8.0 Quality Assurance

B. M. Gillespie and B. P. Gleckler

Quality assurance and quality control practices encompass all aspects of Hanford Site environmental monitoring and surveillance programs. Samples are collected and analyzed according to documented standard analytical procedures. Analytical data quality is 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 monitoring program also includes procedures and protocols for 1) documenting instrument calibrations, 2) conducting program-specific activities in the field, 3) maintaining wells to ensure representative samples are collected, and 4) using dedicated well sampling pumps to avoid crosscontamination.

This section discusses specific measures taken to ensure quality in project management, sample collection, and analytical results.

8.0.1 Environmental Surveillance and Groundwater Monitoring

Comprehensive quality assurance programs, including various quality control practices, are maintained to ensure the quality of data collected through the environmental surveillance and groundwater monitoring programs. Quality assurance plans are maintained for all program activities and define the appropriate controls and documentation required by the U.S. Environmental Protection Agency (EPA) and/or 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 are subject to an overall quality assurance program. This program implements the requirements of DOE Order 5700.6C.

The groundwater monitoring and site surveillance projects have current quality assurance plans that describe the specific quality assurance elements that apply to each project. These plans are approved by a quality assurance organization that conducts surveillances and audits to verify compliance with the plans. Work performed through contracts such as sample analysis must meet the same quality assurance requirements. Potential equipment and services 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

Environmental surveillance samples are collected by staff trained to conduct sampling according to approved and documented procedures (PNL-MA-580, Rev. 2). Continuity of all sampling location identities is maintained through careful documentation. Field duplicates are collected for specific media, and results are addressed in the individual media sections (Section 3.0, “Facility-Related Monitoring,” and Section 4.0, “Environmental Surveillance Information”).

Samples for the groundwater monitoring program are collected by trained staff according to approved and

documented procedures (WHC-CM-7-7). Chain-of-custody procedures are followed (SW-846) that provide for the use of evidence tape in sealing sample bottles to maintain the integrity of the samples during shipping. Full trip blanks and field duplicates are obtained during field operations. Summaries of the 1997 groundwater field quality control sample results are provided in Appendix D of PNNL-11793. The percentages of acceptable field blank and duplicate results in fiscal year 1997 were very high, 88% for blanks and 99% for field duplicates.

8.0.1.3 Analytical Results Quality Assurance/Quality Control

Routine hazardous and nonhazardous chemical analyses for environmental and groundwater surveillance and monitoring water samples are performed primarily by the Quanterra Laboratory, St. Louis, Missouri. Some routine analyses of hazardous and nonhazardous chemicals for the Comprehensive Environmental Response, Compensation, and Liability Act groundwater program were also performed by Recra Labnet, Exton, Pennsylvania and/or LAS, Las Vegas, Nevada. Each laboratory participates in the EPA Water Pollution and Water Supply Performance Evaluation Studies. Each laboratory maintains an internal quality control program that meets the requirements in SW-846 which is audited and reviewed internally and by Pacific Northwest National Laboratory. Pacific Northwest National Laboratory submits additional quality control double-blind spiked samples for analysis.

Routine radiochemical analyses for environmental surveillance and groundwater monitoring samples are performed primarily by Quanterra's Richland, Washington laboratory. Data from LAS, Las Vegas, Nevada and Thermo NUtech, Richmond, California were also used in the 1997 groundwater evaluations. Each laboratory participates in DOE's Quality Assessment Program, Environmental Measurements Laboratory, New York, and EPA's Laboratory Intercomparison Studies at the National Exposure Research Laboratory, Characterization Research Division, Las Vegas, Nevada. An additional quality control blind spiked sample program is conducted for each project. Each laboratory also maintains an internal quality control program, which is audited and reviewed internally and 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 are distributed blind to participating laboratories. These samples contain specific organic and inorganic analytes with concentrations unknown to the analyzing laboratories. After analysis, the results are submitted to the EPA for comparison with known values and other participating laboratory concentrations. Summaries of the results for 1997 are provided in Table 8.0.1 for the primary laboratory, Quanterra, St. Louis, Missouri. The percentage of EPA-acceptable results is high for the laboratory, indicating acceptable performance.

