8.0 Quality Assurance

E. A. Lepel, L. P. Diediker, and D. L. Dyekman

Quality assurance and quality control practices encompassed all aspects of Hanford Site environmental monitoring and surveillance programs. This section discusses specific measures taken 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/quality control for the Hanford Site environmental monitoring and surveillance programs also include procedures and protocols to perform the following tasks:

- Document instrument calibrations.
- Conduct program-specific activities in the field.
- Maintain groundwater wells to assure representative samples were collected.
- Avoid cross-contamination by using dedicated well sampling pumps.

8.0.1 Environmental Surveillance and Groundwater Monitoring

During 2003, comprehensive quality assurance programs, including various quality control practices, were maintained to assure the quality of data collected through the Surface Environmental Surveillance Project and the Groundwater Performance Assessment Project. Quality assurance plans were maintained for all program activities and defined the appropriate controls and documentation required by the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE) for the project-specific requirements.

8.0.1.1 Project Management Quality Assurance

Site environmental surveillance, groundwater monitoring, and related programs such as processing of thermoluminescent dosimeters and performing dose calculations were subject to an overall quality assurance program. This program implemented the requirements of U.S. Department of Energy (DOE) Order 414.1B. Quality assurance plans are maintained by the site surveillance and groundwater monitoring projects; 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 analysis, 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 project are approved and awarded.

8.0.1.2 Sample Collection Quality Assurance/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 8.0.1). Eighty-three percent of the field replicate results with the result greater than the minimum detectable activity for 2003 were acceptable. The results were acceptable if the relative percent difference was less than 30% for the sample and duplicate, as specified in the analytical services contract.

Table 8.0.1. Summary of Field Replicate Results for the Surface Environmental Surveillance Project at Hanford, 2003

Medium	Radionuclides	Number of Results Reported for Each Radionuclide	Number Within Control Limits for Each Radionuclide[a]
Water	Gross alpha	1	0
	Gross beta	1	0
	^{7}Be, ^{40}K, ^{60}Co, ^{106}Ru, ^{125}Sb, ^{134}Cs, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu	1	0
	^{90}Sr	2	2
	^{3}H	4	4
	^{234}U, ^{238}U	3	3
	^{235}U	3	0
Soil	Total organic carbon	1	1
Biota	^{7}Be, ^{60}Co, ^{90}Sr, ^{106}Ru, ^{125}Sb, ^{134}Cs, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{155}Eu	4	0
	^{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

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

Samples for the Groundwater Performance Assessment Project were collected by trained staff according to approved and documented procedures (PNNL-14548, Appendix D). Chain-of-custody procedures were followed (EPA 1986). Samples representing full trip blanks and field duplicates were obtained during field operations. Summaries of the 2003 groundwater field quality control sample results are provided in Appendix D of PNNL-14548. The percentage of acceptable field blank and duplicate results during fiscal year 2003 was 96% for field blanks and 98% 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. This indicates that there was not a contamination problem found with the sample. For field duplicates, 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.

8.0.1.3 Analytical Results Quality Assurance/Quality Control

Routine chemical analyses of water samples were performed under contract primarily by Severn Trent Laboratories, Inc., St. Louis, Missouri, for environmental surveillance and groundwater monitoring. Some routine analyses of hazardous and non-hazardous chemicals for the *Comprehensive Environmental Response, Compensation, and Liability Act* (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 *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, Third Edition* (EPA 1986); each program was audited and reviewed internally by Pacific Northwest National Laboratory. Pacific Northwest National Laboratory submitted additional quality control double-blind spiked samples for analysis.

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

Routine radiochemical analyses of samples for the Surface Environmental Surveillance and Groundwater Performance Assessment Projects were performed primarily by Severn Trent Laboratories, Inc., Richland, Washington. Severn Trent Laboratories, Inc., Richland, participated in the 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 by Pacific Northwest National Laboratory. Additional information on these quality control efforts is provided in the following sections.

8.0.1.4 DOE and EPA Comparison Studies

Standard water samples were distributed blind (activities and concentrations unknown to the analytical laboratory) 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 2003 groundwater samples are provided in PNNL-14548, Appendix D, for the primary laboratory, Severn Trent Laboratories, Inc., St. Louis.

