

8.18 Quality Assurance



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Quality assurance and quality control practices encompass all aspects of Hanford Site environmental monitoring programs. This section discusses specific measures taken in 2004 to ensure quality in project management, sample collection, and analytical results.

Samples were collected and analyzed according to documented standard analytical procedures. Analytical data quality was verified by a continuing program of internal laboratory quality control, participation in interlaboratory crosschecks, replicate sampling and analysis, submittal of blind standard samples and blanks, and splitting samples with other laboratories.

Quality assurance and quality control for the Hanford Site environmental monitoring programs also included procedures and protocols to:

- document instrument calibrations
- conduct program-specific activities in the field
- maintain groundwater wells to ensure representative samples were collected
- avoid cross-contamination by using dedicated well sampling pumps.

8.18.1 Site-Wide and Offsite Environmental Monitoring and Groundwater Monitoring

During 2004, comprehensive quality assurance programs, including various quality control practices, were maintained to assure the quality of data collected through Pacific Northwest National Laboratory's Surface Environmental Surveillance Project and Groundwater Performance Assessment Project. Quality assurance plans were

maintained for all project activities and defined the appropriate controls and documentation required by EPA and DOE.

8.18.1.1 Project Management Quality Assurance

Site environmental monitoring, groundwater monitoring, and related activities such as processing thermoluminescent dosimeters and performing dose calculations were subject to an overall quality assurance program. This program implemented the requirements of DOE Order 414.1B, *Quality Assurance*. Quality assurance plans are maintained by each monitoring project; these plans describe the specific quality assurance elements that apply to each project. These plans were approved by a quality assurance organization that monitored compliance with the plans. Work performed through contracts, such as sample analyses, must meet the same quality assurance requirements. Potential equipment and service suppliers are audited before service contracts or material purchases that could have a significant impact on quality within the projects are approved and awarded.

8.18.1.2 Sample Collection Quality Assurance and Quality Control

Surface Environmental Surveillance Project samples were collected by staff trained to conduct sampling according to approved and documented procedures (PNL-MA-580). Continuity of all sampling location identities was maintained through careful documentation. Field replicates were collected for water, soil, and biota samples (Table 8.18.1). Eighty-two percent of the 2004 field replicate results were acceptable. A result was acceptable



Table 8.18.1. Summary of Field Replicate Results for the Surface Environmental Surveillance Project at Hanford, 2004

| <u>Medium</u> | <u>Radionuclides</u> | <u>Number of Results Reported for Each Radionuclide^(a)</u> | <u>Number Within Control Limits for Each Radionuclide^(a)</u> |
|---------------|------------------------------------|---|---|
| Water | ³ H | 4 | 3 |
| | Gross beta | 1 | 1 |
| | ⁹⁰ Sr | 2 | 2 |
| | ²³⁴ U, ²³⁸ U | 3 | 2 |
| Soil | ⁴⁰ K | 4 | 4 |
| | ²³⁴ U, ²³⁸ U | 4 | 3 |
| | ¹³⁷ Cs | 3 | 3 |
| | ²³⁹ Pu | 2 | 1 |
| Biota | ⁴⁰ K | 4 | 4 |

(a) The sample and duplicate results are acceptable if they have a relative percent difference of less than 30% for the sample and duplicate and the result is above the detection limit or minimum detectable activity.

Relative percent difference (RPD) – A measure of the precision of the measurement of a sample (S) and its duplicate (D). The formula is

$$RPD = \left(\frac{|S - D|}{\frac{(S + D)}{2}} \right) \times 100$$

if it was greater than the minimum detectable activity and the relative percent difference was less than 30% for the sample and duplicate.

Samples for the Groundwater Performance Assessment Project were collected by trained staff according to approved and documented procedures (PNNL-15070, Appendix C). Chain-of-custody procedures were followed in *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, Third Edition* (EPA 1986). Samples representing field blanks and field duplicates were obtained during field operations. Summaries of the 2004 groundwater field quality control sample results are provided in Appendix C of PNNL-15070. The percentage of acceptable field blank and duplicate results during fiscal year 2004 was 97% for field blanks and 99% for field duplicates. For field blanks, a result was acceptable if it was less than two times the method detection limit for non-radiological data or less than two times the total propagated analytical uncertainty. An acceptable result indicates that there was not a contamination problem

found with the sample. For a field duplicate, the result was acceptable if the measured precision was within 20%, as measured by the relative percent difference, and the result was greater than five times the minimum detectable activity or method detection limit.

