7.0 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 analyzed according to documented standard analytical procedures. Analytical data quality is verified by a continuing program of internal laboratory quality control, participation in interlaboratory cross-checks, replicate sampling and analysis, submittal of blind standard samples and blanks, and splitting samples with other laboratories.

Quality assurance/quality control for ground-water environmental surveillance 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 sampling pumps to avoid cross-contamination.

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

Environmental Surveillance

Comprehensive quality assurance programs, including various quality control practices, are maintained to ensure the quality of data collected through the surveillance programs. Quality assurance plans are maintained for all surveillance activities, defining the appropriate controls and documentation required to meet the guidance of the American Society of Mechanical Engineers (ASME) NQA-1 quality assurance program document (U.S. nuclear industry's standard, ASME 1989) and DOE Orders.

Project Management Quality Assurance

Site surveillance 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 Richland Operations Office Order DOE 5700.6C, "Quality Assurance," and is based on ASME NQA-1, *Quality Assurance Program Requirements for Nuclear Facilities* (ASME 1989). The program is defined in a quality assurance manual (PNL 1992), which provides guidance for implementation by addressing the following 18 quality assurance elements. These 18 elements are:

1. Organization
2. Quality Assurance Program
3. Design Control
4. Procurement Document Control
5. Instructions, Procedures, and Drawings
6. Document Control
7. Control of Purchased Items and Services
8. Identification and Control of Items
9. Control of Processes
10. Inspection
11. Test Control
12. Control of Measuring and Test Equipment
13. Handling, Storage, and Shipping
14. Inspection, Test, and Operating Status
15. Control of Nonconforming Items
16. Corrective Action
17. Quality Assurance Records
18. Audits.

The environmental 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 contracts are awarded for services or the purchase of materials are approved, which could have a significant impact on quality within the project.

Sample Collection Quality Assurance/Quality Control

Environmental surveillance samples were collected by staff trained to conduct sampling according to approved and documented procedures (PNNL 1996). 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 of 4.0, "Environmental Surveillance Information."

Samples for ground-water monitoring are collected by trained staff according to approved and documented procedures (PNL 1993). Chain-of-custody procedures are followed (EPA 1986b) 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 were obtained during field operations. Summaries of the 1995 ground-water field quality control results are provided in Tables 7.0.1 and 7.0.2.

Analytical Results Quality Assurance/Quality Control

Routine hazardous and nonhazardous chemical analyses for environmental and ground-water surveillance water samples are performed by DataChem Laboratories, Inc., Salt Lake City, Utah. The laboratory participates in the EPA Water Pollution and Water Supply Performance Evaluation Studies. DataChem Laboratories maintains an internal quality control program that meets the requirements of EPA SW-846 (EPA 1986a), which is audited and reviewed. Pacific Northwest National Laboratory submits additional quality control double-blind spiked samples for analysis.

Routine radiochemical analyses for environmental and ground-water surveillance samples are performed by Quanterra Incorporated's Richland Laboratory, Quanterra Environmental Services. The laboratory participates in DOE's Quality Assessment Program and EPA's Laboratory Intercomparison Studies. An additional quality control blind spiked sample program is conducted for each project. Quanterra Environmental Services also maintains an internal quality control program, which is audited and reviewed. Additional information on these quality control efforts is provided in the following subsections.

U.S. Department of Energy and U.S. Environmental Protection Agency Comparison Studies

DataChem Laboratories participated in the EPA Water Pollution and Water Supply Performance Evaluation Studies. Standard water samples were distributed blind to participating laboratories. These samples contained specific organic and inorganic analytes with concentrations unknown to the analyzing laboratories. After analysis, the results were submitted to EPA for comparison to known values and other participating laboratory concentrations. Summaries of the results during the year are provided in Table 7.0.3. Approximately 97% of the results during the year were within the typically used "3-sigma control limits" (±3 times the standard error of the mean).

The DOE Quality Assessment program and EPA's Intercomparison Studies Program provided standard samples of environmental media (water, air filters, soil, and vegetation) containing specific amounts of one or more radionuclides that were unknown by the participating laboratory. After sample analysis, the results were forwarded to DOE or EPA for comparison with known values and results from other laboratories. Both EPA and DOE have established criteria for evaluating the accuracy of results (Jarvis and Siu 1981, Sanderson 1985). Summaries of the 1995 results for the programs are provided in Tables 7.0.4 and 7.0.5. Approximately 92.5% of the results during the year were within the typically used "3-sigma control limits" (±3 times the standard error of the mean).