The DOE Quality Assessment Program and EPA's Laboratory Intercomparison Studies provided standard samples of environmental media (e.g., water, air filters, soil, and vegetation) containing specific amounts of one or more radionuclides that were unknown by the participating

Table 8.0.1. Summary of Laboratory Performance on EPA Water Pollution and Water Supply Studies, 1997

Laboratory	Water Supply Study March 1997 % Acceptable	Water Pollution Study May 1997 % Acceptable	Water Supply Study September 1997 % Acceptable	Water Pollution Study November 1997 % Acceptable
Quanterra Laboratory, St. Louis, Missouri	89[a]	96[b]	95[c]	81[d]

(a) Unacceptable results were for 2,2-dichloropropane, molybdenum, orthophosphate, residual free chlorine, sulfate, 1,2,3-trichlorobenzene, and 1,2,3-trichloropropane.
(b) Unacceptable results were for arsenic, oil and grease, and orthophosphate.
(c) Unacceptable results were for 1,1-dichloroethylene, trans-1,2-dichloroethylene, and turbidity.
(d) Unacceptable results were for magnesium, total alkalinity (as $CaCO_3$), orthophosphate, Kjeldahl-nitrogen, nonfilterable residue. Possible errors in reporting of silver, titanium, carbonaceous biological oxygen demand, heptachlor epoxide, benzene, and toluene.

laboratory. After analysis, the results are forwarded to DOE or EPA for comparison with known values and results from other laboratories. Both DOE and EPA have established criteria for evaluating the accuracy of results (EPA-600/4-81-004, EML-591, EML-594). Summaries of the 1997 results for the programs are provided in Tables 8.0.2 and 8.0.3.

8.0.1.5 Pacific Northwest National Laboratory Evaluations

In addition to DOE and EPA interlaboratory quality control programs, a quality control program is maintained by Pacific Northwest National Laboratory to evaluate analytical contractor precision and accuracy and to conduct special intercomparisons. This program includes the use of blind spiked samples. Blind spiked quality control samples and blanks were prepared and submitted to check the accuracy and precision of analyses at Quanterra. In 1997, blind spiked samples were submitted for air filters, vegetation, soil, water, and groundwater. Overall, 74% of nonradiochemistry blind spiked determinations were within control limits, and 86% of Quanterra's radiochemistry blind spiked determinations were within control limits (Tables 8.0.4 and 8.0.5). Overall, this indicates acceptable results.

The groundwater monitoring project also submitted blind spiked samples to Recra Labnet for evaluation during the year. The discussion and summary of data can be found in Appendix D of PNNL-11793.

Pacific Northwest National Laboratory also participates in a Quality Assurance Task Force, a program conducted by the Washington State Department of Health. Public and private organizations from Idaho, Oregon, and Washington participate in analyzing the intercomparison samples. However, no samples were designated by the Quality Assurance Task Force for analysis in 1997.

8.0.1.6 Laboratory Internal Quality Assurance Programs

The analyzing laboratories are required to maintain an internal quality assurance and control program. Periodically, the laboratories are internally audited for compliance to the quality assurance and control programs. At Quanterra St. Louis, the quality control programs meet the quality assurance and control criteria in SW-846. The laboratories are also required to maintain a system for reviewing and analyzing the results of the quality control samples to detect problems that may arise from contamination, inadequate calibrations, calculation errors, or improper procedure performance. Method detection levels are determined at least annually for each analytical method.

The internal quality control program at Quanterra Richland involves 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 are used for radiochemical calibrations. Calculation of minimum detectable concentrations involves 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/005/80).

Periodically, inspections of services are performed, which document conformance with contractual requirements of the analytical facility and provide the framework for identifying and resolving potential performance problems. Responses to assessment and inspection findings are documented by written communication, and corrective actions are verified by follow-up audits and inspections. An assessment of Quanterra St. Louis was conducted in 1997 by the Hanford Site's Integrated Contractor Assessment Team, consisting of representatives from Bechtel Hanford, Inc., Pacific Northwest National Laboratory, and Waste Management Federal Services of Hanford, Inc. An inspection of services was also performed at Quanterra Richland in 1997. The purpose of the assessment and inspection of services was to evaluate the continued capability of the laboratories to analyze and process samples for the Hanford Site as specified in the statement of work between the DOE contractors and the laboratories.