The DOE Quality Assessment Program and Environmental Resource Associates' Proficiency Testing Program provided standard samples of environmental media (e.g., water, air filters, soil, 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 2003 results are provided in Tables 8.0.2 and 8.0.3. Ninety-three percent of the DOE quality assessment sample results fell within the acceptable control limits as defined by the DOE Quality Assessment Program. Ninety-eight percent of the Environmental Resource Associates samples fell within the acceptable control limit range as defined by the *National Standards for Water Proficiency Testing Studies, Criteria Document* (NERL-Ci-0045).

8.0.1.5 Pacific Northwest National Laboratory Evaluations

In addition to the DOE and EPA interlaboratory quality control programs, Pacific Northwest National Laboratory 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 2003, 295 blind spiked samples were submitted for the Groundwater Performance Assessment Project (PNNL-14548, Appendix D) and 7 samples were submitted for the Surface Environmental Surveillance Project. The samples included air filters, soil, surface water, and vegetation (Table 8.0.4). The results of all water sample non-radiochemistry blind spiked determinations are discussed in Appendix D of PNNL-14548 and indicated an acceptable performance by the laboratory.

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

For all media, 87% of Severn Trent Laboratories, Inc., Richland, radiochemistry blind spiked determinations were within the control limits (±30% of the known value), which indicated acceptable results. Four results for cobalt-60 determined by gamma spectroscopy were outside the acceptable range – one measurement in soil, one in water, and two in vegetation. The fifth result was the measurement of plutonium-238 in soil.

Table 8.0.2. Summary of Laboratory Performance on DOE Quality Assessment Program Samples for the Surface Environmental Surveillance Project at Hanford, 2003

Medium	Radionuclides	Number of Results Reported for Each Radionuclide	Number of Results Within Acceptable Control Limits for Each Radionuclide[a]
Severn Trent Laboratories, Richland, Washington			
Air filter particulate	Gross alpha, gross beta, ^{54}Mn, ^{60}Co, ^{137}Cs, ^{234}U, ^{238}U, ^{238}Pu, ^{239}Pu, ^{241}Am	2	2
	Total uranium	2	1
	^{90}Sr	2	0
Soil	^{40}K, ^{90}Sr, ^{137}Cs, ^{212}Pb, ^{214}Bi, ^{214}Pb, ^{228}Ac, ^{234}Th, ^{234}U, ^{238}U, ^{239}Pu, ^{241}Am, total uranium	2	2
	^{212}Bi	2	1
	^{238}Pu	1	1
Vegetation	^{40}K, ^{60}Co, ^{137}Cs, ^{241}Am, ^{244}Cm	2	2
	^{239}Pu	1	0
Water	^{3}H, ^{60}Co, ^{134}Cs, ^{137}Cs, ^{234}U, ^{238}U, ^{238}Pu, ^{239}Pu, ^{241}Am, total uranium	2	2
	Gross alpha, gross beta	1	1
	^{90}Sr	2	1

(a) Control limits are from EML-621.

Table 8.0.3. Summary of Laboratory Performance on Hanford Site Surface Environmental Surveillance Project Samples by the Environmental Resource Associates Proficiency Testing Program, 2003

Medium	Radionuclides	Number of Results Reported for Each Radionuclide	Number Within Control Limits for Each Radionuclide[a]
Severn Trent Laboratories, Richland, Washington			
Water	Gross alpha, gross beta	5	5
	^{60}Co, ^{89}Sr, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{226}Ra, ^{228}Ra, total uranium	4	4
	^{89}Sr, ^{90}Sr,	3	3
	^{3}H, ^{65}Zn, ^{133}Ba	2	2
	^{131}I	2	1

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

Table 8.0.4. Summary of Hanford Site Surface Environmental Surveillance Project Blind Spiked Determinations, 2003

Medium	Radionuclides	Number of Results Reported for Each Radionuclide	Number of Results Within Control Limits for Each Radionuclide[a]
Severn Trent Laboratories, Richland, Washington			
Air Filters	^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{238}Pu, $^{239/240}$Pu	2	2
	^{125}Sb, ^{238}U	1	1
Soil	^{40}K, ^{137}Cs, ^{238}U, $^{239/240}$Pu	2	2
	^{90}Sr 2	1	
	^{234}U	1	1
	^{60}Co, ^{238}Pu	1	0
Vegetation	^{40}K, ^{137}Cs, $^{239/240}$Pu	2	2
	^{90}Sr 1	1	
	^{60}Co	2	0
Surface Water	^{3}H, ^{137}Cs, ^{238}Pu, $^{239/240}$Pu	2	2
	^{234}U, ^{238}U	1	1
	^{60}Co	2	1

(a) Control limit of ±30%.