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 and replicate samples. Blind spiked quality control samples and blanks were prepared and submitted to check the accuracy and precision of analyses at DataChem Laboratories and Quanterra Environmental Services. In 1995, blind spiked samples were submitted for air filters, vegetation, soil, tissue, water,

Table 7.0.1. Summary of Ground-Water Surveillance Full Trip Blank Samples, 1995

Constituents	Number of Results Reported	Number Within Control Limits[a]
Radionuclides		
Total alpha	2	2
Total beta	3	3
^{3}H	11	9
^{60}Co	3	2
^{90}Sr	3	3
^{99}Tc	3	2
^{129}I	2	2
^{106}Ru	1	1
^{125}Sb	1	1
^{134}Cs	2	2
^{137}Cs	3	3
^{154}Eu	2	2
^{155}Eu	2	2
U total	10	10
^{234}U	6	6
^{235}U	6	6
^{238}U	6	5
Alkalinity	1	1
ICP metals	8	
Al, Sb, Ba, Cd, Co, Ni, Ag, Sn		8
Be, Ca, K, V		7
Cu, Mg, Mn		6
Cr, Zn		5
Fe		4
Na		2
Anions	9	
Bromide, nitrite, phosphate, sulfate		9
Fluoride		8
Nitrate		7
Chloride		6
Volatile organics	129	124

(a) Control limit is less than detection level (method detection level for hazardous constituents and below total propograted analytical uncertainty for radioactive constituents).

and ground water. Overall, 83% of the DataChem Laboratories blind spiked determinations were within control limits and 85% of Quanterra Environmental Services' blind spiked determinations were within control limits (Table 7.0.6 and 7.0.7). This indicates, overall, acceptable results.

Pacific Northwest National Laboratory also participates in a Quality Assurance Task Force, a program conducted by the Washington Department of Health. Organizations, both public and private, from Idaho, Oregon, and Washington participate in analyzing the intercomparison samples. No samples were designated by the Quality Assurance Task Force for analysis in 1995.

Table 7.0.2. Summary of Ground-Water Surveillance Field Duplicate Samples, 1995

Constituents	Number of Results Reported	Number Above Detection Level	Number Within Control Limits[a]
Radionuclides			
Gamma isotopes (^{60}Co, ^{137}Cs, ^{106}Ru, and ^{125}Sb)	4	1	1
Uranium isotopic (^{234}U, ^{235}U, and ^{238}U)	4	4	4
^{129}I	5	2	2
^{3}H	12	8	8
^{90}Sr	5	3	2
^{99}Tc	4	4	4
Total alpha	3	3	3
Total beta	3	3	3
U total	5	5	4
ICP metals			
Al, Fe, Mg, Mn, Ni, K, Ag, Na, Sn, Sb, Ba, Be, Co, Cu, V, Zn, Ca, Cd, Cr	171	73	66
Ions			
Bromide, chloride, fluoride, nitrate, nitrite, phosphate, sulfate	74	50	49
Volatile organic constituents	76	4	4

(a) Control limits are as follows: If the result is less than 5 times detection level, then duplicate results must be ± detection level. If the result is greater than 5 times detection level, then results must be ± 20% (Relative Percent Difference). If either value is less than the detection level, the Relative Percent Difference was not calculated.

Table 7.0.3. Summary of DataChem Laboratory's EPA Water Pollution and Water Supply Performance Evaluation Studies, 1995

Analytes	Number of Results Reported	Number Within Control Limits[a]
Metals		
Ag, Al, As, B, Ba, Be, Cd, Co, Cr, Cu, Fe, Hg, Mo, Mn, Ni, Pb, Sb, Se, Sr, Tl, Ti, V, Zn	78	78
Other inorganic tests		
pH, conductivity, total dissolved solids, total hardness, calcium, potassium, sodium, alkalinity, chloride, fluoride, sulfate, ammonia, nitrate, nitrite, chemical oxygen demand, etc.	72	69
Organic tests		
Total organic carbon, PCBs, pesticides, herbicides, volatile organic constituents	157	150

(a) Control limits from EPA (1982).

