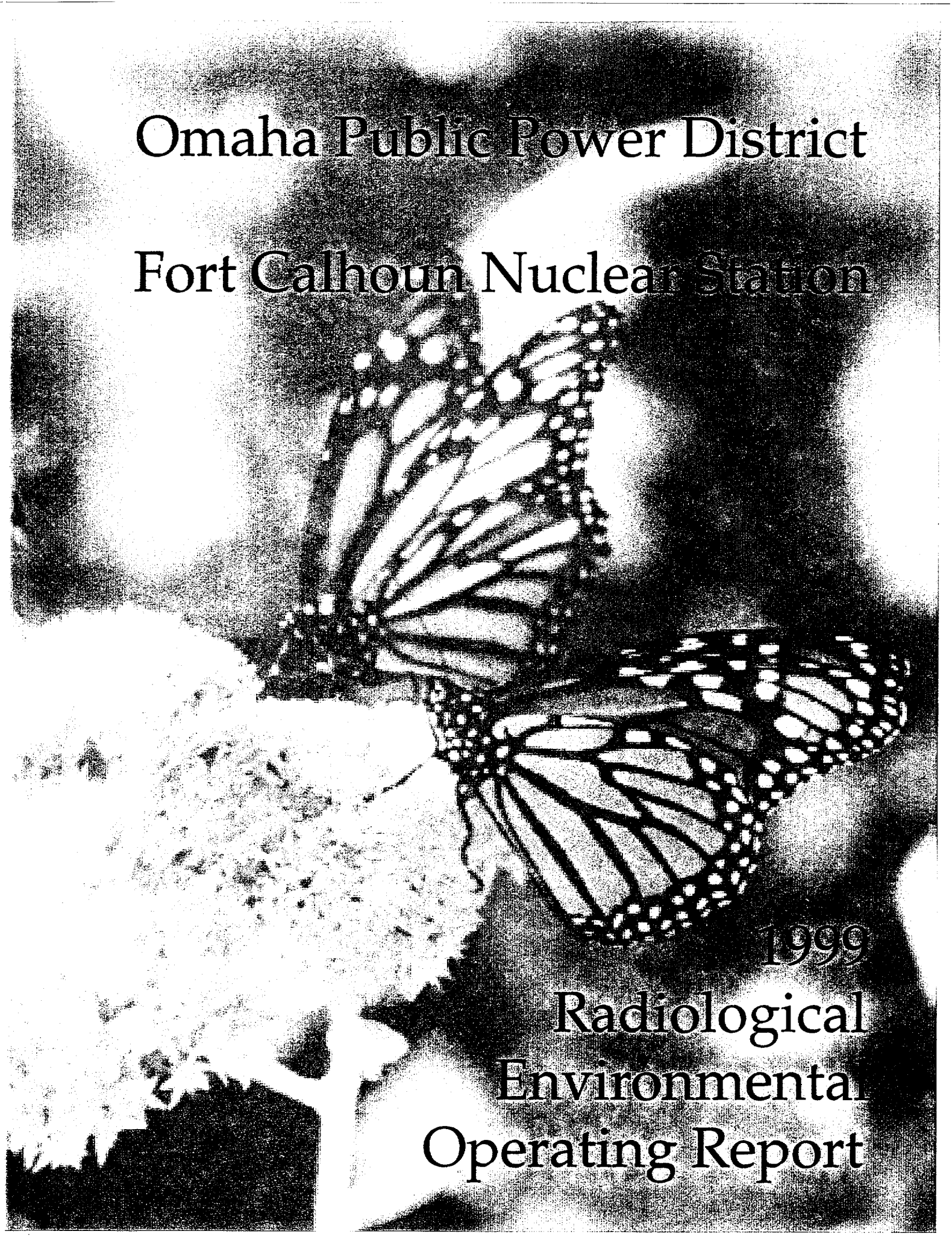
Omaha Public Power District

Fort Calhoun Nuclear Station



1999 Radiological Environmental Operating Report

OMAHA PUBLIC POWER DISTRICT

FORT CALHOUN STATION

RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

TECHNICAL SPECIFICATION 5.9.4b

January 1, 1999 – December 31, 1999

Annual Radiological Environmental Operating Report

This report is submitted in accordance with Section 5.9.4b of the Technical Specification of Fort Calhoun Station Unit No. 1, Facility Operating License DPR-40 for the period January 1, 1999 through December 31, 1999.

In addition, this report provides any observations and anomalies that occurred during the monitoring period.

Reviewed by:

Supervisor-System Chemistry

Approved by:

Manager-Chemistry

Annual Radiological Environmental Operating Report – 1999

In accordance with Technical Specification 5.9.4b, attached is the Fort Calhoun Station (FCS) Annual Radiological Environmental Operating Report for year 1999. The data provided is consistent with the objectives as specified in Section 5 of the Offsite Dose Calculation Manual (ODCM), "Radiological Environmental Monitoring Requirements." The report is presented as follows:

1) An introductory discussion of program observations and environmental impact relevant to the operation of FCS and the implementation of the Radiological Environmental Monitoring Program (REMP).

2) The sample class, sample collection frequency, number of sample locations, and the number of samples collected this reporting period for each class is delineated in Table 1.0.

3) A statistical evaluation of REMP findings is summarized in Table 2.0, in accordance with Regulatory Guide 4.8, Table 1. For each type of sample medium and analysis, Table 2.0 exhibits separately all **indicator** locations, all **control** (background) locations, and the location having the highest annual mean result. For each of these classes, Table 2.0 specifies the following:

   a. The total number of analyses;
   b. The fraction of analyses yielding detectable results (i.e., results above the highest Lower Limit of Detection (LLD) for this period);
   c. The maximum, minimum, and mean results;
   d. The coordinates in distance, in miles, and the direction relative to the FCS Reactor Containment Building (radial degrees) are specified for the location with the highest annual mean.

4) Table 3.0 is a listing of missed samples and explanations.

5) Appendix A describes the Interlaboratory Comparison Program.

6) Appendix B describes the vendor Data Reporting Conventions utilized.

7) Appendix C reports the information required when primary coolant specific activity has exceeded the limits of Technical Specification 2.1.3.

INTRODUCTION

Radiological Environmental Monitoring Program (REMP) – 1999

The document submitted is the Fort Calhoun Station (FCS) Annual Radiological Environmental Operating Report – 1999, documenting the results of the Radiological Environmental Monitoring Program (REMP). Results of completed analyses as required by the FCS Offsite Dose Calculation Manual (ODCM) are presented in the attached tables. The collection of environmental sample media was performed entirely by plant staff and sample analysis/progress report preparation was provided by contract vendor (Teledyne Brown Engineering – Northbrook, Illinois). Data obtained for the REMP this reporting period were well within expected ranges and compared favorably to historical trends. None of the media sampled contained radioactivity attributable to the operation of the Fort Calhoun Station. The following observations and anomalies were documented during the monitoring period:

1) **Water** – Tritium was detected in the third quarter composite sample collected 0.5 miles downstream of the Plant at an analytical LLD of 300 pCi/L (316 ± 107 pCi/L). The 40 CFR 141 limit for tritium in drinking water is 20,000 pCi/L. Plant staff reviewed effluent release data for this period and found no abnormalities. Evaluation of tritium analyses data from the nearest downstream municipal drinking water intake (Metropolitan Utilities District – Omaha, Nebraska) indicated no detectable levels in surface (raw) water or drinking water.