8.0.1.6 Quality Assurance Task Force Results

Pacific Northwest National Laboratory also participated in the Quality Assurance Task Force, a program coordinated by the Washington State Department of Health. Public and private organizations from Idaho, Oregon, and Washington participated in analyzing intercomparison samples in 1999, 2000, 2001, and 2002. The final intercomparison report for the soil samples from the Hanford Site has not been published yet. Results for uranium-234, uranium-235, uranium-238, and total uranium were determined for three aliquots and reported in PNNL-14295.

8.0.1.7 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 *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, Third Edition* (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. Method detection levels were determined at least annually for each analytical method.

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

Periodically, inspections of services were performed that documented conformance with the contractual requirements of the analytical facility and 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 2003, an audit of the commercial laboratories supporting the Groundwater Performance Assessment Project was performed by the DOE-sponsored Environmental Management Consolidated Assessment Program and a joint team from Bechtel Hanford, Inc. and Pacific Northwest National Laboratory representatives. The Environmental Management Consolidated Assessment Program evaluated Severn Trent Laboratories, Inc., St. Louis, on May 20 to 22, 2003, Lionville Laboratory on June 24 to 26, 2003, and Severn Trent Laboratories, Inc., Richland, on August 12 to 14, 2003. The scope of the Environmental Management 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 March 18 to 20, 2003, 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 the implementation of corrective actions for deficiencies identified in previous audits.

A total of 16 findings and 27 observations were noted for the three Environmental Management Consolidated Assessment Program audits, and 7 findings and 6 observations were identified in the joint Bechtel Hanford, Inc. and Pacific Northwest National Laboratory audit. Results of these audits are summarized in Appendix D of PNNL-14548. Corrective actions have been 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.

The Surface Environmental Surveillance Project staff visited Severn Trent Laboratories, Inc., Richland, on June 19 and 20, 2003. The scope of the surveillance was to review (1) low-level tritium analysis, (2) uranium analysis, (3) air filter handling, compositing, and storage, (4) identification and control of items, and (5) observe a Surface Environmental Surveillance Project sample in progress. There were no findings or observations noted during the surveillance.

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 2003 (for the Surface Environmental Surveillance Project) and fiscal year 2003 (for the Groundwater Performance Assessment Project).

8.0.1.8 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 2003. Media that were co-sampled and analyzed for radionuclides included irrigation water, water from 24 locations along and across the Columbia River, water from 12 riverbank springs, water from 2 onsite drinking water locations, and sediment from 25 Columbia River sites from upriver at Priest Rapids Dam downriver to the John Day Dam. Also co-sampled and

analyzed for radionuclides were upwind and downwind samples of whitefish, Canada geese, cottontail rabbits, potato tubers, apples, asparagus, alfalfa, and red and white wines.

The U.S. Food and Drug Administration (FDA) also received co-samples from upwind and downwind sampling locations and analyzed apples, leafy vegetables, potato tubers, and alfalfa for radionuclides (Table 8.0.5). Alfalfa samples from Sunnyside and Riverview had positive results for strontium-90 as reported by the FDA. Duplicate samples from each site did not show positive results. The strontium-90 result from Sunnyside as measured by Pacific Northwest National Laboratory showed agreement with the FDA result. The strontium-90 result from Riverview determined by Pacific Northwest National Laboratory was positive but was not in agreement with the reported value from the FDA.

Quality control for environmental thermoluminescent dosimeters included the audit exposure of three environmental thermoluminescent dosimeters per quarter to known values of radiation (between 17 and 30 mR). For the 12 measurements, the lowest ratio of determined/known exposure was 0.99; the highest determined/known exposure ratio was 1.12, with an average of 1.06 ± 0.03 (Table 8.0.6).

