



Computerized Sample Receiving Station in the Environmental Laboratory

5.0 Quality Assurance

The Quality Assurance (QA) program provides for and documents consistency, precision, and accuracy in collecting and analyzing environmental samples and in interpreting and reporting environmental monitoring data.

5.1 Organizational Responsibilities

WVNS has overall responsibility for quality assurance on-site, while Safety and Environmental Assessment (S&EA) is responsible for ensuring the quality of the environmental monitoring program. Environmental Laboratory management and staff are directly responsible for carrying out activities in a manner consistent with good quality assurance practices.

5.2 Program Design

The quality assurance program for environmental monitoring at the WNYNSC is consistent with DOE Order 5700.6B and is based directly upon the eighteen-element program outlined in "Quality Assurance Program Requirements for Nuclear Facilities" (ANSI/ASME NQA-1, 1986), updated under American Society of Mechanical Engineers (ASME) auspices in 1989. These elements are as follows:

- Organization
- Quality Assurance Program
- Design Control
- Procurement Document Control
- Instructions, Procedures, and Drawings
- Document Control

- Control of Purchased Items and Services
- Identification and Control of Items
- Control of Processes
- Inspection
- Test Control
- Control of Measuring and Test Equipment
- Handling, Storage, and Shipping
- Inspection, Test, and Operating Status
- Control of Nonconforming Items
- Corrective Actions
- Quality Assurance Records
- Audits

Any vendors providing analytical services for the environmental monitoring program are contractually required to maintain a quality assurance program consistent with these elements.

5.3 Procedures

Activities affecting the quality of environmental monitoring data are conducted according to approved procedures that clearly describe how the activity should be performed and what precautions are to be taken in connection with the activity. Any person performing an activity affecting the quality of environmental monitoring data must be trained in that procedure and demonstrate proficiency.

New procedures are developed each time a new activity is added to the monitoring program. Procedures are reviewed annually and are updated when necessary. All procedures are controlled so that only current documents are in use.

5.4 Quality Control in the Field

Quality control (QC), an integral component of environmental monitoring quality assurance, is a way of verifying that samples are being collected and analyzed according to established quality assurance procedures; quality control ensures that sample collection and analysis is consistent and repeatable, and it is a means of tracking down and ascertaining possible sources of error. For example, where possible, sample locations are clearly marked in the field to ensure that ensuing samples are collected in the same locations; collection equipment in place in the field is routinely inspected, calibrated, and maintained; and automated sampling stations are kept locked to prevent tampering.

Samples are collected into appropriate containers and labeled immediately with pertinent information. Date, time, person doing the collecting, and special field sampling conditions are recorded and become part of the record for that sample. If necessary, samples are preserved as soon as possible after collection. The scope of the work is indicated by the fact that during 1990 trained Environmental Laboratory personnel collected almost 7,000 samples.

In order to monitor quality problems that might be introduced by the sampling process, field quality control samples are generated that consist of field duplicates, field blanks, trip blanks, and environmental background samples.

■ **Field duplicates:**

Field duplicates are samples collected at the same location at the same time. From that point, they are treated as separate samples. Field duplicates provide a means of assessing the precision of collection methods and are collected at a minimum rate of one per twenty

analyses; more than 1,300 field duplicate analyses were conducted in 1990.

■ **Field blanks:**

A field blank is a sample of laboratory-distilled water that has been introduced into a sample container at a sample collection site in the field and that is processed from that point as a routine sample. Field blanks are used to detect contamination introduced by the sampling procedure. They are processed at a minimum rate of one per twenty analyses.

If the same collection equipment is used for more than one site, a special form of field blank known as an *equipment blank* may be collected by pouring distilled water through collecting equipment and into a sample container. Equipment blanks are collected to detect any cross-contamination that may be passed from one sampling location to another by equipment. Many site wells and surface water collection stations have collecting equipment in place that remains at that location. This equipment is known as “dedicated” equipment, and special equipment blanks are not necessary at these locations.

More than 150 field blank analyses were performed in 1990. No contamination problems were detected.