2) **Milk** – There were no milk samples available within the 5.0 mile monitoring radius of the plant for year 1999 during the time period when cows are on pasture (May through October). When milk samples are not available, broadleaf/pasture grass vegetation samples are then collected in lieu of milk at the highest ingestion exposure pathway for vegetation. This location is the W. Jones Farm located 0.89 miles from the plant at 165 radial degrees. Analytical results for broadleaf/pasture grasses collected during the pasture season yielded all < LLD.

3) **Sediment** – Cesium-137 was detected in one bottom sediment sample at the indicator location (downstream of plant). Analysis results were 0.034 ± 0.019 pCi/g at an LLD of 0.027 pCi/g dry. Results reported are consistent with normal environmental levels present and can be attributed to fallout.

4) **Air** – The unit at Location OAP-A-(I) [Onsite Station No. 1, 0.5 miles NW of reactor] was found to be out of tolerance higher than the set flow (2.0 cfm) for weeks ending 04/28/99 through 07/28/99. Since this result was conservative, results were calculated based on the set flow of 2.0 cfm. The unit at Location OAP-B-(I) [Onsite Station No. 2, 0.6 miles SW of reactor] was found to be out of tolerance lower than set flow (2.0 cfm) for weeks ending 03/03/99 through 06/02/99. Because this result was non-conservative, the affected data was recalculated based on the As Found actual flow, which was < 2.0 cfm. Condition Report 199901224 was initiated to troubleshoot the anomaly. Location OAP-E-(C) [E.O.F. Building-North Omaha Station] was dropped from the Radiological Environmental Monitoring Program at the end of year 1999 as a control location in lieu of another established controlled location (Valley Substation #902). The latter more appropriately meets the criteria of Regulatory Guide 4.8 for an air particulate control location (10-20 miles distant and in the least prevalent wind direction). For the present, ambient gamma radiation monitoring (TLD) will continue at the discontinued air monitoring site.

Table 1.0 Sample collection program.

Sample Class	Collection Frequency	Number of Sample Locations	Number of Samples Collected This Period
Background Radiation (TLDs)	Quarterly	12	48
Air Particulates	Weekly	6	311
Airborne Iodine	Weekly	6	311
Milk	Semimonthly	2	0
Pasture Grass (milk substitute)		2	25
Water	Monthly	3	36
Fish	Annually	2	5
Sediment	Semiannually	2	4
Food Crops	Annually	2	7
		TOTAL	747

Table 2.0 Radiological Environmental Monitoring Program Summary

Name of Facility: Fort Calhoun Nuclear Power Station - Unit 1 — Docket No. 50-285
Location of Facility: Washington, Nebraska (County, State) — Reporting Period: January-December, 1999

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean: Location[d]	Location with Highest Annual Mean: Mean (F)[c] Range[c]	Control Locations Mean (F)[c] Range[c]	Number Non-Routine Results[e]
Background Radiation (TLD) (mR/week)	Gamma 48	0.5	1.5 (40/40) (1.1-1.8)	OTD-J,K-(I) Both locations, identical averages	1.6 (8/8) (1.4-1.8)	1.4 (8/8) (1.1-1.6)	0
Airborne Particulates (pCi/m^3)	GB 311	0.005	0.027 (208/208) (0.012-0.058)	OAP-B-(I) 0.6 miles SW	0.028 (52 /52) (0.016-0.058)	0.026 (103/103) (0.009-0.055)	0
	GS 24						
	Cs-134	0.001	< LLD	-	-	< LLD	0
	Cs-137	0.001	< LLD	-	-	< LLD	0
	Other Gammas[f]	0.001	< LLD	-	-	< LLD	0
Airborne Iodine (pCi/m^3)	I-131 311	0.07	< LLD	-	-	< LLD	0
Pasture Grass (milk substitute) pCi/g wet	GS 25						
	Mn-54	0.031	< LLD	-	-	< LLD	0
	Co-58	0.031	< LLD	-	-	< LLD	0
	Co-60	0.041	< LLD	-	-	< LLD	0
	Fe-59	0.11	< LLD	-	-	< LLD	0
	Zn-65	0.090	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.037	< LLD	-	-	< LLD	0
	I-131	0.046	< LLD	-	-	< LLD	0
	Cs-134	0.041	< LLD	-	-	< LLD	0
	Cs-137	0.036	< LLD	-	-	< LLD	0
	Ba-La-140	0.025	< LLD	-	-	< LLD	0
Water (pCi/L)	GS 36						
	Cs-134	15	< LLD	-	-	< LLD	0
	Cs-137	15	< LLD	-	-	< LLD	0
	Other Gammas[f]	15	< LLD	-	-	< LLD	0
	H3 12	300	316 (1/8)	OSW-B-(I) 0.5 mi. Downstream	316 (1/4)	< LLD	0

Table 2.0 Radiological Environmental Monitoring Program Summary

Name of Facility: Fort Calhoun Nuclear Power Station - Unit 1 | Docket No. 50-285
Location of Facility: Washington, Nebraska (County, State) | Reporting Period January-December, 1999

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean Location[d]	Location with Highest Annual Mean Mean (F)[c] Range[c]	Control Locations Mean (F)[c] Range[c]	Number Non-Routine Results[e]
Fish	GS 5						
(pCi/g wet)	Mn-54	0.016	< LLD	-	-	< LLD	0
	Co-58	0.024	< LLD	-	-	< LLD	0
	Co-60	0.025	< LLD	-	-	< LLD	0
	Zn-65	0.041	< LLD	-	-	< LLD	0
	Cs-134	0.023	< LLD	-	-	< LLD	0
	Cs-137	0.016	< LLD	-	-	< LLD	0
	Other Gammas[f]	0.044	< LLD	-	-	< LLD	0
Sediment	GS 4						
pCi/g dry	Cs-134	0.038	< LLD	-	-	< LLD	0
	Cs-137	0.027	< LLD	OSD-A-(I) Upstream	0.034 (1/2)	< LLD	0
	Other Gammas[f]	0.028	< LLD	-	-	< LLD	0
Food Crops	GS 7						
(pCi/g wet)	Mn-54	0.018	< LLD	-	-	< LLD	0
	Co-58	0.014	< LLD	-	-	< LLD	0
	Co-60	0.019	< LLD	-	-	< LLD	0
	Fe-59	0.032	< LLD	-	-	< LLD	0
	Zn-65	0.033	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.021	< LLD	-	-	< LLD	0
	Cs-134	0.018	< LLD	-	-	< LLD	0
	Cs-137	0.019	< LLD	-	-	< LLD	0
	Ba-La-140	0.010	< LLD	-	-	< LLD	0

[a] GB = gross beta, GS = gamma scan.