8.0.2 Effluent Monitoring and Near-Facility Environmental Monitoring

The Effluent Monitoring and Near-Facility Environmental Monitoring Programs were subject to the quality assurance requirements specified in the *Hanford Analytical Services*

Table 8.0.5. Comparison of Co-Sampling Results for Samples Collected Near the Hanford Site, 2003[a]

Medium	Sampling Area	Organization[b]	Strontium-90, pCi/g[c,d]	Cesium-137, pCi/g[c,d]	Ruthenium-106, pCi/g[c,d]	Iodine-131 pCi/g[c,d]	Tritium pCi/g[c,d]
Leafy vegetables	Sunnyside	FDA	<0.002	<0.03	<0.1	<0.03	<200
(stem-leaf)		FDA	0.0011 ± 0.0008	<0.03	<0.1	<0.03	<200
		PNNL	0.038 ± 0.0068	0.0025 ± 0.0055	0.014 ± 0.047	NA[e]	NA
Alfalfa	Sunnyside	FDA	0.0024 ± 0.0014	<0.03	<0.1	<0.03	<200
		FDA	0.0057 ± 0.0016	<0.03	<0.1	<0.03	<200
		PNNL	0.064 ± 0.027	0.007 ± 0.012	-0.041 ± 0.1	NA	NA
Alfalfa	Riverview	FDA	0.0038 ± 0.0016	<0.03	<0.1	<0.03	<200
		FDA	<0.002	<0.03	<0.1	<0.03	<200
		PNNL	0.098 ± 0.027	0.002 ± 0.01	-0.062 ± 0.082	NA	NA
Potato tuber	Sagemoor	FDA	<0.002	<0.03	<0.1	<0.03	<200
		FDA	0.0017 ± 0.0006	<0.03	<0.1	<0.03	<200
		PNNL	0.0026 ± 0.0043	0.0014 ± 0.0044	-0.0082 ± 0.039	NA	NA
Potato tuber	Sunnyside	FDA	<0.002	<0.03	<0.1	<0.03	<200
		FDA	<0.002	<0.03	<0.1	<0.03	<200
		PNNL	0.0094 ± 0.0051	0.0018 ± 0.0041	0.0097 ± 0.036	NA	NA
Apples	Sagemoor	FDA	0.0012 ± 0.0006	<0.03	<0.1	<0.03	<200
		FDA	<0.002	<0.03	<0.1	<0.03	<200
		PNNL	-0.0008 ± 0.0016	0.0040 ± 0.0043	-0.031 ± 0.039	NA	NA
Apples	Riverview	FDA	<0.002	<0.03	<0.1	<0.03	<200
		FDA	<0.002	<0.03	<0.1	<0.03	<200
		PNNL	-0.0012 ± 0.0016	0.0051 ± 0.0055	0.028 ± 0.048	NA	NA

(a) Sample results are wet weight.
(b) FDA = U.S. Food and Drug Administration; PNNL = Pacific Northwest National Laboratory.
(c) To convert pCi/g to Bq/g, multiply by 0.037.
(d) Errors reported are 2 standard deviations. Less than (<) values are minimum detectable activities at 3 standard deviations.
(e) NA = Not analyzed; not specifically requested by contract unless present.

Table 8.0.6. Comparison of Pacific Northwest National Laboratory Thermoluminescent Dosimeter Results with Known Exposure, 2003

Quarter	Exposure Date	Known Exposure[a] milliroentgen (mR)	Determined Exposure milliroentgen (mR)	Ratio of Determined/ Known Exposure
1st	February 20, 2003	22 ± 0.82	23.18 ± 0.35	1.05
		17 ± 0.63	18.57 ± 0.89	1.09
		30 ± 1.1	31.4 ± 0.83	1.05
2nd	May 19, 2003	21 ± 0.78	22.17 ± 0.68	1.06
		26 ± 0.97	28.27 ± 0.44	1.09
		18 ± 0.67	17.78 ± 0.25	0.99
3rd	August 14, 2003	29 ± 1.1	30.38 ± 1.01	1.05
		19 ± 0.71	21.31 ± 0.54	1.12
		25 ± 0.93	26.3 ± 0.11	1.05
4th	November 13, 2003	20 ± 0.74	21.06 ± 0.90	1.05
		28 ± 1.0	29.32 ± 1.42	1.05
		24 ± 0.89	24.5 ± 1.02	1.02

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

Quality Assurance Requirements Document (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 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 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.