■ **Trip blanks:**

Trip blanks are prepared by pouring laboratory-distilled water into sample bottles in the laboratory. These bottles are placed into sample coolers and remain there throughout the sampling procedure. Trip blanks are collected only when volatile organics are being monitored in order to detect any volatile organic contamination introduced into the samples from the containers or coolers, or from handling during the collection process or shipping. More than sixty trip blanks were collected in 1990, with no problems of contamination from these sources found.

■ **Environmental background samples:**

The environmental monitoring program includes samples from locations remote from the site for each pathway being monitored for possible radiological contamination. Results from these samples show natural radiological concentrations in samples clearly outside of site influence. These samples serve as backgrounds or "controls," another form of field quality control sample. About 1,000 environmental background sample analyses were conducted in 1990 as part of the environmental monitoring program.

5.5 Quality Control in the Laboratory

Nearly 9,000 samples were processed by the Environmental Laboratory in 1990, including samples collected by laboratory staff and samples submitted to the laboratory by other departments or agencies. More than 60% of these samples were analyzed by the Environmental Laboratory staff, with the rest being sent to other laboratories. Samples not analyzed by the Environmental Laboratory must maintain a level of quality control similar to that maintained by the Environmental Laboratory. Vendor laboratories are required to participate in all relevant crosschecks and to maintain all relevant certifications.

In order to monitor the accuracy and precision of data produced by the Environmental Laboratory, laboratory quality control practices specific to each analytical method are clearly described in approved references or procedures. Laboratory quality control consists of proper training of analysts, maintenance and calibration of measuring equipment and instrumentation, and specific methods of processing samples as a means of monitoring laboratory performance.

Analytical instruments and counting systems are calibrated at specified frequencies and logs of instrument calibration and maintenance are kept. Calibration methods for each instrument are specified in procedures or in manufacturers' directions. Standards traceable to the National Institute of Standards and

Technology (NIST) are used to calibrate counting and source instrumentation.

Laboratory quality control samples consist of three general types: standards (including spikes), used to assess accuracy; blanks, to assess the possibility of contamination; and duplicates, to assess precision. Crosschecks also are performed.

■ **Standards:**

Laboratory standards consist of materials containing a known concentration of the analyte of interest, such as a pH buffer or a Pu-239 counting standard. These may consist of NIST-traceable standards or standard reference materials (SRMs) from other sources. At a minimum, one reference standard is analyzed for each ten sample analyses, or one per day, to determine if the method is producing results within acceptable limits.

The results of standard analyses are plotted on control charts that specify acceptable limits. If results are outside the control limits, the system must be brought back into control before sample analysis can resume.

Another form of standard analysis is a laboratory spike, in which a known amount of analyte is added to a sample or blank before the sample is analyzed. The percent recovery of the analyte is an indication of how much of the analyte of interest is being detected in the analysis of actual samples; hence, a spike is an assessment of the accuracy of the method. Acceptability limits are also documented for spike recovery.

Control charts are kept and are routinely monitored. To supplement the routine analysis of standards, EPA quality control samples of known concentrations are submitted to analysts in the laboratory by the S&EA quality assurance staff. The concentrations of the samples are unknown to the analyst and serve as an additional performance check on the accuracy of Environmental Laboratory analyses. More than 400 laboratory standard analyses (including spikes) were performed in 1990.

■ **Laboratory blanks:**

Laboratory blanks are prepared from a matrix similar to that of the sample but known to contain none of the analyte of interest. For instance, distilled water, taken through the same preparatory procedure as a sample, serves as a laboratory blank for both radiological and chemical water analyses. Positive results for an analyte in a blank indicate that something was wrong with the analysis and corrective action should be taken. One blank is routinely processed daily or with each "run" of samples. S&EA quality control provided blank samples as additional checks on the prevention of cross-contamination in the analytical process in the Environmental Laboratory.

A special form of laboratory blank for radiological samples is an instrument background count, which is a count taken of a planchette or vial containing no sample. The count serves two purposes: 1) to determine if contamination is present in the counting instrument; and 2) to determine the background correction that should be applied in calculations of radiological activity. A background count is performed before each day's counting.