8.18.1.3 Analytical Results Quality Assurance and Quality Control

Routine chemical analyses of water samples were performed under contract primarily by Severn Trent Laboratories, Inc., St. Louis, Missouri, for the environmental surveillance and groundwater monitoring projects. Some routine analyses of hazardous and non-hazardous chemicals for the CERCLA groundwater program also were performed under contract by Lionville Laboratory, Inc., Lionville, Pennsylvania. Each laboratory participated in the EPA-sanctioned Water Pollution and Water Supply Performance Evaluation Studies conducted by Environmental Resource Associates. Each laboratory maintained an internal quality control program that met the requirements in EPA (1986); each program was audited and reviewed internally by Pacific Northwest National Laboratory, which submitted additional quality control double-blind spiked samples to these laboratories for analysis.

Routine inorganic metals analyses were also performed by Battelle Marine Sciences Laboratory. The laboratory participated in the NSI Laboratory Proficiency Testing Program. NSI Solutions, Inc. supplied spiked soil and water samples that were analyzed by Pacific Northwest National Laboratory. Analytical results were provided to NSI Solutions, Inc. and compared to the known concentrations of the spikes. Water sample results from seven studies in 2004 were reported. The criteria of being acceptable were met by 90% of the results from the water

Double-blind spiked sample – A sample of known activity and/or concentration prepared to look like a typical sample submitted to the analytical service laboratory.

samples. There were also results reported from two soil studies in 2004; 98% of these results were acceptable. The results are summarized in Table 8.18.2.

Routine radiochemical analyses of samples for the environmental surveillance and groundwater monitoring projects were performed primarily by Severn Trent Laboratories, Inc., Richland, Washington. Severn Trent Laboratories, Inc., Richland, participated in DOE's Quality Assessment Program at the Environmental Measurements Laboratory in New York, and the InterLab RadChem Proficiency Testing Program conducted by Environmental Resource Associates. Environmental Resource Associates prepared and distributed proficiency standard samples according to EPA requirements. A quality control blind spiked sample program also was conducted for each project by Pacific Northwest National Laboratory. The laboratory maintains an internal quality control program, which was audited and reviewed internally. Additional information on these quality control efforts is provided in the following sections.

8.18.1.4 DOE and EPA Comparison Studies

Blind water samples (containing activities and concentrations unknown to the analytical laboratory) were distributed to participating laboratories as part of the EPA

performance evaluation program. These blind samples contained specific organic and inorganic analytes that had concentrations unknown to the analyzing laboratories. After analysis, the results were submitted to Environmental Resource Associates, the EPA performance evaluation program sponsor, for comparison with known values and results from other participating laboratories. Summaries of the results for 2004 groundwater samples are provided in PNNL-15070, Appendix C, for the primary laboratory, Severn Trent Laboratories, Inc., St. Louis.

The DOE Quality Assessment Program and the Environmental Resource Associates Proficiency Testing Program provided standard samples of environmental media (e.g., water, air filters, soil, and vegetation) that contained specific amounts of one or more radionuclides that were unknown by the participating laboratory. After analysis, the results were forwarded to the DOE Quality Assessment Program or Environmental Resource Associates for comparison with known values and results from other laboratories. Both the DOE Quality Assessment Program and Environmental Resource Associates had established criteria for evaluating the accuracy of results (NERL-Ci-0045; EML-621). Summaries of the 2004 results are provided in Tables 8.18.3 and 8.18.4. The DOE Quality Assessment Program ended in 2004 after one set of samples was analyzed. The laboratory that provided this service,