[b] LLD = nominal lower limit of detection based on a 95% confidence level.

[c] Mean and range are based on detectable measurements only (i.e., >LLD) Fraction of detectable measurements at specified locations is indicated in parentheses (F).

[d] Locations are specified: (1) by code, (2) by name, and (3) by distance and direction relative to the Reactor Containment Building.

[e] Non-routine results are those which exceed ten times the control station value. If no control station value is available, the result is considered non-routine if it exceeds the typical pre-operational value for the medium or location.

[f] Value given for "Other gammas" refers to Co-60 for all sample types but fish. For fish the value given is for Ru-103.

Table 3.0 Listing of Missed Samples

Sample Type	Date	Location	Reason

There were no missed sample media in the REMP for year 1999

APPENDIX A

INTERLABORATORY COMPARISON PROGRAM RESULTS

NOTE: Teledyne Brown Engineering - Environmental Services, Midwest Laboratory participates in intercomparison studies administered by Environmental Resources Associates, and serves as a replacement for studies conducted previously by the U.S. EPA Environmental Monitoring Systems Laboratory, Las Vegas, Nevada. Results are reported in Appendix A. TLD Intercomparison results, in-house spikes, blanks, duplicates and mixed analyte performance evaluation program results are also reported. Appendix A is updated four times a year; the complete Appendix is included in March, June, September and December monthly progress reports only.

January, 1999 through December, 1999

Appendix A

Interlaboratory Comparison Program Results

Teledyne Brown Engineering Environmental Services Midwest Laboratory has participated in interlaboratory comparison (crosscheck) programs since the formulation of its quality control program in December 1971. These programs are operated by agencies which supply environmental type samples (e.g., milk or water) containing concentrations of radionuclides known to the issuing agency but not to participant laboratories. The purpose of such a program is to provide an independent check on the laboratory's analytical procedures and to alert it to any possible problems.

Participant laboratories measure the concentration of specified radionuclides and report them to the issuing agency. Several months later, the agency reports the known values to the participant laboratories and specifies control limits. Results consistently higher or lower than the known values or outside the control limits indicate a need to check the instruments or procedures used.

The results in Table A-1 were obtained through participation in the environmental sample crosscheck program for milk, water and air filters during the past twelve months. Data for previous years is available upon request.

This program was conducted by Environmental Resources Associates and serves to replace studies conducted by the U.S. Environmental Protection Agency.

The results in Table A-2 were obtained for Thermoluminescent Dosimeters (TLDs), via various International Intercomparisons of Environmental Dosimeters under the sponsorships listed in Table A-2. Teledyne test results are also listed.

Table A-3 lists results of the analyses on in-house "spiked" samples for the past twelve months. All samples are prepared using NIST traceable sources. Data for previous years available upon request.

Table A-4 lists results of the analyses on in-house "blank" samples for the past twelve months. Data for previous years available upon request.

Table A-5 list results of the in-house "duplicate" program for the past twelve months. Acceptance is based on the difference of the results being less than the sum of the errors. Data for previous years available upon request.

The results in Table A-6 were obtained through participation in the Mixed Analyte Performance Evaluation Program.

The results in Table A-7 were obtained through participation in the Environmental Measurement Laboratory Quality Assessment Program.

Attachment A lists acceptance criteria for "spiked" samples.

Out-of-limit results are explained directly below the result.

12-31-99

ATTACHMENT A

ACCEPTANCE CRITERIA FOR "SPIKED" SAMPLES

LABORATORY PRECISION: ONE STANDARD DEVIATION VALUES FOR VARIOUS ANALYSES[a]

Analysis	Level	One Standard Deviation for single determinations
Gamma Emitters	5 to 100 pCi/liter or kg >100 pCi/liter or kg	5.0 pCi/liter 5% of known value
Strontium-89[b]	5 to 50 pCi/liter or kg >50 pCi/liter or kg	5.0 pCi/liter 10% of known value
Strontium-90[b]	2 to 30 pCi/liter or kg >30 pCi/liter or kg	5.0 pCi/liter 10% of known value
Potassium-40	>0.1 g/liter or kg	5% of known value
Gross alpha	≤20 pCi/liter >20 pCi/liter	5.0 pCi/liter 25% of known value
Gross beta	≤100 pCi/liter >100 pCi/liter	5.0 pCi/liter 5% of known value
Tritium	≤4,000 pCi/liter >4,000 pCi/liter	1s = (pCi/liter) = $169.85 \times (\text{known})^{0.0933}$ 10% of known value
Radium-226,-228	<0.1 pCi/liter	15% of known value
Plutonium	0.1 pCi/liter, gram, or sample	10% of known value
Iodine-131, Iodine-129[b]	≤55 pCi/liter >55 pCi/liter	6.0 pCi/liter 10% of known value
Uranium-238, Nickel-63[b] Technetium-99[b]	≤35 pCi/liter >35 pCi/liter	6.0 pCi/liter 15% of known value
Iron-55[b]	50 to 100 pCi/liter >100 pCi/liter	10 pCi/liter 10% of known value
Others[b]	–	20% of known value

[a] From EPA publication, "Environmental Radioactivity Laboratory Intercomparison Studies Program, Fiscal Year, 1981-1982, EPA-600/4-81-004.

[b] Teledyne limit.

Table A-1. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA), comparison of ERA and Teledyne Midwest Laboratory results[a].

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[b] Teledyne Results ±2 Sigma[c]	ERA Result[d] 1s, N=1	Control Limits
STW-861	WATER	Sep, 1999	Ra-226	15.6 ± 0.3	16.5 ± 1.7	12.2 - 20.8
STW-861	WATER	Sep, 1999	Ra-228	3.2 ± 0.3	2.2 ± 0.2	1.2 - 3.1
The activity reported is the average of three separate analyses. Individual results : 2.6, 2.9 and 4.0.						
STW-861	WATER	Sep, 1999	Uranium	39.4 ± 1.2	45.4 ± 4.5	37.7 - 53.1
STW-862	WATER	Nov, 1999	I-131	23.9 ± 0.1	23.3 ± 2.3	18.1 - 28.5

[a] Results obtained by Teledyne Brown Engineering Environmental Services Midwest Laboratory as a participant in the environmental sample crosscheck program operated by Environmental Resource Associates(ERA).

[b] All results are in pCi/L, except for elemental potassium (K) data in milk, which are in mg/L; air filter samples, which are in pCi/Filter.

[c] Unless otherwise indicated, the TBEESML results are given as the mean ± 2 standard deviations for three determinations.

[d] ERA results are presented as the known values and expected laboratory precision (1s, 1 determination) and control limits as defined by ERA.

