviews each set of data provided by a contract analytical laboratory after data validation and then compares the results to historical results, duplicate samples, and control samples. The quality system diagram on the following page shows that the process consists of three stages: planning, implementation, and assessment. The planning stage can be divided into the DQO process, the sampling design, and the QA plans associated with the program. The implementation stage entails the actual collection of samples and analysis in accordance with the SOPs and quality control guidelines. The final stage is data quality assessment, and includes data verification and validation, and review of the decision-making process to ensure that effluents, emissions, and receptor data are adequate to assess impacts to the health of the BNL environment. The outcome of the quality process is defensible products and decisions.

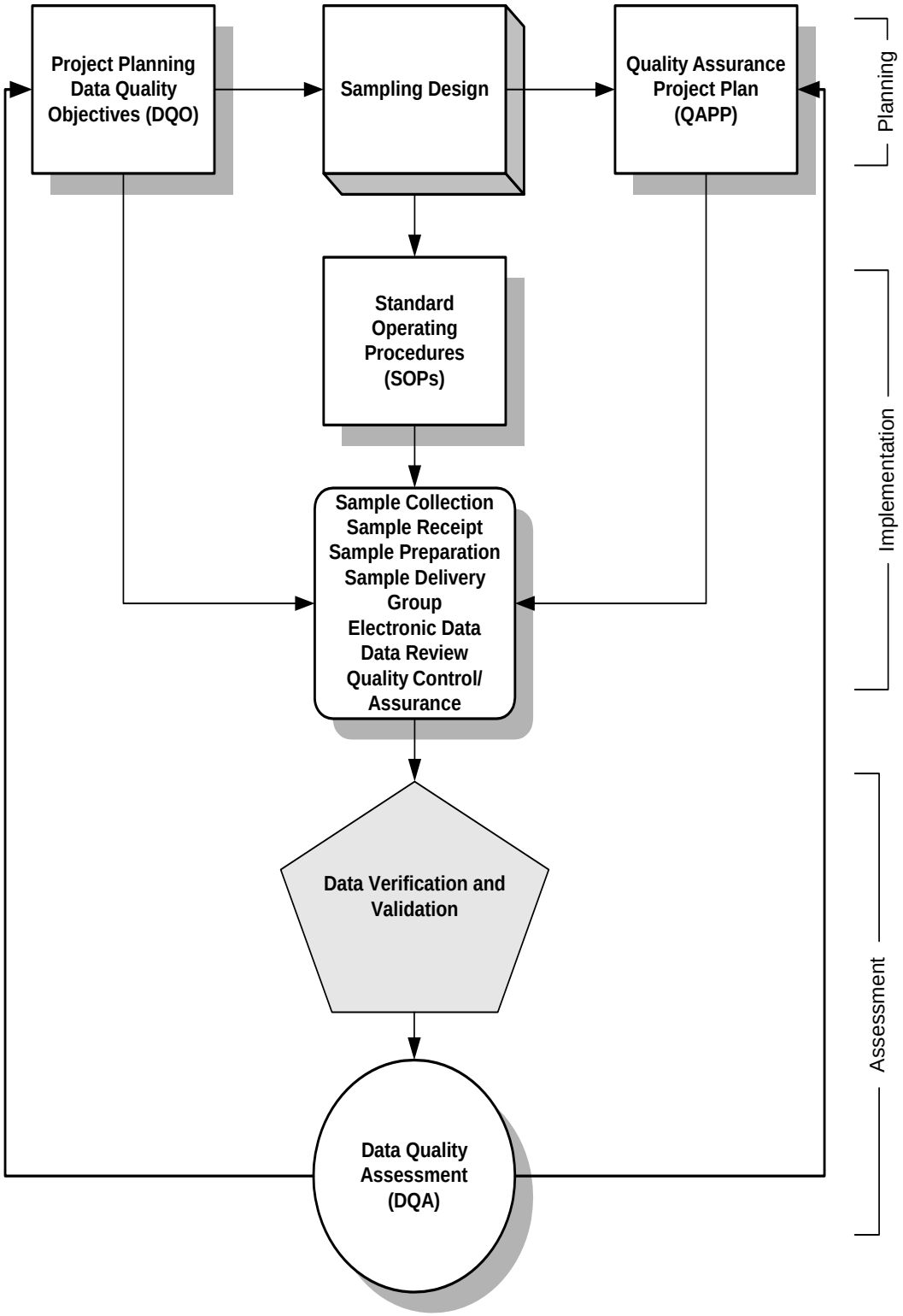

Figure 4-1. Data Quality Flowchart

REFERENCES

ANSI /HPS N13.1-1999 standard (ANSI 1999), *Sampling and Monitoring Release of Airborne Radioactive Substance from the Stacks and Ducts of Nuclear Facilities.*

BNL. 1997. *Radiochemical Data Validation Standard Operating Procedure*. Brookhaven National Laboratory, Upton, NY.

BNL. 1999b. *Quality Assurance Project Plan: Analysis of Radionuclides and Hazardous Chemicals at Brookhaven National Laboratory*. RCD/ASL-99-01 Rev. 0. Radiological Control Division/Analytical Services Lab, Brookhaven National Laboratory, Upton, NY. May 1999.

BNL. 1999b. *BNL Groundwater Monitoring Program Quality Assurance Project Plan (QAPP)*. Brookhaven National Laboratory, Upton, NY. August 31, 1999.

BNL. 1999c. *Sitewide Groundwater Monitoring Quality Assurance Project Plan (Draft)*. Environmental Restoration Division, Brookhaven National Laboratory, Upton, NY.

BNL 2004a. *Environmental Monitoring Standard Operating Procedures*. Brookhaven National Laboratory, Upton, NY.

DOE. 1977. *Guidance for Radiochemical Data Collection and Review*. Report EM-76, U.S. Department of Energy, Washington, DC.

DOE. 1994. *RD-4 Guidance for Radiochemical Data Validation*. Draft Report EM-73, U.S. Department of Energy, Washington, DC.

DOE Order 414.1. 1998. *Quality Assurance*. U.S. Department of Energy, Washington, DC. November 24, 1998.

DOE Order 450.1.1. 2003. *Environmental Protection Program*. U.S. Department of Energy, Washington, DC. Change 1: 6-29-90.

EPA. 1992. *Evaluation of Metals Data for the Contract Laboratory Program*. EPA Region II, SOP HW-2. U.S. Environmental Protection Agency, Washington, DC.

EPA. 1996. *CLP Organic Data Review and Preliminary Review*. EPA Region II, SOP HW-6. U.S. Environmental Protection Agency, Washington, DC.

EPA. 1998. Requirements for Quality Assurance Project Plans for Environmental Data Operations. Report QA/R-5. U.S. Environmental Protection Agency, Washington, DC.

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