Table 8.18.2. Summary of Laboratory Performance on NSI Laboratory Proficiency Test Program Samples, 2004

| <u>Medium</u> | <u>Analytes</u> | <u>Number of Results Reported for Each Analyte</u> | <u>Number Within Control Limits for Each Analyte</u> |
|---------------|---|--|--|
| Soil | Al, Sb, As, Ba, Cd, Cr, Co, Cu, Fe, Pb Mn, Hg, Mo, Ni, K, Se, Ag, Tl, V, Zn | 2 | 2 |
| | Be | 2 | 1 |
| | B, Ca, Mg, Na, Sr, Sn, Ti | 1 | 1 |
| Water | Al, Sb, As, Ba, Be, Cd, Ca, Cr, Cu, Pb, Mg, Hg, Mo, Ni, K, Se, Ag, specific conductance (at 25°C), Tl, total alkalinity (CaCO ₃), total dissolved solids, V, Zn | 5 | 5 |
| | Mn, Na, total hardness (CaCO ₃) | 5 | 4 |
| | B, Fe, pH | 3 | 3 |
| | Co, Sr, total dissolved solids | 2 | 2 |



Table 8.18.3. Summary of Laboratory Performance on Hanford Site Surface Environmental Surveillance Project Samples by the DOE Quality Assessment Program, 2004

| <u>Medium</u> | <u>Radionuclides</u> | <u>Number of Results Reported for Each Radionuclide</u> | <u>Number of Results Within Acceptable Control Limits for Each Radionuclide^(a)</u> |
|--|--|---|---|
| Severn Trent Laboratories, Richland, Washington | | | |
| Air filter particulate | Gross alpha, gross beta, ⁶⁰ Co, ⁹⁰ Sr, ¹³⁴ Cs, ¹³⁷ Cs, ²³⁴ U, ²³⁸ U, ²³⁸ Pu, ²³⁹ Pu, ²⁴¹ Am, total uranium | 1 | 1 |
| Soil | ⁴⁰ K, ⁹⁰ Sr, ¹³⁷ Cs, ²¹² Bi, ²¹² Pb, ²¹⁴ Bi, ²¹⁴ Pb, ²²⁸ Ac, ²³⁴ Th, ²³⁴ U, ²³⁸ U, ²³⁸ Pu, ²³⁹ Pu, ²⁴¹ Am, total uranium | 1 | 1 |
| Vegetation | ⁴⁰ K, ⁶⁰ Co, ⁹⁰ Sr, ¹³⁷ Cs, ²³⁸ Pu, ²³⁹ Pu, ²⁴¹ Am, ²⁴⁴ Cm | 1 | 1 |
| Water | ³ H, ⁶⁰ Co, ⁹⁰ Sr, ¹³⁷ Cs, ²³⁴ U, ²³⁸ U, ²³⁸ Pu, ²³⁹ Pu, ²⁴¹ Am, total uranium | 1 | 1 |
| | Gross alpha, gross beta | 1 | 0 |

(a) Control limits are from EML-621.

Table 8.18.4. Summary of Laboratory Performance on Hanford Site Surface Environmental Surveillance Project Samples by the Environmental Resource Associates Proficiency Testing Program, 2004

| <u>Medium</u> | <u>Radionuclides</u> | <u>Number of Results Reported for Each Radionuclide</u> | <u>Number Within Control Limits for Each Radionuclide^(a)</u> |
|--|---|---|---|
| Severn Trent Laboratories, Richland, Washington | | | |
| Water | Gross alpha | 6 | 6 |
| | ⁶⁰ Co, ¹³⁴ Cs, ¹³⁷ Cs, ²²⁶ Ra, ²²⁸ Ra, total uranium | 5 | 5 |
| | ⁸⁹ Sr, ⁹⁰ Sr, | 5 | 4 |
| | ⁶⁵ Zn, ¹³³ Ba | 4 | 4 |
| | ³ H, ¹³¹ I | 3 | 3 |

(a) Control limits are from NERL-Ci-0045.

Environmental Measurements Laboratory, was transitioned from a DOE facility to a Department of Homeland Security laboratory. Hence, its mission changed and, as a result, only one set of samples were provided in 2004. Severn Trent Laboratories, Inc., St Louis, analyzed and reported on that one set. Acceptable control limits as defined by the DOE Quality Assessment Program were met by 96% of the DOE quality assessment sample results. The acceptable control limit range as defined by the *National*

Standards for Water Proficiency Testing Studies, Criteria Document (NERL-Ci-0045) was met by 97% of the Environmental Resource Associates samples.