Table A-2. Crosscheck program results; Thermoluminescent Dosimeters. (TLDs).

Lab Code	TLD Type	Date	Measurement	mR: Teledyne Results ± 2 Sigma	mR: Known Value	mR: Average ± 2 Sigma (All Participants)
Teledyne Testing						
98-1	LiF-100 Chips	May, 1998	Lab, 1	15.5 ± 1.3	16.7	-
98-1	LiF-100 Chips	May, 1998	Lab, 2	23.9 ± 0.9	32.4	-
98-1	LiF-100 Chips	May, 1998	Lab, 3	59.8 ± 1.9	60.2	-
98-1	$CaSO_4$: Dy Cards	May, 1998	Reader 1, #1	18.5 ± 0.8	16.7	-
98-1	$CaSO_4$: Dy Cards	May, 1998	Reader 1, #2	27.3 ± 1.7	32.4	-
98-1	$CaSO_4$: Dy Cards	May, 1998	Reader 1, #3	70.0 ± 4.7	60.2	-
Chips and Cards were irradiated by Teledyne Brown Engineering, Westwood, New Jersey, in May, 1998.						
Teledyne Testing						
99-1	LiF-100 Chips	Mar, 1999	Lab, 1	14.5 ± 0.5	15.4	-
99-1	LiF-100 Chips	Mar, 1999	Lab, 2	29.3 ± 1.0	31.8	-
99-1	LiF-100 Chips	Mar, 1999	Lab, 3	60.0 ± 0.2	59.1	-
99-1	$CaSO_4$: Dy Cards	Mar, 1999	Reader 1, #1	18.3 ± 0.5	15.4	-
99-1	$CaSO_4$: Dy Cards	Mar, 1999	Reader 1, #2	35.9 ± 1.3	31.8	-
99-1	$CaSO_4$: Dy Cards	Mar, 1999	Reader 1, #3	66.5 ± 4.4	59.1	-
Chips and Cards were irradiated by Teledyne Brown Engineering, Westwood, New Jersey, in March, 1999.						

Table A-3. In-house "spike" samples.

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[a]		
				Teledyne Results 2s, n=1[b]	Known Activity	Control[c] Limits
SPW-140	WATER	Jan, 1999	Ra-226	14.51 ± 0.52	13.79	9.65 - 17.93
SPW-140	WATER	Jan, 1999	Ra-228	9.47 ± 1.49	8.28	5.80 - 10.76
SPW-142	WATER	Jan, 1999	Gr. Alpha	30.82 ± 2.49	33.97	16.99 - 50.96
SPW-142	WATER	Jan, 1999	Gr. Beta	30.87 ± 1.91	30.18	20.18 - 40.18
SPW-254	WATER	Jan, 1999	H-3	37752.00 ± 540.00	38559.00	30847.20 - 46270.80
SPAP-270	AIR FILTER	Jan, 1999	Cs-137	2.04 ± 0.02	1.82	1.09 - 2.55
SPAP-787	AIR FILTER	Jan, 1999	Gr. Beta	5.97 ± 0.02	5.38	0.00 - 15.38
SPW-789	WATER	Jan, 1999	Co-60	44.83 ± 7.11	40.46	30.46 - 50.46
SPW-789	WATER	Jan, 1999	Cs-137	45.17 ± 8.63	37.70	27.70 - 47.70
SPW-791	WATER	Feb, 1999	Ra-226	15.50 ± 0.60	13.80	9.66 - 17.94
SPW-791	WATER	Feb, 1999	Ra-228	6.36 ± 1.39	8.20	5.74 - 10.66
SPW-792	WATER	Feb, 1999	Gr. Alpha	24.36 ± 2.08	33.97	16.99 - 50.96
SPW-792	WATER	Feb, 1999	Gr. Beta	28.98 ± 1.79	30.13	20.13 - 40.13
SPU-1030	WATER	Feb, 1999	Ra-226	38.81 ± 1.30	34.45	24.12 - 44.79
SPW-1460	WATER	Mar, 1999	Ra-226	13.26 ± 0.55	13.79	9.65 - 17.93
SPW-1460	WATER	Mar, 1999	Ra-228	12.53 ± 1.47	16.26	11.38 - 21.13
SPW-1466	WATER	Mar, 1999	Gr. Alpha	61.00 ± 3.08	49.44	24.72 - 74.15
SPW-1466	WATER	Mar, 1999	Gr. Beta	35.52 ± 1.86	30.07	20.07 - 40.07
SPMI-1677	MILK	Mar, 1999	Cs-137	17.17 ± 2.08	18.78	8.78 - 28.78
SPMI-1677	MILK	Mar, 1999	Sr-90	34.94 ± 1.53	31.85	25.48 - 38.22
SPW-1681	WATER	Mar, 1999	Sr-89	49.30 ± 3.85	59.20	47.36 - 71.04
SPW-1681	WATER	Mar, 1999	Sr-90	29.00 ± 1.65	31.85	25.48 - 38.22
SPW-2264	WATER	Apr, 1999	Ra-226	12.44 ± 0.14	13.80	9.66 - 17.94
SPW-2264	WATER	Apr, 1999	Ra-228	18.73 ± 1.92	16.08	11.26 - 20.90
SPAP-2395	AIR FILTER	Apr, 1999	Cs-137	1.86 ± 0.02	1.81	1.09 - 2.53
SPW-2265	WATER	Apr, 1999	Gr. Alpha	62.89 ± 5.90	49.40	24.70 - 74.10
SPW-2265	WATER	Apr, 1999	Gr. Beta	34.52 ± 3.24	30.00	20.00 - 40.00
SPW-2574	WATER	Apr, 1999	H-3	56548.00 ± 648.00	57517.00	46013.60 - 69020.40
SPMI-2686	MILK	Apr, 1999	Cs-134	23.56 ± 5.30	22.30	12.30 - 32.30
SPMI-2686	MILK	Apr, 1999	Cs-137	40.21 ± 7.19	37.50	27.50 - 47.50
SPW-2688	WATER	Apr, 1999	Co-60	20.79 ± 5.61	19.64	9.64 - 29.64
SPW-2688	WATER	Apr, 1999	Cs-134	23.16 ± 6.13	22.29	12.29 - 32.29
SPW-2688	WATER	Apr, 1999	Cs-137	37.49 ± 3.75	31.60	21.60 - 41.60
SPAP-2653	AIR FILTER	Apr, 1999	Gr. Beta	8.96 ± 0.05	8.19	0.00 - 18.19
SPVE-2977	VEGETATION	May, 1999	Cs-134	0.67 ± 0.04	0.68	0.41 - 0.95
SPVE-2977	VEGETATION	May, 1999	Cs-137	0.55 ± 0.05	0.58	0.35 - 0.81
SPW-3314	WATER	May, 1999	Ra-226	13.62 ± 0.35	13.79	9.65 - 17.93
SPW-3314	WATER	May, 1999	Ra-228	16.57 ± 1.73	15.93	11.15 - 20.71
SPSO-3317	SOIL	May, 1999	Cs-134	0.09 ± 0.01	0.07	0.04 - 0.10
SPSO-3317	SOIL	May, 1999	Cs-137	0.54 ± 0.05	0.42	0.25 - 0.59
SPSO-3318	SOIL	May, 1999	Cs-134	0.09 ± 0.02	0.07	0.04 - 0.10

Table A-3. In-house "spike" samples.

