QUALITY ASSURANCE

The quality assurance (QA) program at the West Valley Demonstration Project provides for and documents consistency, precision, and accuracy in collecting and analyzing environmental samples and in interpreting and reporting environmental monitoring data.

Organizational Responsibilities

The Safety and Environmental Assessment (S&EA) department is responsible for ensuring the quality of the environmental monitoring program. Environmental Laboratory management and staff are directly responsible for carrying out sampling and analytical activities in a manner consistent with good quality assurance practices.

Program Design

The quality assurance program for environmental monitoring at the WNYNSC is consistent with DOE Order 5700.6C, *Quality Assurance,* and the WVDP's *Environmental Quality Assurance Plan* (West Valley Nuclear Services 1991) and is based directly upon the eighteen-element program outlined in *Quality Assurance Program Requirements for Nuclear Facilities* (American Society of Mechanical Engineers 1989), which describes the major aspects of a good quality assurance program. The program focuses upon assigning responsibilities and upon thorough planning, specification, control, and documentation of all aspects of an activity:

√ *Responsibility.* Responsibilities involved in overseeing and managing an activity are clearly defined. Personnel who check and verify the activity are independent of those who perform the activity.

√ *Planning.* The activity is planned beforehand and the plan is followed. All activities are documented. Similarly, purchases of any equipment or items are planned, specified precisely, and verified for correctness upon receipt.

√ *Control of design, procedures, items, and documents.* Any activity, equipment, or construction is clearly described or defined and tested, and changes in the design are tested and documented. Procedures clearly state how activities will be conducted. Only approved procedures are used. Any equipment or particular items are clearly identified, inspected, calibrated, and tested before use. Calibration status is clearly labeled. Items that do not conform are identified and separated from other items and the nonconformity is documented.

√ *Documentation.* Records are kept of all activities in order to verify what was done. Records must be clearly traceable to an item or activity.

√ *Corrective action.* If a problem should arise, the cause of the problem is identified, a corrective action planned, responsibility assigned, and the problem remedied.

√ *Audits.* Scheduled audits and self-assessments verify compliance with all aspects of the quality assurance program and determine its effectiveness.

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

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 that could affect the quality of environmental monitoring data must be trained in that procedure and demonstrate proficiency.

New procedures are developed each time an activity is added to the monitoring program. Procedures are reviewed annually and are updated when necessary. All procedures are controlled so that only those that are current are used.

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 is a means of tracking down possible sources of error. For example, sample locations are clearly marked in the field to ensure that future 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

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and become part of the record for that sample. If necessary, samples are preserved as soon as possible after collection.

In order to monitor quality problems that might be introduced by the sampling process, duplicate field samples, field blank samples, and trip blank samples are collected. Background samples are collected for baseline environmental information.

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.

Field Blanks

A field blank is a sample of laboratory-distilled water that is put into a sample container at a field collection site and 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. No field contamination problems have been detected.

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 laboratory-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 the equipment. Many wells and surface water collection stations on the site have collecting equipment that remains at that location. This equipment is "dedicated" equipment, and special equipment blanks are not necessary at these locations because the equipment is used exclusively at that site.

Trip Blanks

Trip blanks are prepared by pouring laboratory-distilled water into sample bottles in the laboratory. The bottles are then placed into sample coolers and remain there throughout the sampling. Trip blanks are collected only when volatile organics are being monitored in order to detect any volatile organic contamination from the containers, coolers, or from handling during collection, storage, or shipping. No contamination from these sources has been found.

Environmental Background Samples

The environmental monitoring program includes samples taken from locations remote from the site for each pathway being monitored for possible radiological contamination such as air, water, vegetation, and meat. Analysis of these samples that are clearly outside of site influence show natural radiological concentrations and serve as backgrounds or "controls," another form of field quality control sample. These samples provide baseline information to compare with information from near-site or on-site samples so that any possible influence from the site can be determined.

Quality Control in the Laboratory

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 test 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. Results of Environmental Laboratory and vendor laboratory analyses also are compared to certified results from laboratories operated by the Department of Energy and the Environmental Protection Agency.

Standards

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

The results of analyses of standards are plotted on control charts, which specify acceptable limits. If the method of analysis produces results within acceptable limits, then analysis of actual environmental samples may proceed and the results are deemed usable.

Laboratory Spikes

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 also is an assessment of the accuracy of the method. Acceptance limits are documented for spike recovery and spike results are recorded on control charts.

Control charts are routinely monitored. To supplement the routine analysis of standards, 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.

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. A positive result for an analyte in a blank indicates that something is wrong with the analysis and that corrective action should be taken. In general, one laboratory blank is processed daily or with each "run" of samples for a given analyte.