8.18.1.5 Pacific Northwest National Laboratory Evaluations

In addition to the DOE and EPA interlaboratory quality control programs, Pacific Northwest National Laboratory

Blind spiked sample – A sample of known activity and/or concentration submitted to the analytical laboratory but not necessarily in the same physical geometry as the typical samples submitted.

maintained a quality control program to evaluate analytical contractor precision and accuracy and to conduct special intercomparisons. This program included the use of both radiological and non-radiological blind spiked samples. Blind spiked quality control samples and blanks were prepared and submitted to check the accuracy and precision of analyses at Severn Trent Laboratories, Inc., Richland. In 2004, 221 blind spiked samples were submitted for the Groundwater Performance Assessment Project (PNNL-15070, Appendix C) and 8 samples were submitted for the Surface Environmental Surveillance Project. The samples included air filters, soil, water, and vegetation (Table 8.18.5). The results of all water sample non-radiochemistry blind spiked determinations are discussed in Appendix C of PNNL-15070 and indicated an acceptable performance by the laboratory.

For all media, 98% of Severn Trent Laboratories, Inc., Richland, radiochemistry blind spiked determinations were within the control limits ($\pm 30\%$ of the known value), which indicated acceptable results. One result for cobalt-60 in vegetation by gamma spectroscopy was slightly outside the acceptable range ($\pm 31\%$).

8.18.1.6 Laboratory Internal Quality Assurance Programs

The analytical laboratories were required to maintain an internal quality assurance and control program. Periodically, the laboratories were audited for compliance to the quality assurance and control programs. At Severn Trent Laboratories, Inc., St. Louis, the quality control program met the quality assurance and control criteria in EPA (1986). The laboratories also were required to maintain a system to review and analyze the results of the quality control samples to detect problems that may have arisen from contamination, inadequate calibrations, calculation errors, or improper procedure performance. Detection levels for each analytical method were determined at least annually.

The internal quality control program at Severn Trent Laboratories, Inc., Richland, involved routine calibrations of counting instruments, yield determinations of radiochemical procedures, frequent radiation check sources and background counts, replicate and spiked sample analyses, matrix and reagent blanks, and maintenance of control charts to indicate analytical deficiencies. Available calibration standards traceable to the National Institute of Standards and Technology were used for radiochemical calibrations. Calculation of minimum detectable concentrations involved the use of factors such as the average counting efficiencies and background for detection instruments, length of time for background and sample counts,

Table 8.18.5. Summary of Hanford Site Surface Environmental Surveillance Project Blind Spiked Determinations, 2004

| <u>Medium</u> | <u>Radionuclides</u> | <u>Number of Results Reported for Each Radionuclide</u> | <u>Number of Results Within Control Limits for Each Radionuclide^(a)</u> |
|--|--|---|--|
| Severn Trent Laboratories, Richland, Washington | | | |
| Air Filters | ^{60}Co , ^{90}Sr , ^{137}Cs , ^{234}U , ^{238}U | 2 | 2 |
| | ^{238}Pu | 1 | 1 |
| Soil | ^{40}K , ^{90}Sr , ^{137}Cs , ^{234}U , ^{238}U , ^{238}Pu , $^{239/240}\text{Pu}$ | 2 | 2 |
| Vegetation | ^{40}K , ^{60}Co , ^{90}Sr , ^{137}Cs , ^{238}Pu , $^{239/240}\text{Pu}$ | 2 | 2 |
| Surface Water | ^3H , ^{60}Co , ^{137}Cs , ^{238}Pu , $^{239/240}\text{Pu}$, ^{234}U , ^{238}U | 2 | 2 |

(a) Control limit of $\pm 30\%$.



sample volumes, radiochemical yields, and a pre-designated uncertainty multiplier (EPA 520/1-80-012).

Periodically, inspections of services were performed and conformance with the contractual requirements of the analytical facility was documented. This procedure provided the framework to identify and resolve potential performance problems. Responses to assessment and inspection findings were documented by written communication, and corrective actions were verified by follow-up audits and inspections.

In 2004, six audits of the commercial laboratories supporting the Groundwater Performance Assessment Project were performed. Three audits were performed by the DOE Consolidated Assessment Program, one audit by a joint team from Bechtel Hanford, Inc. and Pacific Northwest National Laboratory, and two audits by Bechtel Hanford, Inc. only. The DOE Consolidated Assessment Program audit evaluated Severn Trent Laboratories, Inc., St. Louis, on March 30 and April 1, 2004, Lionville Laboratory on May 4 to 6, 2004, and Severn Trent Laboratories, Inc., Richland, on August 3 to 5, 2004. The scope of the DOE Consolidated Assessment Program audits included the following specific functional areas: (1) quality assurance management systems and general laboratory practices, (2) data quality for organic analyses, (3) data quality for inorganic and wet chemistry analyses, (4) data quality for radiochemistry analyses, (5) hazardous and radioactive materials management, and (6) verification of corrective-action implementation from previous audit findings.