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[a] Teledyne Results 2s, n=1[b]	Known Activity	Control[c] Limits
SPSO-3318	SOIL	May, 1999	Cs-137	0.54 ± 0.02	0.42	0.25 - 0.59
SPW-3315	WATER	May, 1999	Gr. Beta	32.57 ± 1.63	29.95	19.95 - 39.95
SPF-3777	FISH	May, 1999	Cs-134	0.43 ± 0.03	0.52	0.31 - 0.73
SPF-3777	FISH	May, 1999	Cs-137	0.57 ± 0.04	0.60	0.36 - 0.84
SPW-3721	WATER	Jun, 1999	Rn-222	553.52 ± 46.70	610.35	366.21 - 854.49
SPW-4005	WATER	Jun, 1999	Ra-226	13.85 ± 0.42	13.79	9.65 - 17.93
SPW-4005	WATER	Jun, 1999	Ra-228	16.42 ± 1.81	15.77	11.04 - 20.50
SPW-4006	WATER	Jun, 1999	Gr. Alpha	46.32 ± 2.80	49.41	24.71 - 74.12
SPW-4006	WATER	Jun, 1999	Gr. Beta	32.12 ± 1.83	29.90	19.90 - 39.90
SPW-4869	WATER	Jul, 1999	Ra-226	14.00 ± 0.47	13.79	9.65 - 17.93
SPW-4869	WATER	Jul, 1999	Ra-228	14.96 ± 1.53	15.62	10.93 - 20.31
SPW-4870	WATER	Jul, 1999	Gr. Alpha	70.07 ± 3.45	29.84	14.92 - 44.76
SPW-4870	WATER	Jul, 1999	Gr. Beta	84.01 ± 2.62	41.18	31.18 - 51.18
Results for gross alpha and beta appear to be approximately 2x the spike level. The sample volume or spike level is suspect.						
SPW-4964	WATER	Jul, 1999	H-3	60442.00 ± 679.00	56807.00	45445.60 - 68168.40
SPAP-5001	AIR FILTER	Jul, 1999	Cs-137	2.03 ± 0.02	1.79	1.07 - 2.51
SPAP-5003	AIR FILTER	Jul, 1999	Gr. Beta	7.48 ± 0.02	8.15	0.00 - 18.15
SPMI-5348	MILK	Jul, 1999	Sr-89	46.85 ± 4.96	55.53	44.42 - 66.64
SPMI-5348	MILK	Jul, 1999	Sr-90	31.47 ± 1.65	31.60	25.28 - 37.92
SPW-5502	WATER	Jul, 1999	Sr-89	43.27 ± 2.81	51.15	40.92 - 61.38
SPW-5502	WATER	Jul, 1999	Sr-90	31.80 ± 1.56	31.59	25.27 - 37.91
SPF-5676	FISH	Jul, 1999	Cs-134	0.67 ± 0.04	0.65	0.39 - 0.91
SPF-5676	FISH	Jul, 1999	Cs-137	0.63 ± 0.05	0.60	0.36 - 0.83
SPCH-5833	CHARCOAL CANISTER	Aug, 1999	I-131(g)	1.46 ± 0.06	1.40	0.84 - 1.96
SPVE-5826	VEGETATION	Aug, 1999	I-131(g)	1.43 ± 0.09	1.25	0.75 - 1.75
SPMI-5828	MILK	Aug, 1999	Cs-134	31.46 ± 5.05	30.23	20.23 - 40.23
SPMI-5828	MILK	Aug, 1999	Cs-137	39.22 ± 7.60	37.23	27.23 - 47.23
SPMI-5828	MILK	Aug, 1999	I-131	72.33 ± 1.06	79.17	63.34 - 95.00
SPMI-5828	MILK	Aug, 1999	I-131(g)	77.99 ± 8.12	79.17	47.50 - 89.17
SPW-5830	WATER	Aug, 1999	Ra-226	13.82 ± 0.34	13.79	9.65 - 17.93
SPW-5830	WATER	Aug, 1999	Ra-228	13.59 ± 1.80	15.46	10.82 - 20.10
SPW-5831	WATER	Aug, 1999	Gr. Alpha	46.05 ± 2.93	41.17	20.59 - 61.76
SPW-5831	WATER	Aug, 1999	Gr. Beta	35.66 ± 2.01	29.78	19.78 - 39.78
SPW-6076	WATER	Aug, 1999	I-131	83.72 ± 0.98	99.30	79.44 - 119.16
SPW-6076	WATER	Aug, 1999	I-131(g)	105.38 ± 18.30	99.30	59.58 - 109.30
SPW-6542	WATER	Sep, 1999	Ra-226	15.38 ± 0.52	13.79	9.65 - 17.93
SPW-6542	WATER	Sep, 1999	Ra-228	16.48 ± 2.25	15.46	10.82 - 20.10
SPW-6543	WATER	Sep, 1999	Gr. Alpha	47.77 ± 2.69	41.17	20.59 - 61.76
SPW-6543	WATER	Sep, 1999	Gr. Beta	35.25 ± 1.86	29.78	19.78 - 39.78
SPW-7468	WATER	Oct, 1999	Ra-226	14.36 ± 0.41	13.79	9.65 - 17.93

Table A-3. In-house "spike" samples.