S&EA quality assurance staff also provide blank samples to check possible cross-contamination 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 planchet or vial containing no sample. The count serves three purposes:

1) to determine if contamination is present in the counting instrument

2) to determine if the instrument is responding in an acceptable manner

3) to determine the background correction that should be applied in calculations of radiological activity.

A background count is taken before each day's counting. Background counts are recorded on control charts with defined acceptance limits. An unacceptable count requires corrective action before analyses can proceed.

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. As with standards, duplicate samples are submitted for analysis by S&EA quality assurance personnel as an additional performance check on laboratory precision.

Crosschecks

The Environmental Laboratory participates in formal radiological crosscheck programs conducted by the Department of Energy's Radiological and Environmental Science Laboratory (RESL), the Environmental Monitoring Systems Laboratory of the USEPA (EMSL) in Las Vegas, and the Environmental Measurements Laboratory (EML) in New York City. Crosscheck performance is summarized in *Appendix D*.

In conjunction with the on-site Analytical and Process Chemistry Laboratory, the Environmental Laboratory maintains certification with the New York State Department of Health (NYSDOH) to analyze samples for various nonradiological parameters.

More than 15,000 samples were handled by the Environmental Laboratory in 1992, including samples collected by laboratory staff and samples submitted to the laboratory by other departments or agencies. Roughly 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 similar level of quality control that is specified in contracts between the site and the vendor laboratories. Vendor laboratories are required to participate in all relevant crosschecks and to maintain all relevant certifications.

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.

Record Keeping

Control of records is an integral part of the environmental monitoring program. Field data sheets, chain-of-custody forms, requests for analysis, sample-shipping documents, sample logs, bench logs, laboratory data sheets, equipment maintenance logs, calibration logs, training records, crosscheck performance records, data packages, 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 reviewed routinely and securely stored.

The Laboratory Information Management System (LIMS), installed in the Environmental Laboratory in late 1990, is used to log samples, print labels, store and process data, monitor quality control samples, track samples, produce sampling and analytical worklists, and generate reports. The primary vendor laboratory provides data in electronic form for direct entry into the LIMS.

Chain-of-Custody Procedures

Field data sheets, which are filled out when samples are collected, serve as chain-of-custody

records for routine 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. By contract, vendor laboratories are required to maintain internal chain-of-custody records and to store the samples under secure conditions.

Audits

Routine internal appraisals of S&EA and the Environmental Laboratory are conducted by site quality assurance personnel, who also audit the environmental monitoring programs. Off-site commercial laboratories under contract to perform environmental analyses for the WVDP are audited at least annually by teams of environmental and quality assurance professionals. In addition, external agencies audit the program as a whole. (See *Environmental Compliance Summary: Calendar Year 1992.*)

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 with those of other laboratories participating in the crosscheck. Crosscheck summaries are issued when results are received, and the causes of missed crosscheck analyses are investigated as part of the corrective action process.

Monthly trend analysis reports document possible warning levels or trends picked up as part of the environmental monitoring program.

Monthly State Pollutant Discharge Elimination System (SPDES) discharge reports are generated and submitted to the New York State Department of Environmental Conservation (NYSDEC). These reports document analysis of permitted water discharges required by NYSDEC.

Independent Data Verification

All Environmental Laboratory analytical data are reviewed and approved by a qualified person other than the person conducting the analysis. As part of the validation procedure, quality control samples analyzed in conjunction with the samples are examined and calculations are checked before approval. Safety and Environmental Assessment 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 validated, evaluated, and approved before being reported or used in calculations. Reports generated from data are peer reviewed before being issued. In addition, the correct transcription of data from original documents to the LIMS must be verified before the sample data in the LIMS can be formally approved and used in reports.

Analytical Methods Evaluation

A study was carried out in late 1992 and early 1993 to corroborate observed uranium concentrations in treated waters discharged from lagoon 3 at outfall WNSP001. Values obtained by routine radiological isotopic analyses will be compared to nonroutine uranium isotopic results obtained by high sensitivity thermal ionization mass spectrometry (TIMS).

Self-Assessments

Three major self-assessments of the environmental monitoring program were conducted in 1992. The first assessment in March focused on sampling activities; the second, in June, focused on analytical procedures, calibration, and data validation. A combined assessment in September and October covered sample shipping, personnel training, quality assurance/quality control, chemical hygiene, and records management. All appraisals addressed corrective actions and peer review.

The major findings were a lack of timely follow-up of previously identified items and updating of procedures to keep up with changing documentation needs. These items are being addressed during 1993.

Self-assessments were also conducted to review Project activities relating to the National Environmental Policy Act (NEPA) and to air permitting and compliance management. No major issues were identified, although it was observed that procedures establishing NEPA documentation at the Project needed updating to reflect the current organizational structure. Actions to implement the recommendations are on schedule.