Table 7.0.4. Summary of Quanterra Environmental Services' Performance on DOE Quality Assessment Program Samples, 1995

Media	Radionuclides	Number of Results Reported	Number Within Acceptable Control Limits[a]
Air filters	^{54}Mn, ^{57}Co, ^{60}Co, ^{125}Sb, ^{137}Cs, ^{144}Ce, ^{238}Pu, ^{239}Pu, ^{134}Cs, total alpha, total beta	2	2
	^{241}Am	2	1
	^{90}Sr	2	0
	^{106}Ru, U total	1	1
Soil	^{40}K, ^{90}Sr, ^{137}Cs, ^{241}Am, ^{238}Pu, ^{239}Pu	2	2
	U total	1	1
Vegetation	^{40}K, ^{60}Co, ^{137}Cs, ^{241}Am, ^{239}Pu	2	2
	^{238}Pu, ^{90}Sr	1	1
Water	^{3}H, ^{137}Cs, ^{241}Am, ^{239}Pu, ^{90}Sr, total alpha, total beta	2	2
	^{60}Co, ^{54}Mn	2	1
	^{238}Pu, ^{244}Cm, ^{134}Cs, U total	1	1

(a) Control limits are from Sanderson et al. (1995).

Table 7.0.5. Summary of Quanterra Environmental Services' Performance on EPA Intercomparison Program Samples, 1995

Media	Radionuclides	Number of Results Reported	Number Within Control Limits[a]
Air filters	Total alpha, total beta, ^{90}Sr, $^{!37}$Cs	1	1
Milk	^{89}Sr, ^{90}Sr, ^{137}Cs	1	1
	^{131}I	1	0
Water	^{239}Pu, ^{131}I	1	1
	^{133}Ba, ^{3}H, ^{65}Zn	2	2
	^{60}Co, ^{89}Sr, ^{90}Sr, ^{134}Cs, ^{137}Cs	3	3
	Total alpha, total beta, U total, ^{226}Ra, ^{228}Ra	4	4

(a) Control limits are from Jarvis and Siu (1981).

Table 7.0.6. Summary of Ground-Water Surveillance Project Quarterly Blind Spiked Determinations, 1995

Constituents	Number of Results Reported[a]	Number Within ±30% RPD[b]
^{3}H	12	12
^{60}Co	12	12
^{90}Sr	12	11
^{99}Tc	12	10
^{129}I	12	8
^{137}Cs	12	12
^{239}Pu	12	9
U total	12	12
Chloroform	12	9
Carbon tetrachloride	12	7
Trichloroethylene	12	9
Chromium	12	12
Cyanide	12	12
Fluoride	12	9
Nitrate	12	12

(a) Blind samples were submitted in triplicate each quarter and compared to actual spike value.
(b) RPD = Relative Percent Difference.

Laboratory Internal Quality Assurance Programs

DataChem Laboratories and Quanterra Environmental Services are required to maintain an internal quality control program. Periodically, the laboratories are internally audited for compliance to the quality control programs. At the DataChem Laboratories, the quality control program meets the quality control criteria of EPA SW-846 (EPA 1986b). This program also requires the laboratory 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 annually for each analytical method.

Quanterra Environmental Services' internal quality control program involves routine calibrations of counting instruments, yield determinations of radiochemical procedures, frequent radiation check sources and background

Table 7.0.7. Summary of Surface Environmental Surveillance Project Blind Spiked Determinations, 1995

Sample Media	Radionuclides	Number of Results Reported	Number Within Control Limits[a]
Air filters	^{54}Mn, ^{57}Co, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{144}Ce, ^{238}Pu, ^{239}Pu	21	20
Soil	^{40}K, ^{90}Sr, ^{137}Cs, ^{234}U, ^{238}U, ^{238}Pu, ^{239}Pu	17	10
Water	^{3}H, ^{54}Mn, ^{57}Co, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{144}Ce, ^{234}U, ^{238}U, ^{239}Pu	27	25
Vegetation	^{40}K, ^{90}Sr, ^{137}Cs, ^{238}Pu, ^{239}Pu	15	12
Animal tissue	^{40}K, ^{90}Sr, ^{137}Cs, ^{234}U, ^{238}U	5	4

(a) Control limit of ± 30%.

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. Minimum detectable concentration verification is conducted (when requested) for radionuclide-media combination analyses. 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 1980a).

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 audit and inspection findings are documented by written communication, and corrective actions are verified by follow-up audits and inspections. There were no scheduled inspections of services performed in 1995; however, the laboratories were frequently contacted regarding questions on results, clarification of methodology, status of scheduled improvements, etc.

Internal laboratory quality control program data are summarized by the laboratories 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.