The purpose of the joint Bechtel Hanford, Inc. and Pacific Northwest National Laboratory audit conducted on August 10 to 12, 2004, was to evaluate the continued support of analytical services to Hanford Site contractors as specified in the statement of work between Fluor Hanford, Inc. and Severn Trent Laboratories, Inc. The audit was based on the analytical and quality assurance requirements for both groundwater and multimedia samples as specified in the statement of work. The primary areas of focus were personnel training, procedure compliance, sample receipt and tracking, instrument operation and calibration, equipment maintenance, instrumentation records and logbooks, implementation of Severn Trent Laboratories, Inc.'s quality assurance management plan in accordance with *Hanford Analytical Services Quality Assurance Requirements Document* (DOE/RL-96-68,

Volumes 1 and 4), and implementation of corrective actions for deficiencies identified in previous audits.

A total of 22 findings and 33 observations were noted for the three DOE Consolidated Assessment Program audits, 11 findings and 6 observations were identified in the joint Bechtel Hanford, Inc. and Pacific Northwest National Laboratory audit, and 5 findings and 19 observations were identified by Bechtel Hanford, Inc. only audits. Results of these audits are summarized in Appendix C of PNNL-15070. Corrective actions were accepted for all the audits and verification of the corrective actions will be performed in future audits. All laboratories have been qualified to continue to provide analytical services for samples generated at DOE sites.

Internal laboratory quality control program data were reported with the analytical results. Scientists at Pacific Northwest National Laboratory summarized the results quarterly. The Surface Environmental Surveillance Project and the Groundwater Performance Assessment Project indicated that each laboratory met the contract-specified requirements for each quarter of calendar year 2004 (for the Surface Environmental Surveillance Project) and fiscal year 2004 (for the Groundwater Performance Assessment Project).

8.18.1.7 Media Audits and Comparisons

Additional audits and comparisons were conducted on several specific types of samples. The Washington State Department of Health routinely co-sampled various environmental media and measured external radiation levels at multiple locations during 2004. Media that were co-sampled and analyzed for radionuclides included irrigation water, water from 19 locations along and across the Columbia River, water from 5 Columbia River shoreline springs, water from 1 onsite drinking water location, soil from 13 locations on and off the site, and sediment from 6 Columbia River sites from Priest Rapids Dam (upriver from the site) to McNary Dam (downriver from the site). Also co-sampled and analyzed for radionuclides were samples of carp as well as upwind and downwind samples of quail, mule deer (muscle and bone), concord grapes, potato tubers, asparagus, alfalfa, cow milk, and red and white wines.

The U.S. Food and Drug Administration (FDA) also received co-samples from downwind sampling locations and analyzed leafy vegetables, potato tubers, and concord grapes for radionuclides (Table 8.18.6). The FDA determined that concord grapes from the Riverview area had positive results for strontium-90. However, these values were below the strontium-90 detection limit determined by Pacific Northwest National Laboratory for the same sample. All other results from the FDA were below detection limits.

Quality control for environmental thermoluminescent dosimeters included audits that exposed three environmental thermoluminescent dosimeters per quarter to known values of radiation (between 17 and 29 milliroentgen). For the twelve measurements, the lowest ratio of determined/known exposure was 0.99; the highest determined/known exposure ratio was 1.09, with an average of 1.05 ± 0.03 (Table 8.18.7).

8.18.2 Effluent Monitoring and Environmental Monitoring Near Facilities and Operations

The Effluent Monitoring and Near-Facility Environmental Monitoring Programs were subject to the quality assurance requirements specified in DOE/RL-96-68. These quality assurance programs complied with DOE Order 414.1B, using standards from the American Society of Mechanical Engineers (ASME NQA-1 1997 Edition) as their basis. The program also adhered to the guidelines and objectives in *Requirements for Quality Assurance Project Plans for Environmental Data Operations* (EPA QA/R-5).