8.0.2.1 Sample Collection Quality Assurance

Samples for the Effluent Monitoring and Near-Facility Environmental Monitoring Programs were collected by staff trained for the task 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.

8.0.2.2 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 contract(s) established between the contractor and the analytical laboratory(s). Table 8.0.7 provides a summary of the Hanford Site's analytical laboratories used for processing effluent monitoring and near-facility monitoring samples in 2003.

The quality of the analytical data was assured by several means. Counting room instruments, for instance, 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 laboratory qualified to perform analyses through formal classroom and on-the-job training.

The participation of the Hanford Site analytical laboratories in the EPA and DOE laboratory performance evaluation programs also served to assure the quality of the data

Table 8.0.7. Hanford Site Laboratories Used by Site Contractors and Types of Effluent Monitoring and Near-Facility Monitoring Samples Analyzed, 2003

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	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 (transitioned from Fluor Hanford, Inc. on October 1, 2003).
(c) Operated by Pacific Northwest National Laboratory.

produced. The Waste Sampling and Characterization Facility performance was evaluated in four different laboratory performance studies for 2003. In the EPA Water Pollution Studies #96 and #102 and Soil Studies #43 and #45, 317 different analytes and compounds were submitted to the Waste Sampling and Characterization Facility for analysis. Of the 317 reported analytes, 311 results were acceptable while 6 were unacceptable for a total acceptable rate of 98%. In the DOE Mixed Analyte Performance Evaluation Program studies (MAPEP-02-W10 and MAPEP-03-S10), 84 different radionuclides and analytes were submitted to the Waste Sampling and Characterization Facility for analysis. Of the 84 reported radionuclide analytes, 80 results were acceptable while 4 were unacceptable for a total acceptable rate of 95%. In the National Institute of Standards and Technology Radiochemistry Intercomparison Program study, 8 different radionuclides were submitted to the Waste Sampling Characterization Facility for 40 different analyses. All radionuclide results were acceptable for a total acceptable rate of 100%.

In the DOE Quality Assessment Program, 67 different radionuclides were submitted to the Waste Sampling Characterization Facility for analysis and 61 different radionuclides were submitted to the 222-S Analytical Laboratory. Of the 67 reported radionuclides for the Waste Sampling Characterization Facility, 65 results were acceptable while 2 were unacceptable for a total acceptable rate of 97%. Of the 61 reported radionuclides for the 222-S Analytical Laboratory, 55 results were acceptable while 6 were unacceptable for a total acceptable rate of 90%. Performance results for the DOE Quality Assessment Program and others are presented in Tables 8.0.8 through 8.0.10.

Table 8.0.8. The Hanford Site's Waste Sampling and Characterization Facility[a] Performance on DOE Quality Assessment Program Samples, 2003

Medium		Number of Results Report for Each Radionuclide	Number of Results Within Control Limits for Each Radionuclide
Air filters	^{54}Mn, ^{60}Co, ^{90}Sr, ^{137}Cs, ^{234}U, ^{238}Pu, ^{238}U, ^{239}Pu, ^{241}Am, gross alpha, gross beta	22	22
Soil	^{40}K, ^{90}Sr, ^{137}Cs, ^{234}U, ^{238}U, ^{239}Pu, ^{241}Am	14	13 (^{90}Sr failed once)
Vegetation	^{40}K, ^{60}Co, ^{90}Sr, ^{137}Cs, ^{239}Pu, ^{241}Am, ^{244}Cm	7	7
Water	^{3}H, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{234}U, ^{238}Pu, ^{238}U, ^{239}Pu, ^{241}Am, gross alpha, gross beta	24	23 (^{90}Sr failed once)

(a) Onsite laboratory operated by Fluor Hanford, Inc.