Media Audits and Comparisons

Additional audits and comparisons are 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 1995. Media that were co-sampled with the Washington State Department of Health included: 26 ground-water wells; 3 Columbia River sites; 2 riverbank springs; 1 onsite pond; 2 onsite drinking water systems; 3 offsite water systems; 8 Columbia River sediment sites; 4 air monitoring stations; 15 thermoluminescent dosimeter sites; and 1 rabbit. Also co-sampled were upwind and downwind samples of alfalfa, tomatoes, leafy vegetables, whitefish, melons, potatoes, chicken, concord grapes, and wine. Results will be available in the Washington State Department of Health 1995 annual report. The National Food and Drug Administration also co-sampled vegetables, fruit, and wheat. The data are presented in Table 7.0.8.

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 1995 results is shown in Table 7.0.9. On average, the thermoluminescent dosimeter measurements were biased 0.76% higher than the known values.

Effluent Monitoring and Near-Facility Environmental Monitoring

The Site effluent monitoring and near-facility environmental monitoring programs are subject to the quality assurance programs defined in the Westinghouse Hanford Company *Quality Assurance Manual* (WHC 1989), and Pacific Northwest National Laboratory *Quality Assurance Manual* (PNL 1992). These quality assurance programs comply with DOE Order 5700.6C, "Quality Assurance" (1989 edition, without addenda), using ASME NQA-1, *Quality Assurance Program Requirements for Nuclear Facilities* (ASME 1989), as their basis. The programs also adhere to the EPA guidelines in *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans* (EPA 1980a) and *Data Quality Objectives for Remedial Response Activities* (EPA 1987).

The facility 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 performed through contracts, such as sample analysis, must meet the requirements of these plans. Suppliers are audited before contract selection is made for equipment and services that may significantly impact the quality of a project.

Sample Collection Quality Assurance

Effluent monitoring and near-facility environmental monitoring samples are collected by staff who are trained for the task in accordance with approved procedures. Established sample locations are accurately identified and documented to ensure continuity of data for those sites. Effluent and environmental sample locations, for the Hanford Site, are described in the *Environmental Monitoring Plan* (DOE 1994a).

Table 7.0.8. Comparison of Food and Drug Administration (FDA) Co-Sampling, 1995

Media	Area	Organization	^{131}I (pCi/kg)	^{106}Ru (pCi/kg)	^{137}Cs (pCi/kg)[a,b]	^{40}K (pCi/kg)[a]	^{90}Sr (pCi/kg)[a,b]	Tritium (pCi/kg)[a]
Alfalfa	Benton City Area	FDA	ND[c]	ND	ND	18.6 ± 4.0	NV[d]	NA[e]
		PNNL	ND	ND	<0.016	29.8 ± 3.08	0.0493 ± 0.0116	NA
	Horn Rapids Area	FDA	ND	ND	ND	22.2 ± 4.6	NV	NA
		PNNL	ND	ND	<0.0115	25.5 ± 2.69	0.0175 ± 0.00611	NA
	Sunnyside Area	FDA	ND	ND	ND	16.4 ± 2.4	NV	NA
		PNNL	ND	ND	<0.00936	22.5 ± 2.34	0.0177 ± 0.00643	NA
	Riverview Area	FDA	ND	ND	ND	21.3 ± 4.6	NV	NA
		PNNL	ND	ND	<0.0104	18.4 ± 1.94	0.0967 ± 0.027	NA
	Sagemoor Area	FDA	ND	ND	ND	15.7 ± 2.6	NV	NA
		PNNL	ND	ND	0.0103 ± 0.00878	21.0 ± 2.17	0.0947 ± 0.0246	NA
Leafy vegetables	Riverview Area	FDA	ND	ND	ND	3.3 ± 0.8	NA	ND
		PNNL	ND	ND	<0.0103	4.47 ± 0.598	<0.00309	NA
	Sunnyside Area	FDA	ND	ND	ND	2.9 ± 0.9	3.0 ± 1.4	ND
		PNNL	ND	ND	<0.00983	1.82 ± 0.418	<0.00296	NA
Potatoes	Sagemoor Area	FDA	ND	ND	ND	4.0 ± 0.9	NA	ND
		PNNL	ND	ND	<0.00941	3.62 ± 0.600	<0.00296	NA
	Sunnyside Area	FDA	ND	ND	ND	4.6 ± 0.9	ND	ND
		PNNL	ND	ND	<0.0118	4.47 ± 0.705	<0.00292	NA
	Riverview Area	FDA	ND	ND	ND	4.6 ± 0.9	ND	ND
		PNNL	ND	ND	<0.0113	4.05 ± 0.605	<0.00280	NA
Apples	Riverview Area	FDA	ND	ND	ND	1.1 ± 0.8	ND	ND
		PNNL	ND	ND	<0.00927	0.647 ± 0.284	<0.00191	<141[f]
	Sagemoor Area	FDA	ND	ND	ND	1.0 ± 0.7	NA	ND
		PNNL	ND	ND	<0.0099	0.839 ± 0.326	<0.00251	<138[f]

(a) ±2 sigma total propagated analytical uncertainty.
(b) < values are 2 sigma total propagated analytical uncertainties.
(c) ND = not detected.
(d) NV = not available at this time.
(e) NA = not analyzed.
(f) Reported in pCi/L of water extract.