Internal laboratory quality control program data are summarized by the laboratories monthly or in quarterly reports. The results of the quality control sample summary reports and the observations noted by each laboratory indicated an acceptably functioning internal quality control program.

8.0.1.7 Media Audits and Comparisons

Additional audits and comparisons are conducted on several specific types of samples. The Washington State

Table 8.0.2. Summary of Laboratory Performance on DOE Quality Assessment Program Samples, 1997

Medium	Radionuclides	Number of Results Reported for Each Analyte	Number Within Acceptable Control Limits[a]
Quanterra Environmental Services, Richland, Washington			
Air filter particulate	^{54}Mn, ^{57}Co, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{144}Ce, ^{234}U, ^{238}Pu, ^{238}U, ^{239}Pu, ^{241}Am, gross alpha, gross beta, U total	2	2
	^{125}Sb	2	1
Soil	^{40}K, ^{60}Co, ^{90}Sr, ^{137}Cs, ^{234}U, ^{238}Pu, ^{238}U, ^{239}Pu, ^{241}Am, ^{244}Cm, U total	2	2
Vegetation	^{40}K, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{239}Pu, ^{241}Am, ^{244}Cm	2	2
Water	^{3}H, ^{90}Sr, ^{137}Cs, ^{234}U, ^{238}Pu, ^{238}U, ^{239}Pu, ^{241}Am, gross alpha, gross beta, U total	2	2
	^{60}Co, ^{54}Mn	2	1
	^{134}Cs	1	1
LAS, Las Vegas, Nevada			
Water	^{3}H, ^{54}Mn, ^{60}Co, ^{90}Sr, ^{137}Cs, ^{238}Pu, ^{238}U, ^{239}Pu, ^{241}Am, gross alpha, gross beta, U total	2	2
	^{234}U	2	1
	^{134}Cs	1	1
Thermo NUtech, Richmond, California			
Water	^{3}H, ^{54}Mn, ^{60}Co, ^{90}Sr, ^{137}Cs, ^{238}Pu, ^{238}U, ^{239}Pu, ^{241}Am, gross alpha, gross beta, U total	2	2
	U total	2	1
	^{134}Cs	1	1

(a) Control limits are from EML-591 and EML-594.

Table 8.0.3. Summary of Laboratory Performance on EPA Intercomparison Program Samples, 1997

Medium	Radionuclides	Number of Results Reported for Each Analyte	Number Within Control Limits for Each Analyte[a]
Quanterra Environmental Services, Richland, Washington			
Water	^{3}H, ^{65}Zn, ^{131}I, ^{133}Ba	2	2
	^{89}Sr, ^{90}Sr	4	4
	^{60}Co, ^{134}Cs, ^{137}Cs	4	3
	Gross alpha, gross beta, U total, ^{226}Ra, ^{228}Ra	5	5
LAS, Las Vegas, Nevada			
Water	^{131}I	1	1
	^{65}Zn, ^{133}Ba	2	2
	^{3}H	2	1
	^{60}Co, ^{89}Sr, ^{90}Sr, ^{137}Cs	4	4
	^{134}Cs	4	3
	Gross alpha, gross beta, U total, ^{228}Ra	5	5
	^{226}Ra	5	4
Thermo NUtech, Richmond, California			
Water	^{3}H, ^{65}Zn, ^{131}I, ^{133}Ba	2	2
	^{60}Co, ^{89}Sr, ^{90}Sr, ^{134}Cs, ^{137}Cs	4	4
	Gross alpha, gross beta, U total, ^{226}Ra, ^{228}Ra	5	5

(a) Control limits are from EPA-600/4-81-004.