The monitoring programs each have a quality assurance project plan describing applicable quality assurance elements. These plans were approved by contractor quality

Table 8.18.6. Comparison of Co-Sampling Results for Samples Collected Near the Hanford Site, 2004^(a)

| Medium | Sampling Area | Organization | Strontium-90, pCi/g ^(b,c) | Cesium-137, pCi/g ^(b,c) | Ruthenium-106, pCi/g ^(b,c) | Iodine-131 pCi/g ^(b,c) | Tritium pCi/g ^(b,c) |
|------------------------------|---------------|--------------|--------------------------------------|------------------------------------|---------------------------------------|-----------------------------------|--------------------------------|
| Leafy vegetables (stem-leaf) | Sunnyside | FDA | <0.0020 | <0.032 | <0.10 | <0.032 | <200 |
| | | FDA | <0.0020 | <0.032 | <0.10 | <0.032 | <200 |
| | | PNNL | 0.0003 ± 0.004 | 0.004 ± 0.004 | 0.0091 ± 0.032 | NA | NA |
| Leafy vegetables (stem-leaf) | Riverview | FDA | <0.0020 | <0.032 | <0.10 | <0.032 | <200 |
| | | FDA | <0.0020 | <0.032 | <0.10 | <0.032 | <200 |
| | | PNNL | 0.013 ± 0.004 | -0.0004 ± 0.004 | -0.007 ± 0.04 | NA | NA |
| Potato tuber | Sunnyside | FDA | <0.0020 | <0.032 | <0.10 | <0.032 | <200 |
| | | FDA | <0.0020 | <0.032 | <0.10 | <0.032 | <200 |
| | | PNNL | NR | -0.003 ± 0.005 | 0.026 ± 0.044 | NA | NA |
| Concord grapes | Riverview | FDA | 0.00078 ± 0.00070 | <0.032 | <0.10 | <0.032 | <200 |
| | | FDA | 0.0011 ± 0.0008 | <0.032 | <0.10 | <0.032 | <200 |
| | | PNNL | -0.001 ± 0.002 | -0.001 ± 0.003 | -0.003 ± 0.026 | NA | NA |

(a) Sample results are wet weight.

(b) To convert pCi/g to Bq/g, multiply by 0.037.

(c) Errors reported are 2 standard deviations. Less than (<) values are minimum detectable activities at 2 standard deviations.

FDA = U.S. Food and Drug Administration.

NA = Not analyzed; not specifically requested by contract unless present.

NR = Not reported; incident report filed.

PNNL = Pacific Northwest National Laboratory.



Table 8.18.7. Comparison of Pacific Northwest National Laboratory Thermoluminescent Dosimeter Results with Known Exposure, 2004

| Quarter | Exposure Date | Known Exposure,^(a) milliroentgen (mR) | Determined Exposure,^(a) milliroentgen (mR) | Ratio of Determined/ Known Exposure |
|----------------|----------------------|---|--|--|
| 1st | February 12, 2004 | 29 ± 1.08 | 30.98 ± 1.03 | 1.07 |
| | | 18 ± 0.67 | 18.68 ± 0.36 | 1.04 |
| | | 26 ± 0.97 | 25.81 ± 1.19 | 0.99 |
| 2nd | May 14, 2004 | 27 ± 1.00 | 27.86 ± 0.61 | 1.03 |
| | | 23 ± 0.86 | 23.33 ± 0.33 | 1.01 |
| | | 17 ± 0.63 | 17.76 ± 0.18 | 1.04 |
| 3rd | August 13, 2004 | 22 ± 0.82 | 22.06 ± 0.72 | 1.00 |
| | | 19 ± 0.71 | 20.48 ± 0.42 | 1.08 |
| | | 28 ± 1.04 | 29.92 ± 0.80 | 1.07 |
| 4th | November 16, 2004 | 20 ± 0.74 | 21.77 ± 0.85 | 1.09 |
| | | 25 ± 0.93 | 27.07 ± 0.04 | 1.08 |
| | | 18 ± 0.67 | 19.21 ± 0.12 | 1.07 |

(a) Assumed 2 standard deviation error was 3.72%.

assurance groups, who monitored compliance with the plans. Work such as sample analyses performed through contracts had to meet the requirements of these plans. Suppliers were audited before the contract selection was made for equipment and services that may have significantly affected the quality of a project.