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[a] Teledyne Results 2s, n=1[b]	Known Activity	Control[c] Limits
SPW-7468	WATER	Oct, 1999	Ra-228	13.41 ± 1.45	15.16	10.61 - 19.71
SPW-7469	WATER	Oct, 1999	Gr. Beta	31.37 ± 3.16	29.68	19.68 - 39.68
SPW-7486	WATER	Oct, 1999	I-131	49.26 ± 0.89	48.82	36.82 - 60.82
SPMI-7488	MILK	Oct, 1999	I-131	49.54 ± 0.89	48.82	36.82 - 60.82
SPSO-7761	SOIL	Oct, 1999	Cs-134	0.06 ± 0.01	0.07	0.04 - 0.10
SPSO-7761	SOIL	Oct, 1999	Cs-137	0.53 ± 0.01	0.49	0.29 - 0.69
SPAP-7763	AIR FILTER	Oct, 1999	Cs-137	1.84 ± 0.02	1.79	1.07 - 2.51
SPW-7469	WATER	Oct, 1999	Gr. Alpha	43.55 ± 4.67	41.16	20.58 - 61.74
SPF-8545	FISH	Oct, 1999	Cs-134	0.60 ± 0.03	0.59	0.36 - 0.83
SPF-8545	FISH	Oct, 1999	Cs-137	0.60 ± 0.04	0.59	0.36 - 0.83
SPMI-9028	MILK	Oct, 1999	Cs-134	39.43 ± 6.37	37.43	27.43 - 47.43
SPMI-9028	MILK	Oct, 1999	Cs-137	40.93 ± 9.42	37.05	27.05 - 47.05
SPW-8773	WATER	Nov, 1999	Ra-226	11.30 ± 0.14	13.79	9.65 - 17.93
SPW-8773	WATER	Nov, 1999	Ra-228	15.18 ± 2.26	15.00	10.50 - 19.50
SPW-8774	WATER	Nov, 1999	Gr. Alpha	43.12 ± 3.09	41.15	20.58 - 61.73
SPW-8774	WATER	Nov, 1999	Gr. Beta	31.98 ± 2.06	29.62	19.62 - 39.62
SPW-9133	WATER	Nov, 1999	Co-60	30.70 ± 4.43	29.06	19.06 - 39.06
SPW-9133	WATER	Nov, 1999	Cs-134	40.56 ± 4.53	36.59	26.59 - 46.59
SPW-9133	WATER	Nov, 1999	Cs-137	38.20 ± 6.14	36.98	26.98 - 46.98
SPW-9720	WATER	Nov, 1999	H-3	57335.00 ± 657.00	58177.00	46541.60 - 69812.40
SPW-9717	WATER	Dec, 1999	Ra-228	18.88 ± 1.80	14.80	10.36 - 19.24
SPW-9719	WATER	Dec, 1999	Ra-226	14.91 ± 0.48	13.79	9.65 - 17.93
SPCH-9806	CHARCOAL CANISTER	Dec, 1999	I-131(g)	0.06 ± 0.01	0.06	0.04 - 0.09
SPW-9718	WATER	Dec, 1999	Gr. Alpha	44.82 ± 2.39	44.81	22.41 - 67.22
SPW-9718	WATER	Dec, 1999	Gr. Beta	33.93 ± 1.72	29.54	19.54 - 39.54
SPW-9718	WATER	Dec, 1999	Gr. Beta	33.93 ± 1.72	29.54	19.54 - 39.54

[a] All results are in pCi/L, except for elemental potassium (K) in milk, which are in mg/L.; air filter samples, which are in pCi/Filter; and food products, which are in mg/kg.

[b] All samples are the results of single determinations.

[c] Control limits are based on Attachment A, page A2 of this report.

NOTE: For fish, Jello is used for the spike matrix. For vegetation, Sawdust is used for the spike matrix.

Table A-4. In-house "blank" samples.

Lab Code	Sample Type	Sample Date	Analysis	Concentration pCi/L[a]. Teledyne Results (4.66 Sigma) LLD	Teledyne Results (4.66 Sigma) Activity[b]	Acceptance Criteria (4.66 Sigma)
SPW-141	WATER	Jan 1999	Gr. Alpha	< 0.470	0.207 ± 0.320	< 1.00
SPW-141	WATER	Jan 1999	Gr. Beta	< 0.890	0.234 ± 0.591	< 3.20
SPW-141	WATER	Jan 1999	Ra-226	< 0.064	0.054 ± 0.030	< 1.00
SPW-141	WATER	Jan 1999	Ra-228	< 1.000	0.460 ± 0.530	< 1.00
SPW-255	WATER	Jan 1999	H-3	< 178.000	23.455 ± 94.510	< 200.00
SPW-790	WATER	Feb 1999	Gr. Alpha	< 0.440	-0.130 ± 0.250	< 1.00
SPW-790	WATER	Feb 1999	Gr. Beta	< 1.010	-0.250 ± 0.610	< 3.20
SPW-790	WATER	Feb 1999	Ra-226	< 0.036	0.026 ± 0.017	< 1.00
SPW-790	WATER	Feb 1999	Ra-228	< 0.850	0.355 ± 0.440	< 1.00
SPW-1461	WATER	Mar 1999	Gr. Alpha	< 0.800	0.060 ± 0.540	< 1.00
SPW-1461	WATER	Mar 1999	Gr. Beta	< 1.600	0.460 ± 1.080	< 3.20
SPW-1461	WATER	Mar 1999	Ra-226	< 0.044	0.071 ± 0.028	< 1.00
SPW-1461	WATER	Mar 1999	Ra-228	< 0.700	0.280 ± 0.350	< 1.00
SPMI-1678	MILK	Mar 1999	Sr-89	< 0.590	-0.190 ± 0.670	< 5.00
SPMI-1678	MILK	Mar 1999	Sr-90		1.020 ± 0.360	< 1.00
Low level of Sr-90 concentration in milk (1-5 pCi/L) is not unusual.						
SPW-1682	WATER	Mar 1999	Sr-89	< 0.530	-0.310 ± 0.450	< 5.00
SPW-1682	WATER	Mar 1999	Sr-90	< 0.590	0.256 ± 0.307	< 1.00
SPW-2263	WATER	Apr 1999	Gr. Alpha	< 0.380	-0.160 ± 0.240	< 1.00
SPW-2263	WATER	Apr 1999	Gr. Beta	< 0.880	0.320 ± 0.580	< 3.20
SPW-2263	WATER	Apr 1999	Ra-226	< 0.013	0.023 ± 0.009	< 1.00
SPW-2263	WATER	Apr 1999	Ra-228	< 0.680	0.310 ± 0.360	< 1.00
SPW-2575	WATER	Apr 1999	H-3	< 158.000	23.150 ± 79.380	< 200.00
SPAP-2652	AIR FILTER	Apr 1999	Gr. Beta	< 0.003	-0.000 ± 0.001	< 3.20
SPW-3316	WATER	May 1999	Ra-226	< 0.027	0.030 ± 0.014	< 1.00
SPW-3316	WATER	May 1999	Ra-228	< 0.800	0.192 ± 0.397	< 1.00
SPW-3316	WATER	May 1999	Gr. Alpha	< 0.830	0.310 ± 0.600	< 1.00
SPW-3316	WATER	May 1999	Gr. Beta	< 1.580	0.220 ± 1.110	< 3.20
SPW-4004	WATER	Jun 1999	Gr. Alpha	< 0.870	-0.030 ± 0.570	< 1.00
SPW-4004	WATER	Jun 1999	Gr. Beta	< 1.740	0.470 ± 1.150	< 3.20
SPW-4004	WATER	Jun 1999	Ra-226	< 0.023	0.036 ± 0.014	< 1.00
SPW-4004	WATER	Jun 1999	Ra-228	< 0.990	0.770 ± 0.551	< 1.00
SPW-4871	WATER	Jul 1999	Gr. Alpha	< 0.660	-0.420 ± 0.470	< 1.00
SPW-4871	WATER	Jul 1999	Gr. Beta	< 1.420	0.400 ± 1.060	< 3.20
SPW-4871	WATER	Jul 1999	Ra-226	< 0.019	0.021 ± 0.013	< 1.00
SPW-4871	WATER	Jul 1999	Ra-228	< 0.620	0.610 ± 0.360	< 1.00

Table A-4. In-house "blank" samples.