Department of Health routinely cosampled various environmental media and measured external radiation levels at multiple locations during 1997. Media that were cosampled included groundwater from 23 wells, water from 4 Columbia River locations along the river, water from 3 riverbank springs, water from 2 onsite drinking water locations, sediment from 4 Columbia River sites, surface soil samples from 4 locations, samples from 3 air monitoring stations, and thermoluminescent dosimeters from 14 sites. Also cosampled were upwind and downwind samples of leafy vegetables, fruit, perennial vegetation, alfalfa, and wine. Results will be published in the Washington State Department of Health 1997 annual report.

The Food and Drug Administration also cosampled fruit, leafy vegetables, and potatoes from upwind and downwind sampling locations. The data are presented in Table 8.0.6.

Quality control for environmental thermoluminescent dosimeters includes the audit exposure of three environmental thermoluminescent dosimeters per quarter to known values of radiation (between 17 and 28 mR). A summary of 1997 results is shown in Table 8.0.7. On average, the thermoluminescent dosimeter measurements were biased 1% higher than the known values.

Table 8.0.4. Summary of Groundwater Monitoring Project Double-Blind Spike Determinations, 1997[a]

Constituent	Number of Results Reported[b,c]	Number Within Control Limits	Control Limits, %
Tritium	12	12	60 to 140
Cobalt-60	12	12	60 to 140
Strontium-90	12	12	60 to 140
Technetium-99	12	11	60 to 140
Iodine-129	6[d]	5	60 to 140
Cesium-137	12	12	60 to 140
Plutonium-239,240	12	10	60 to 140
U total	12	12	60 to 140
Chloroform	12	12	Determined each quarter
Carbon tetrachloride	12	12	Determined each quarter
Trichloroethene	12	12	Determined each quarter
Chromium	12	12	±20
Cyanide	12	5	±25
Fluoride	12	5	±25
Nitrate	12	12	±25
Total organic halides (spiked with 2,4,6-trichlorophenol)	7	2	±25
Total organic halides (spiked with chloroform, carbon tetrachloride, and trichloroethene)	7	2	±25
Total organic carbon (spiked with potassium phthalate)	6	3	±25
Gross alpha (spiked with ^{239}Pu)	6	4	±10
Gross beta (spiked with ^{90}Sr)	6	0	±10

(a) The Groundwater Monitoring Project reporting requirements are by fiscal year (October 1 through September 30).
(b) Blind samples were submitted in triplicate each quarter and compared to actual spike values.
(c) Total organic halides, total organic carbon, gross alpha, and gross beta samples were submitted in triplicate during the second and third quarters of fiscal year 1997 only.
(d) Twelve samples were forwarded to the laboratory during the year: 3 were not analyzed because of a laboratory error; 3 were not analyzed because sample volumes did not meet required detection limits.

Table 8.0.5. Summary of Surface Environmental Surveillance Project Blind Spiked Determinations, 1997

Medium	Radionuclides	Number of Results Reported	Number Within Control Limits[a]
Air filters	^{7}Be, ^{54}Mn, ^{57}Co, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{144}Ce, ^{238}Pu, ^{239}Pu	15	11
Soil	^{40}K, ^{90}Sr, ^{137}Cs, ^{234}U, ^{238}U, ^{238}Pu, ^{239}Pu	20	14[b]
Water	^{3}H, ^{54}Mn, ^{57}Co, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{144}Ce, ^{234}U, ^{238}U, ^{238}Pu, ^{239}Pu	25	22
Vegetation	^{40}K, ^{90}Sr, ^{137}Cs, ^{238}Pu, ^{239}Pu	15	15

(a) Control limit of ±30%.
(b) Uranium isotopic results were determined using a different preparation method than was used to determine the standard value.