■ **Laboratory Duplicates:**

Duplicates are analyzed to assess precision in the analytical process. Laboratory duplicates are created by splitting existing samples before analysis; each split is treated as a separate sample. If the analytical process is in control, results for each split should be within documented criteria of acceptability. Approximately 700 laboratory duplicate analyses were performed in 1990. As with standards, duplicate samples were submitted to the Environmental Laboratory by S&EA quality assurance as an additional performance check on laboratory precision.

■ **Crosschecks:**

The Environmental Laboratory participates in formal radiological crosscheck programs conducted by the Department of Energy

Radiological and Environmental Science Laboratory (RESL), the Environmental Monitoring Systems Laboratory of the USEPA (EMSL), Las Vegas, and the Environmental Measurements Laboratory (EML), New York City. Crosscheck performance is summarized in Appendix D.

In addition to radiological crosschecks, the Environmental Laboratory, in conjunction with the on-site Analytical and Process Chemistry Laboratories, maintains certification by the New York State Department of Health (NYSDOH) for various non-radiological analytes. To maintain this certification, the laboratory participates in semiannual crosschecks for the analytes certified by NYSDOH.

5.6 Personnel Training

Anyone performing environmental monitoring program activities must be trained in the appropriate procedures and qualified accordingly before carrying out the procedure as part of the site environmental monitoring program. Requalifications are conducted periodically.

5.7 Record Keeping

Control of records is an integral part of the environmental monitoring program. Field data sheets, chain-of-custody forms, analytical requests, sample-shipping documents, sample logs, bench logs, laboratory data sheets, equipment maintenance logs, calibration logs, training records, crosscheck performance records, and weather measurements, in addition to other records, are all maintained as documentation of the environmental monitoring program. All records pertaining to the program are also reviewed routinely and securely stored.

In late 1990 new computer software, the Laboratory Information Management System (LIMS), was installed in the Environmental Laboratory. Although installed too late for use in 1990, this system will be integrated into the laboratory record-keeping system and will be used for sample logging, auto-logging of samples, printing labels for samples, data

storage and processing, monitoring of quality control samples, sample tracking, producing sampling and analytical worklists, and generating reports. This new system will decrease much of the paperwork involved in the environmental monitoring program.

5.8 Chain-of-custody Procedures

Field data sheets, which are filled out when samples are collected, serve as chain-of-custody records for the samples. Samples are brought in from the field and logged at the sample receiving station, after which they are stored in a sample lock-up before analysis or shipping.

Samples sent to other laboratories for analysis are accompanied by a chain-of-custody/analytical request form. Signature control must be maintained by the agent transporting the samples. Vendor laboratories are required to maintain internal chain-of-custody records and to store the samples under secure conditions.

5.9 Audits

Routine internal appraisals of the Safety & Environmental Assessment Department and the Environmental Laboratory are conducted by site quality assurance personnel, who also audit the environmental monitoring programs. In addition, agencies external to the WVDP audit the program as a whole.

5.10 Performance Reporting

The performance of the laboratory in crosscheck programs is published in the summary of results for each crosscheck. The Environmental Laboratory results are compared with the true value for the samples and the Environmental Laboratory performance is compared with those of other laboratories participating in the crosscheck.

Quarterly summaries of quality control performance may be included in the appropriate monthly trend analysis reports.

Monthly trend analysis reports document possible warning levels or trends picked up as part of the environmental monitoring program. Monthly SPDES discharge reports are generated and submitted to the New York State Department of Environmental Conservation (NYSDEC).

5.11 Independent Data Verification

All Environmental Laboratory analytical data is reviewed and approved by a qualified person other than the person conducting the analysis. As part of the verification procedure, quality control samples analyzed in conjunction with the samples are examined and calculations are checked before approval. S&EA quality assurance personnel also conduct checks of the data in addition to the initial, routine reviews. All software used to generate data is subjected to a verification procedure before being used.

Data must be formally approved before being reported or used in the calculation of environmental monitoring data. Reports generated from data are subjected to a peer review process before being issued.