Lab Code	Sample Type	Sample Date	Analysis	Concentration pCi/L[a]. Teledyne Results (4.66 Sigma) LLD	Teledyne Results (4.66 Sigma) Activity[b]	Acceptance Criteria (4.66 Sigma)
SPW-4965	WATER	Jul 1999	H-3	< 176.000	8.100 ± 87.800	< 200.00
SPMI-5349	MILK	Jul 1999	Sr-89	< 0.410	-0.750 ± 0.540	< 5.00
SPMI-5349	MILK	Jul 1999	Sr-90		1.140 ± 0.360	< 1.00
Low level of Sr-90 concentration in milk (1-5 pCi/L) is not unusual.						
SPW-5501	WATER	Jul 1999	Sr-89	< 0.450	0.150 ± 0.450	< 5.00
SPW-5501	WATER	Jul 1999	Sr-90	< 0.580	0.280 ± 0.310	< 1.00
SPMI-5829	MILK	Aug 1999	I-131	< 0.240	0.140 ± 0.140	< 0.50
SPW-5832	WATER	Aug 1999	Gr. Alpha	< 0.890	0.570 ± 0.600	< 1.00
SPW-5832	WATER	Aug 1999	Gr. Beta	< 2.000	0.590 ± 1.230	< 3.20
SPW-5832	WATER	Aug 1999	Ra-226	< 0.020	0.090 ± 0.010	< 1.00
SPW-5832	WATER	Aug 1999	Ra-228	< 0.780	0.110 ± 0.370	< 1.00
SPW-6067	WATER	Aug 1999	I-131	< 0.250	0.017 ± 0.170	< 0.50
SPW-6541	WATER	Sep 1999	Gr. Alpha	< 0.770	0.360 ± 0.530	< 1.00
SPW-6541	WATER	Sep 1999	Gr. Beta	< 1.690	0.410 ± 1.130	< 3.20
SPW-6541	WATER	Sep 1999	Ra-226	< 0.020	0.160 ± 0.020	< 1.00
SPW-6541	WATER	Sep 1999	Ra-228	< 1.280	0.018 ± 0.594	< 1.00
SPW-7467	WATER	Oct 1999	Ra-226		0.069 ± 0.014	< 1.00
SPW-7467	WATER	Oct 1999	Ra-228	< 0.892	0.461 ± 0.467	< 1.00
SPW-7487	WATER	Oct 1999	I-131	< 0.260	0.080 ± 0.150	< 0.50
SPMI-7489	MILK	Oct 1999	I-131	< 0.250	0.140 ± 0.150	< 0.50
SPW-8775	WATER	Nov 1999	Ra-226		0.050 ± 0.012	< 1.00
SPW-8775	WATER	Nov 1999	Ra-228	< 0.989	0.380 ± 0.500	< 1.00
SPW-9721	WATER	Nov 1999	H-3	< 158.000	51.400 ± 80.600	< 200.00
SPW-9719	WATER	Dec 1999	Ra-226		0.031 ± 0.013	< 1.00

[a] Liquid sample results are reported in pCi/Liter, air filter sample results are in pCi/filter, charcoal sample results are in pCi/charcoal, and solid sample results are in pCi/kilogram.
[b] The activity reported is the net activity result.

Table A-5. In-house "duplicate" samples.

Lab Codes	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
E-47, 48	Jan, 1999	Gr. Beta	1.206 ± 0.056	1.265 ± 0.061	1.236 ± 0.041
E-47, 48	Jan, 1999	K-40	1.283 ± 0.136	1.394 ± 0.182	1.339 ± 0.114
SW-68, 69	Jan, 1999	K-40 (FP)	1.300 ± 0.130	1.300 ± 0.130	1.300 ± 0.092
LW-153, 154	Jan, 1999	Gr. Beta	1.509 ± 0.647	1.619 ± 0.646	1.564 ± 0.457
WW-373, 374	Jan, 1999	H-3	171.100 ± 83.600	131.700 ± 81.800	151.400 ± 58.481
SW-867, 868	Jan, 1999	H-3	1,149.300 ± 122.100	1,225.000 ± 124.400	1,187.150 ± 87.155
SWT-425, 426	Jan, 1999	Gr. Beta	2.572 ± 0.639	2.646 ± 0.598	2.609 ± 0.438
CW-450, 451	Jan, 1999	Gr. Beta	0.600 ± 1.100	0.700 ± 1.100	0.650 ± 0.778
SW-570, 571	Feb, 1999	K-40 (FP)	1.730 ± 0.173	1.644 ± 0.164	1.687 ± 0.119
LW-614, 615	Feb, 1999	Gr. Alpha	0.354 ± 0.369	0.666 ± 0.390	0.510 ± 0.268
LW-614, 615	Feb, 1999	Gr. Beta	2.213 ± 0.406	2.613 ± 0.442	2.413 ± 0.300
MI-682, 683	Feb, 1999	Co-60	0.200 ± 0.600	-0.400 ± 2.700	-0.100 ± 1.383
MI-682, 683	Feb, 1999	Cs-137	0.300 ± 3.700	0.600 ± 2.700	0.450 ± 2.290
MI-682, 683	Feb, 1999	I-131	0.200 ± 0.300	0.200 ± 0.300	0.200 ± 0.212
WW-968, 969	Feb, 1999	H-3	199.300 ± 89.600	80.900 ± 84.500	140.100 ± 61.580
CW-1042, 1043	Feb, 1999	Gr. Beta	3.200 ± 1.500	3.500 ± 1.530	3.350 ± 1.071
LW-1523, 1524	Feb, 1999	Gr. Beta	1.930 ± 0.567	2.197 ± 0.584	2.063 ± 0.407
MI-1627, 1628	Mar, 1999	K-40	1,340.200 ± 118.000	1,409.300 ± 112.000	1,374.750 ± 81.345
WW-1808, 1809	Mar, 1999	H-3	4.400 ± 83.400	47.400 ± 85.300	25.900 ± 59.648
LW-2937, 2938	Mar, 1999	Gr. Beta	3.044 ± 0.663	3.242 ± 0.660	3.143 ± 0.468
AP-2155, 2156	Mar, 1999	Be-7	0.078 ± 0.017	0.073 ± 0.015	0.075 ± 0.011
AP-2357, 2358	Mar, 1999	Be-7	0.081 ± 0.016	0.086 ± 0.020	0.084 ± 0.013
AP-1991, 1992	Mar, 1999	Be-7	0.218 ± 0.079	0.149 ± 0.062	0.184 ± 0.050
AP-1991, 1992	Mar, 1999	Be-7	0.083 ± 0.011	0.082 ± 0.015	0.083 ± 0.009
LW-2405, 2406	Mar, 1999	Gr. Beta	3.322 ± 0.473	2.292 ± 0.468	2.807 ± 0.333
LW-2474, 2475	Mar, 1999	Gr. Beta	2.003 ± 0.592	2.742 ± 0.648	2.372 ± 0.439
LW-2474, 2475	Mar, 1999	H-3	124.016 ± 84.129	151.507 ± 85.318	137.762 ± 59.910
MI-2019, 2020	Apr, 1999	K-40	1,277.300 ± 173.000	1,377.800 ± 107.000	1,327.550 ± 101.708
MI-2019, 2020	Apr, 1999	Sr-90	0.615 ± 0.366	1.126 ± 0.368	0.871 ± 0.260
WW-2040, 2041	Apr, 1999	Gr. Beta	1.424 ± 0.316	1.233 ± 0.329	1.329 ± 0.228
WW-2040, 2041	Apr, 1999	K-40 (FP)	1.100 ± 0.110	1.100 ± 0.110	1.100 ± 0.078
MI-2134, 2135	Apr, 1999	K-40	1,316.000 ± 147.000	1,485.100 ± 168.000	1,400.550 ± 111.617
AP-2658, 2659	Apr, 1999	Be-7	0.134 ± 0.067	0.175 ± 0.105	0.154 ± 0.062
MI-2019, 2020	Apr, 1999	Calcium	0.850 ± 0.085	0.880 ± 0.088	0.865 ± 0.061
MI-2251, 2252	Apr, 1999	K-40	1,261.900 ± 156.000	1,320.800 ± 141.000	1,291.350 ± 105.139