Table 8.0.6. Comparison of Food and Drug Administration Cosampling, 1997

Medium	Area[a]	Organization	Potassium-40, pCi/g[b]	Strontium-90, pCi/g[b,c]	Cesium-137, pCi/g[c]	Ruthenium-106, pCi/g[c]
Apples	Riverview	FDA[d]	2.6 ± 0.9	NA[e]	<0.01	<0.01
		PNNL[f]	0.528 ± 0.289	<0.0018	<0.0098	<0.069
	Sagemoor	FDA	1.7 ± 0.9	NA	<0.01	<0.01
		PNNL	1.28 ± 0.323	<0.0021	<0.0087	<0.064
Leafy vegetables	Riverview	FDA	4.7 ± 1.1	NA	<0.01	<0.01
		PNNL	3.01 ± 0.465	0.034 ± 0.0083	<0.0081	<0.075
	Sunnyside	FDA	3.4 ± 0.9	NA	<0.01	<0.01
		PNNL	2.4 ± 0.41	<0.0042	<0.0089	<0.079
Potatoes	Horn Rapids	FDA	5.5 ± 0.8	NA	<0.01	<0.01
		PNNL	3.8 ± 0.48	<0.0050	<0.0066	<0.055
	Sagemoor	FDA	4.0 ± 0.8	NA	<0.01	<0.01
		PNNL	3.45 ± 0.47	0.0042 ± 0.0037	<0.0079	<0.059
	Sunnyside	FDA	4.4 ± 0.7	NA	<0.01	<0.01
		PNNL	3.44 ± 0.50	<0.0037	<0.0073	<0.073

(a) Locations are identified in Figure 4.4.1.
(b) ±2-sigma total propagated analytical uncertainty.
(c) < values are ±2-sigma total propagated analytical uncertainties.
(d) FDA = Food and Drug Administration.
(e) NA = Not analyzed.
(f) PNNL = Pacific Northwest National Laboratory.

Table 8.0.7. Comparison of Thermoluminescent Dosimeter Results with Known Exposure, 1997

Quarter/ Exposure		Known Exposure, mR[a]	Determined Exposure, mR[b]	Known Exposure, %
1st	February 7, 1997	17 ± 0.63	16.83 ± 0.15	99
	February 7, 1997	19 ± 0.70	18.87 ± 0.00	99
	February 7, 1997	26 ± 0.96	25.98 ± 1.09	100
2nd	May 13, 1997	19 ± 0.70	17.97 ± 0.57	95
	May 13, 1997	25 ± 0.93	24.04 ± 0.22	96
	May 13, 1997	28 ± 1.04	27.00 ± 1.13	96
3rd	August 14, 1997	18 ± 0.67	17.92 ± 0.91	100
	August 14, 1997	20 ± 0.74	20.82 ± 0.46	104
	August 14, 1997	27 ± 1.00	27.54 ± 0.57	102
4th	December 5, 1997	18 ± 0.67	17.83 ± 1.47	99
	December 5, 1997	21 ± 0.78	20.55 ± 1.13	98
	December 5, 1997	28 ± 1.04	27.65 ± 0.30	99

(a) ±2 sigma total propagated analytical uncertainty.
(b) ±2 times the standard deviation.

8.0.2 Effluent Monitoring and Near-Facility Environmental Monitoring

The site effluent monitoring and near-facility environmental monitoring programs are subject to the quality assurance requirements specified in the Hanford Analytical Services Quality Assurance Requirements Document (DOE/RL-96-68). These quality assurance programs comply with DOE Order 5700.6C, using standards from the American Society of Mechanical Engineers (ASME NQA-1-1989 Edition) as their basis. The programs also adhere to the guidelines and objectives in EPA/005/80 and EPA/540/G-87/003.

The effluent monitoring and near-facility environmental monitoring programs each have a quality assurance project plan describing applicable quality assurance elements. These plans are approved by contractor quality assurance groups, who conduct surveillances and audits to verify compliance with the plans. Work such as sample analysis performed through contracts must meet the requirements of these plans. Suppliers are audited before the contract selection is made for equipment and services that may significantly impact the quality of a project.

8.0.2.1 Sample Collection Quality Assurance

Effluent monitoring and near-facility environmental monitoring samples are collected by staff trained for the task in accordance with approved procedures. Established sampling locations are accurately identified and documented to ensure continuity of data for those sites. Effluent and near-facility environmental sampling locations for the Hanford Site are described in DOE/RL-91-50, Rev. 2.