8.18.2.1 Sample Collection Quality Assurance

Samples for the Effluent Monitoring and Near-Facility Environmental Monitoring Programs were collected by staff trained in accordance with approved procedures. Established sampling locations were accurately identified and documented to assure continuity of data for those sites and are described in DOE/RL-91-50.

8.18.2.2 Analytical Results Quality Assurance

Samples for the Effluent Monitoring and Near-Facility Environmental Monitoring Programs were analyzed by up to three different analytical laboratories. The use of these laboratories was dependent on the Hanford contractor collecting the samples and the contract(s) established between the contractor and the analytical laboratory(s). Table 8.18.8 provides a summary of the Hanford Site's

analytical laboratories used for effluent monitoring and near-facility monitoring samples in 2004.

The quality of the analytical data was assured by several means. For instance, counting room instruments were kept within calibration limits through daily checks, the results of which were stored in computer databases. Radiochemical standards used in analyses were regularly measured and the results were reported and tracked. Formal, written laboratory procedures were used to analyze samples. Analytical procedural control was assured through administrative procedures. Chemical technologists at the laboratories were qualified to perform analyses through formal classroom and on-the-job training.

The participation of the Hanford Site analytical laboratories in EPA and DOE laboratory performance evaluation programs also served to assure the quality of the data produced. The Waste Sampling and Characterization Facility performance was evaluated in four different laboratory performance studies for 2004. For the EPA Water Pollution Studies 108 and 114, Soil Studies 45 and 47, and Soil Study 48 for inorganic and organic analyses, 360 different analytes and compounds were submitted to the Waste Sampling and Characterization Facility for analysis. Of the 360 reported analytes, 341 results were acceptable while 19 were unacceptable for a total acceptable rate of 95%. In the DOE Mixed Analyte Performance

Table 8.18.8. Hanford Site Laboratories Used by Site Contractors and Types of Effluent Monitoring and Near-Facility Monitoring Samples Analyzed, 2004

| Analytical Laboratory | Effluent Monitoring Samples | | | | | | Near-Facility Environmental Monitoring Samples | | |
|---|-----------------------------|-------|---------------------------------------|-----------------------|-------|---------------------|--|-------|--|
| | Fluor Hanford, Inc. | | Pacific Northwest National Laboratory | Bechtel Hanford, Inc. | | Fluor Hanford, Inc. | | | |
| | Air | Water | Air | Air | Water | Air | Water | Other | |
| Waste Sampling and Characterization Facility ^(a) | X | X | | | X | X | X | X | |
| 222-S Analytical Laboratory ^(b) | | | | | | | | X | |
| Severn Trent Laboratories, Inc., Richland | X | X | X | X | X | | | | |
| Radiochemical Processing Laboratory ^(c) | X | X | X | | | | | | |

(a) Operated by Fluor Hanford, Inc.
 (b) Operated by CH2M HILL Hanford Group, Inc.
 (c) Operated by Pacific Northwest National Laboratory.

Evaluation Program studies (MAPEP-03-W11 and MAPEP-04-MaS12), 122 different radionuclides and analytes were submitted to the Waste Sampling and Characterization Facility for analysis. Of the 122 reported radionuclide analytes, 116 results were acceptable while 6 were unacceptable for a total acceptable rate of 95%. In the National Institute of Standards and Technology Radiochemistry Intercomparison Program study, four different radionuclides (strontium-90, plutonium-238, uranium-238, and americium-241) in filters and soils were submitted to the Waste Sampling and Characterization Facility for 40 different analyses. All radionuclide results for both filters and soils were acceptable for a total acceptable rate of 100%. In the DOE Quality Assessment Program, 36 different radionuclides were submitted to the Waste Sampling and Characterization Facility for analysis, and 17 different radionuclides were submitted to the 222-S Analytical Laboratory. Of the 36 reported radionuclides for the Waste Sampling and Characterization

Facility, 36 results were acceptable for a total acceptable rate of 100%. Of the 17 reported radionuclides for the 222-S Analytical Laboratory, all 17 results were acceptable for a total acceptable rate of 100%. The 222-S Analytical Laboratory also participated in the 2004 study of DOE's Mixed Analyte Performance Evaluation Program. Of the 33 reported radionuclides, 32 were found to be acceptable for an acceptable rate of 97%. Performance results for the DOE Quality Assessment Program and others are presented in Tables 8.18.9 through 8.18.11.