Table 7.0.9. Comparison of Thermoluminescent Dosimeter Results with Known Exposure, 1995

Quarter	Known Exposure, mR	Determined, mR (±2 SD)	% of Exposure
First	17 ± 0.63	16.59 ± 0.58	97.61
	23 ± 0.85	22.61 ± 0.21	98.32
	27 ± 1.00	27.03 ± 1.38	100.10
Second	19 ± 0.70	19.02 ± 0.18	100.11
	22 ± 0.81	21.65 ± 1.48	98.41
	28 ± 1.04	27.48 ± 0.38	98.14
Third	18 ± 0.67	17.51 ± 0.29	97.28
	24 ± 0.89	25.08 ± 0.11	104.50
	26 ± 0.96	27.62 ± 0.45	106.23
Fourth	17 ± 0.63	17.76 ± 0.49	104.47
	20 ± 0.74	20.31 ± 0.02	101.55
	25 ± 0.93	25.59 ± 0.16	102.36

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) used. Table 7.0.10 provides a summary of Hanford's analytical laboratory use for effluent monitoring and near-facility monitoring samples, which are grouped by contractor and sample media.

The quality of the analytical data is assured by several means. Counting room instruments are kept within calibration limits through daily checks, the results of which are stored in computer databases. Radiochemical standards used in analyses are measured regularly 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.

Table 7.0.10. Laboratories Utilized in 1995 by Contractor and Sample Type

	Laboratories Utilized for Effluent Monitoring Samples					Laboratories Utilized for Near-Facility Environmental Monitoring Samples		
	WHC[a]		PNNL[b]	BHI[c]		WHC		
Laboratory	Air Samples	Water Samples	Air Samples	Air Samples	Water Samples	Air Samples	Water Samples	Other
Waste Sampling and Characterization Facility	X	X		X		X	X	X
222-S Analytical Laboratory							X	X
Quanterra Environmental Services (Richland)	X		X	X	X	X		
PNNL Analytical Chemistry Laboratory	X	X	X					

(a) Westinghouse Hanford Company.
(b) Pacific Northwest National Laboratory.
(c) Bechtel Hanford Inc.

The analytical laboratories participation in EPA and DOE laboratory intercomparison programs also assist in assuring the quality of the data produced. Laboratory intercomparison program results can be found in Tables 7.0.11 through 7.0.16 for the Waste Sampling and Characterization Facility, the 222-S Analytical Laboratory, and the Pacific Northwest National Laboratory Analytical Chemistry Laboratory.

Table 7.0.11. Waste Sampling and Characterization Facility Performance on DOE Quality Assessment Program Samples, 1995

Sample Media	Analysis	Number of Results Reported	Number Within Control Limits	Number Outside of Control Limits
Air filters	Total alpha, total beta, ^{54}Mn, ^{57}Co, ^{60}Co, ^{90}Sr, ^{106}Ru, ^{125}Sb, ^{134}Cs, ^{137}Cs, ^{144}Ce, ^{238}Pu, ^{239}Pu, ^{241}Am, U total	27	27	0
Soil	^{40}K, ^{90}Sr, ^{137}Cs, ^{238}Pu, ^{239}Pu, ^{241}Am	8	5	3[a]
Vegetation	^{40}K, ^{60}Co, ^{90}Sr, ^{137}Cs, ^{239}Pu, ^{241}Am	9	8	1[b]
Water	Total alpha, total beta, ^{3}H, ^{54}Mn, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{238}Pu, ^{239}Pu, ^{241}Am, U total	21	21	0

(a) One ^{90}Sr analysis, one ^{238}Pu analysis, and one ^{239}Pu analysis were not within control limits.
(b) One ^{239}Pu analysis was not within control limits.