8.0.2.2 Analytical Results Quality Assurance

Effluent monitoring and near-facility environmental monitoring samples are analyzed by four different analytical laboratories. The use of these laboratories is dependent on the Hanford contractor collecting the samples and contract(s) established between the contractor and the analytical laboratory(s). Table 8.0.8 provides a summary of Hanford's analytical laboratory utilization for effluent monitoring and near-facility monitoring samples grouped by contractor and sample media.

The quality of the analytical data is ensured by several means. Counting room instruments, for instance, are

Table 8.0.8. Laboratories Utilized by Contractor and Sample Type, 1997

Analytical Laboratory	Effluent Monitoring Samples					Near-Facility Environmental Monitoring Samples		
	Fluor Daniel Hanford, Inc.		Pacific Northwest National Laboratory	Bechtel Hanford, Inc.		Fluor Daniel 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[a]							X	X
Quanterra Environmental Services, Richland	X	X	X	X	X	X		
PNNL[b] Analytical Chemistry Laboratory	X	X	X					

(a) Onsite laboratory operated by Waste Management Federal Services of Hanford, Inc.
(b) Pacific Northwest National Laboratory.

kept within calibration limits through daily checks, the results of which are stored in computer databases. Radiochemical standards used in analyses are regularly measured and the results are reported and tracked. Formal, written laboratory procedures are used in analyzing samples. Analytical procedural control is ensured through administrative procedures. Chemical technologists at the laboratory qualify to perform analyses through formal classroom and on-the-job training.

The participation of the analytical laboratories in DOE and EPA laboratory intercomparison programs also serves to ensure the quality of the data produced. Laboratory intercomparison program results for 1997 can be found in Tables 8.0.9 through 8.0.14 for the Waste Sampling and Characterization Facility, the 222-S Analytical Laboratory, and the Pacific Northwest National Laboratory Analytical Chemistry Laboratory. Laboratory intercomparison results for Quanterra were previously provided in Tables 8.0.2 and 8.0.3. In 1996, the EPA intercomparison program deleted some of the analysis categories (e.g., air filters) from the program because of budget reductions.

Table 8.0.9. Waste Sampling and Characterization Facility[a] Performance on DOE Quality Assessment Program Samples, 1997

Medium	Radionuclide	Number of Results Reported	Number Within Control Limits	Number Outside Control Limits
Air filters	Gross alpha, gross beta, ^{54}Mn, ^{57}Co, ^{60}Co, ^{90}Sr, ^{106}Ru, ^{125}Sb, ^{134}Cs, ^{137}Cs, ^{144}Ce, ^{234}U, ^{238}U, ^{238}Pu, ^{239}Pu, ^{241}Am, U total	42	33	9[a]
Soil	^{40}K, ^{60}Co, ^{90}Sr, ^{137}Cs, ^{238}U, ^{239}Pu, ^{241}Am	18	18	0
Vegetation	^{40}K, ^{60}Co, ^{90}Sr, ^{137}Cs, ^{239}Pu, ^{241}Am, ^{244}Cm	17	17	0
Water	Gross alpha, gross beta, ^{3}H, ^{54}Mn, ^{60}Co, ^{90}Sr, ^{137}Cs, ^{234}U, ^{238}U, ^{238}Pu, ^{239}Pu, ^{241}Am, U total	36	36	0

(a) Onsite laboratory operated by Waste Management Federal Services of Hanford, Inc.
(b) One gross alpha, one ^{54}Mn, one ^{57}Co, one ^{60}Co, one ^{90}Sr, one ^{137}Cs, and three ^{125}Sb results were not within control limits.

Table 8.0.10. 222-S Analytical Laboratory[a] Performance on DOE Quality Assessment Program Samples, 1997

Medium	Radionuclide	Number of Results Reported	Number Within Control Limits	Number Outside Control Limits
Soil	^{40}K, ^{90}Sr, ^{137}Cs	8	8	0
Vegetation	^{40}K, ^{60}Co, ^{90}Sr, ^{137}Cs, ^{239}Pu, ^{241}Am, ^{244}Cm	15	13	2[b]
Water	^{3}H, ^{54}Mn, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{238}Pu, ^{239}Pu, ^{241}Am, U total	28	26	2[c]

(a) Onsite laboratory operated by Waste Management Federal Services of Hanford, Inc.
(b) One ^{137}Cs and one ^{241}Am result were not within control limits.
(c) One ^{134}Cs and one U total result were not within control limits.