Table 8.0.9. The Hanford Site's 222-S Analytical Laboratory[a] Performance on DOE Quality Assessment Program Samples, 2003

Medium	Radionuclide	Number of Results Reported for Each Radionuclide	Number of Results Within Acceptable Limits for Each Radionuclide
Air filters	^{54}Mn, ^{60}Co, ^{90}Sr, ^{137}Cs, ^{238}Pu, ^{239}Pu, ^{241}Am, gross alpha, gross beta	18	17
Soil	^{90}Sr, ^{137}Cs, ^{212}Pb, ^{214}Bi, ^{214}Pb, ^{228}Ac, ^{238}Pu, ^{239}Pu, total uranium	11	11
Vegetation	^{60}Co, ^{90}Sr, ^{137}Cs	10	7
Water	^{3}H, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{238}Pu, ^{239}Pu, ^{241}Am, gross alpha, gross beta, total uranium	22	20

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

Table 8.0.10. The Hanford Site's 222-S Analytical Laboratory[a] Performance on EPA Laboratory Water Pollution Inorganic and Organic Studies, 2003

Laboratory	Water Pollution Study (WP-99) June 2003 % Acceptable	Water Pollution Study (WP-105) December 2003 % Acceptable
222-S Analytical Laboratory	96[b]	99[c]

(a) Onsite "high-level" radiological laboratory operated by CH2M HILL Hanford, Inc.
(b) Of 103 analytes, 99 were evaluated as acceptable.
(c) Of 166 analytes, 165 were evaluated as acceptable.

8.0.3 References

ASME-NQA-1-1997. 1997. *Quality Assurance Requirements for Nuclear Facility Applications*. American Society of Mechanical Engineers, New York.

Comprehensive Environmental Response, Compensation, and Liability Act. 1980. Public Law 96-150, as amended, 94 Stat. 2767, 42 USC 9601 et seq.

DOE Order 414.1B. "Quality Assurance."

DOE/RL-91-50, Rev. 3. 2000. *Environmental Monitoring Plan, United States Department of Energy Richland Operations Office*. U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-96-68. 1996. *Hanford Analytical Services Quality Assurance Requirements Document*. U.S. Department of Energy, Richland Operations Office, Richland, Washington.

EML-621. June 2003. *Semi-Annual Report of the Department of Energy, Office of Environmental Management, Quality Assessment Program*. PD Greenlaw and A Berne, Environmental Measurements Laboratory, U.S. Department of Energy, New York.

EPA. 1986. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, Third Edition*. Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA 520/1-80-012. 1980. *Upgrading Environmental Radiation Data: Health Physics Society Committee Report HPSR-1 (1980)*. U.S. Environmental Protection Agency, Washington, D.C.

EPA QA/R-5. 1994. *Requirements for Quality Assurance Project Plans for Environmental Data Operations*. U.S. Environmental Protection Agency, Washington, D.C.

MAPEP-02-W10. 2003. *Water Sample MAPEP-02-W10 Performance Report*. U.S. Department of Energy, Mixed Analyte Performance Evaluation Program, Radiological and Environmental Sciences Laboratory, Idaho Falls, Idaho.

MAPEP-03-S10. 2003. *Soil Sample MAPEP-03-S10 Performance Report*. U.S. Department of Energy, Mixed Analyte Performance Evaluation Program, Radiological and Environmental Sciences Laboratory, Idaho Falls, Idaho.

NERL-Ci-0045. December 30, 1998. *National Standards for Water Proficiency Testing Studies, Criteria Document*. U.S. Environmental Protection Agency, Washington, D.C.

PNL-MA-580, Rev. 4. 2004. *Surface Environmental Surveillance Procedures Manual*. RW Hanf and TM Poston (eds.), Pacific Northwest National Laboratory, Richland, Washington.

PNNL-14295. 2003. *Hanford Site Environmental Report for Calendar Year 2002*. TM Poston, RW Hanf, RL Dirkes, and LF Morasch (eds.), Pacific Northwest National Laboratory, Richland, Washington.

PNNL-14548. 2004. *Hanford Site Groundwater Monitoring for Fiscal Year 2003*. MJ Hartman, LF Morasch, and WD Webber (eds.), Pacific Northwest National Laboratory, Richland, Washington.