Table 7.0.12. 222-S Analytical Laboratory Performance on DOE Quality Assessment Program Samples, 1995

Sample Media	Analysis	Number of Results Reported	Number Within Control Limits	Number Outside of Control Limits
Soil	^{40}K, ^{137}Cs, ^{238}Pu, ^{239}Pu	6	6	0
Vegetation	^{40}K, ^{90}Sr, ^{137}Cs, ^{239}Pu	5	4	1[a]
Water	^{3}H, ^{54}Mn, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{238}Pu, ^{239}Pu, ^{241}Am, U total	16	15	1[b]

(a) One ^{90}Sr analysis was not within control limits.
(b) One ^{241}Am analysis was not within control limits.

Table 7.0.13. Pacific Northwest National Laboratory Analytical Chemistry Laboratory Performance on DOE Quality Assessment Program Samples, 1995

Sample Media	Analysis	Number of Results Reported	Number Within Control Limits	Number Outside of Control Limits
Air filters	^{54}Mn, ^{57}Co, ^{60}Co, ^{90}Sr, ^{106}Ru, ^{125}Sb, ^{134}Cs, ^{137}Cs, ^{144}Ce, ^{238}Pu, ^{239}Pu, ^{241}Am	12	12	0
Water	^{3}H, ^{54}Mn, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{238}Pu, ^{239}Pu, ^{241}Am, U total	9	9	0

Table 7.0.14. Waste Sampling and Characterization Facility Performance on EPA Intercomparison Program Samples, 1995

Sample Category	Analysis	Number of Results Reported	Number Within Control Limits	Number Outside of Control Limits
Air filters	Total alpha, total beta, ^{90}Sr, ^{137}Cs	8	8	0
Total alpha-beta in water	Total alpha, total beta	6	4	2[a]
Gamma in water	^{60}Co, ^{65}Zn, ^{106}Ru, ^{134}Cs, ^{137}Cs, ^{133}Ba,	20	17	3[b]
Strontium in water	^{89}Sr, ^{90}Sr	4	4	0
Uranium-radium in water	U total, ^{226}Ra, ^{228}Ra	9	7	2[c]
Plutonium in water	^{239}Pu	1	1	0
Tritium in water	^{3}H	3	1	2[d]
Blind A[e]	Total alpha, U total, ^{226}Ra, ^{228}Ra	8	8	0
Blind B[f]	Total beta, ^{60}Co, ^{89}Sr, ^{90}Sr, ^{134}Cs, ^{137}Cs	12	10	2[g]

(a) Two total alpha analyses were not within control limits.
(b) Three ^{134}Cs analyses were not within control limits. EPA has indicated that laboratories calibrating with a mixed gamma standard are having difficulty with this analysis.
(c) Two uranium analyses were not within control limits.
(d) Two tritium analyses were not within control limits.
(e) Blind A samples are liquid samples with unknown quantities of alpha emitters, which are analyzed for total alpha and each radionuclide component.
(f) Blind B samples are liquid samples with unknown quantities of beta emitters, which are analyzed for total beta and each radionuclide component.
(g) One total beta analysis and one ^{89}Sr analysis were not within control limits.

Table 7.0.15. 222-S Analytical Laboratory Performance on EPA Intercomparison Program Samples, 1995

Sample Category	Analysis	Number of Results Reported	Number Within Control Limits	Number Outside of Control Limits
Total alpha-beta in water	Total alpha, total beta	6	3	3[a]
Gamma in water	^{60}Co, ^{65}Zn, ^{106}Ru, ^{134}Cs, ^{137}Cs, ^{133}Ba,	20	20	0
Uranium-radium in water	U total	5	2	3[b]
Plutonium in water	^{239}Pu	1	1	0
Blind A[c]	Total alpha, U total	3	3	0
Blind B[d]	Total beta, ^{60}Co, ^{134}Cs, ^{137}Cs	8	7	1[e]

(a) None of the total beta analyses were within control limits.
(b) Three uranium analyses were not within control limits.
(c) Blind A samples are liquid samples with unknown quantities of alpha emitters, which are analyzed for total alpha and each radionuclide component.
(d) Blind B samples are liquid samples with unknown quantities of beta emitters, which are analyzed for total beta and each radionuclide component.
(e) One total beta analysis was not within control limits.

Table 7.0.16. Pacific Northwest National Laboratory Analytical Chemistry Laboratory Performance on EPA Intercomparison Program Samples, 1995

Sample Category	Analysis	Number of Results Reported	Number Within Control Limits	Number Outside of Control Limits
Air filters	Total alpha, total beta, ^{90}Sr, ^{137}Cs	4	4	0