The DOE Quality Assessment Program was discontinued in June 2004 and replaced by the DOE Mixed Analyte Performance Evaluation Program. The new program expanded the performance evaluation sample matrices to include filters (started in July 2004) and vegetation (started in January 2005).



Table 8.18.9. The Hanford Site's Waste Sampling and Characterization Facility^(a) Performance on DOE Quality Assessment Program Samples and on DOE Mixed Analyte Performance Evaluation Program Samples, 2004

| <u>Medium</u> | <u>Radionuclide</u> | <u>Number of Results Reported</u> | <u>Number of Results Within Control Limits</u> |
|---------------|--|-----------------------------------|---|
| Air filters | ⁵⁴ Mn, ⁵⁷ Co, ⁶⁰ Co, ⁶⁵ Zn, ⁹⁰ Sr, ¹³⁴ Cs, ¹³⁷ Cs, ²³⁴ U, ²³⁸ Pu, ²³⁸ U, ^{239/240} Pu, ²⁴¹ Am, gross alpha, gross beta | 25 | 24 (⁹⁰ Sr failed once) |
| Soil | ⁴⁰ K, ⁵⁴ Mn, ⁵⁷ Co, ⁶⁰ Co, ⁶⁵ Zn, ⁹⁰ Sr, ¹³⁴ Cs, ¹³⁷ Cs, ²³⁴ U, ²³⁸ Pu, ²³⁸ U, ^{239/240} Pu, ²⁴¹ Am | 19 | 17 (²³⁴ U and ²³⁸ U failed; only naturally occurring uranium was present in the MAPEP ^(b) soil sample) |
| Vegetation | ⁴⁰ K, ⁶⁰ Co, ⁹⁰ Sr, ¹³⁷ Cs, ^{239/240} Pu, ²⁴¹ Am, ²⁴⁴ Cm | 7 | 7 |
| Water | ³ H, ⁵⁴ Mn, ⁵⁷ Co, ⁶⁰ Co, ⁶⁵ Zn, ⁹⁰ Sr, ¹³⁴ Cs, ¹³⁷ Cs, ²³⁴ U, ²³⁸ Pu, ²³⁸ U, ^{239/240} Pu, ²⁴¹ Am, gross alpha, gross beta | 23 | 23 |

- (a) Onsite laboratory operated by Fluor Hanford, Inc.
 (b) Mixed Analyte Performance Evaluation Program.

Table 8.18.10. The Hanford Site's 222-S Analytical Laboratory^(a) Performance on DOE Quality Assessment Program Samples, 2004

| <u>Medium</u> | <u>Radionuclide</u> | <u>Number of Results Reported</u> | <u>Number of Results Within Acceptable Limits</u> |
|---------------|---|-----------------------------------|---|
| Air filters | ⁶⁰ Co, ¹³⁴ Cs, ¹³⁷ Cs, gross alpha, gross beta | 5 | 5 |
| Soil | ¹³⁷ Cs, total uranium | 2 | 2 |
| Vegetation | ¹³⁷ Cs | 1 | 1 |
| Water | ³ H, ⁶⁰ Co, ⁹⁰ Sr, ¹³⁷ Cs, ²³⁸ Pu, ^{239/240} Pu, gross alpha, gross beta, total uranium | 9 | 9 |

- (a) Onsite high-level radiological laboratory operated by CH2M HILL Hanford Group, Inc. (Note: These samples are low-level environmental activity samples.)

Table 8.18.11. The Hanford Site's 222-S Analytical Laboratory^(a) Performance on EPA Laboratory Water Pollution Inorganic and Organic Studies, 2004

| <u>Laboratory</u> | Water Pollution Study 111 June 2004 | Water Pollution Study 117 December 2004 |
|-----------------------------|--|--|
| | <u>% Acceptable</u> | <u>% Acceptable</u> |
| 222-S Analytical Laboratory | 99 ^(b) | 99 ^(c) |

- (a) Onsite high-level radiological laboratory operated by CH2M HILL Hanford Group, Inc.
 (b) Of 163 analytes, 161 were evaluated as acceptable.
 (c) Of 170 analytes, 169 were evaluated as acceptable.