Table 8.0.11. Pacific Northwest National Laboratory Analytical Chemistry Laboratory Performance on DOE Quality Assessment Program Samples, 1997

Medium	Radionuclide	Number of Results Reported	Number Within Control Limits	Number Outside Control Limits
Air filters	Gross alpha, gross beta, ^{54}Mn, ^{57}Co, ^{60}Co, ^{90}Sr, ^{106}Ru, ^{125}Sb, ^{134}Cs, ^{137}Cs, ^{144}Ce, ^{238}U, ^{238}Pu, ^{239}Pu,^{241}Am, U total	40	39	1[a]
Water	Gross alpha, gross beta, ^{3}H, ^{54}Mn, ^{55}Fe, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{238}U, ^{238}Pu,^{239}Pu, ^{241}Am, U total	33	32	1[b]

(a) One ^{125}Sb result was not within control limits.
(b) One ^{238}U result was not within control limits.

Table 8.0.12. Waste Sampling and Characterization Facility[a] Performance on EPA Intercomparison Program Samples, 1997

Category	Radionuclide	Number of Results Reported	Number Within Control Limits	Number Outside Control Limits
Gross alpha-beta in water	Gross alpha, gross beta	6	5	1[b]
Gamma in water	^{60}Co, ^{65}Zn, ^{134}Cs, ^{137}Cs, ^{133}Ba	10	10	0
Strontium in water	^{89}Sr, ^{90}Sr	2	2	0
Uranium-radium in water	Uranium (natural), ^{226}Ra, ^{228}Ra	9	9	0
Tritium in water	^{3}H	2	2	0
Blind A[c]	Gross alpha, uranium (natural), ^{226}Ra, ^{228}Ra	8	8	0
Blind B[d]	Gross beta, ^{60}Co, ^{89}Sr, ^{90}Sr, ^{134}Cs, ^{137}Cs	12	10	2[e]

(a) Onsite laboratory operated by Waste Management Federal Services of Hanford, Inc.
(b) One gross beta result was not within control limits.
(c) Blind A samples are liquid samples with unknown quantities of alpha emitters analyzed for gross alpha and each radionuclide component.
(d) Blind B samples are liquid samples with unknown quantities of beta emitters analyzed for gross beta and each radionuclide component.
(e) One ^{89}Sr result and one ^{90}Sr result were not within control limits.

Table 8.0.13. 222-S Analytical Laboratory[a] Performance on EPA Intercomparison Program Samples, 1997

Category	Radionuclide	Number of Results Reported	Number Within Control Limits	Number Outside Control Limits
Gamma in water	^{60}Co, ^{65}Zn, ^{134}Cs, ^{137}Cs, ^{133}Ba	10	10	0
Uranium-radium in water	Uranium (natural)	1	0	1
Tritium in water	^{3}H	2	0	2
Blind A[b]	Gross alpha, uranium (natural)	4	3	1[c]
Blind B[d]	Gross beta, ^{60}Co, ^{134}Cs, ^{137}Cs	8	7	1[e]

(a) Onsite laboratory operated by Waste Management Federal Services of Hanford, Inc.
(b) Blind A samples are liquid samples with unknown quantities of alpha emitters analyzed for gross alpha and each radionuclide component.
(c) One uranium (natural) result was not within control limits.
(d) Blind B samples are liquid samples with unknown quantities of beta emitters analyzed for gross beta and each radionuclide component.
(e) One gross beta result was not within control limits.

Table 8.0.14. Pacific Northwest National Laboratory Performance on EPA Intercomparison Program Samples, 1997

Category	Radionuclide	Number of Results Reported	Number Within Control Limits	Number Outside Control Limits
Uranium-radium in water	Uranium (natural), ^{226}Ra, ^{228}Ra	3	3	0
Tritium in water	^{3}H	1	1	0