Table A-5. In-house "duplicate" samples.

Lab Codes	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
MI-2451, 2452	Apr, 1999	K-40	1,647.700 ± 201.000	1,706.300 ± 159.000	1,677.000 ± 128.142
SS-2528, 2529	Apr, 1999	Gr. Beta	7.724 ± 1.978	9.287 ± 1.970	8.505 ± 1.396
SS-2528, 2529	Apr, 1999	K-40	7.530 ± 0.520	8.073 ± 0.388	7.802 ± 0.324
SS-2758, 2759	Apr, 1999	Gr. Beta	6.540 ± 2.200	4.960 ± 2.190	5.750 ± 1.552
SS-2758, 2759	Apr, 1999	K-40	7.483 ± 0.416	7.357 ± 0.432	7.420 ± 0.300
SS-2758, 2759	Apr, 1999	Sr-90	0.006 ± 0.008	-0.005 ± 0.007	0.000 ± 0.005
BS-3093, 3094	Apr, 1999	Gr. Beta	5.180 ± 1.350	5.960 ± 1.370	5.570 ± 0.962
F-3072, 3073	Apr, 1999	K-40	2.991 ± 0.332	2.438 ± 0.347	2.714 ± 0.240
MI-3001, 3002	Apr, 1999	K-40	1,485.800 ± 142.000	1,564.900 ± 162.000	1,525.350 ± 107.713
LW-3149, 3150	Apr, 1999	Gr. Beta	1.982 ± 0.595	2.120 ± 0.612	2.051 ± 0.427
SW-3047, 3048	May, 1999	Gr. Beta	2.281 ± 0.585	2.194 ± 0.567	2.238 ± 0.407
SW-3047, 3048	May, 1999	K-40 (FP)	1.300 ± 0.130	1.400 ± 0.140	1.350 ± 0.096
F-3238, 3239	May, 1999	Gr. Beta	3.329 ± 0.135	3.388 ± 0.144	3.358 ± 0.099
F-3238, 3239	May, 1999	K-40	2.866 ± 0.366	2.792 ± 0.337	2.829 ± 0.249
BS-3195, 3196	May, 1999	K-40	8.610 ± 0.620	9.320 ± 0.540	8.965 ± 0.411
AP-3769, 3770	May, 1999	Be-7	0.135 ± 0.075	0.188 ± 0.097	0.161 ± 0.061
MI-3259, 3260	May, 1999	K-40	1,444.800 ± 94.200	1,460.300 ± 166.000	1,452.550 ± 95.433
AP-3304, 3305	May, 1999	Be-7	0.104 ± 0.083	0.095 ± 0.068	0.099 ± 0.054
G-3461, 3462	May, 1999	Be-7	0.454 ± 0.210	0.350 ± 0.154	0.402 ± 0.130
G-3461, 3462	May, 1999	K-40	5.341 ± 0.492	4.837 ± 0.619	5.089 ± 0.395
SW-3217, 3218	May, 1999	Gr. Alpha	1.223 ± 1.323	2.490 ± 1.230	1.857 ± 0.903
SW-3217, 3218	May, 1999	Gr. Beta	4.956 ± 1.232	5.715 ± 1.221	5.336 ± 0.867
LW-2937, 2938	May, 1999	Gr. Beta	2.379 ± 0.626	2.864 ± 0.641	2.622 ± 0.448
SWU-2853, 2854	May, 1999	Gr. Beta	2.860 ± 0.539	3.065 ± 0.577	2.962 ± 0.395
DW-2878, 2879	May, 1999	Gr. Beta	0.706 ± 0.319	0.849 ± 0.335	0.777 ± 0.231
G-3461, 3462	May, 1999	Gr. Beta	5.205 ± 0.169	5.166 ± 0.110	5.186 ± 0.101
SO-3482, 3483	May, 1999	Cs-137	0.456 ± 0.059	0.467 ± 0.048	0.461 ± 0.038
SO-3482, 3483	May, 1999	Gr. Beta	24.880 ± 1.980	26.170 ± 2.150	25.525 ± 1.461
SO-3482, 3483	May, 1999	K-40	20.631 ± 1.240	20.077 ± 0.906	20.354 ± 0.768
SO-2832, 2833	May, 1999	Cs-137	0.390 ± 0.052	0.403 ± 0.031	0.397 ± 0.030
SO-2832, 2833	May, 1999	K-40	26.000 ± 0.660	24.673 ± 1.240	25.337 ± 0.702
SWT-3675, 3676	May, 1999	Gr. Beta	2.439 ± 0.598	2.530 ± 0.630	2.484 ± 0.434
LW-3699, 3700	May, 1999	Gr. Beta	2.488 ± 0.596	3.002 ± 0.654	2.745 ± 0.442
MI-3748, 3749	Jun, 1999	K-40	1,553.800 ± 178.000	1,408.600 ± 149.000	1,481.200 ± 116.066
SW-4107, 4108	Jun, 1999	Gr. Alpha	3.993 ± 0.919	3.606 ± 0.875	3.800 ± 0.635

Table A-5. In-house "duplicate" samples.

Lab Codes	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
SW-4107, 4108	Jun, 1999	Gr. Beta	6.271 ± 0.754	6.910 ± 0.807	6.591 ± 0.552
SS-4065, 4066	Jun, 1999	K-40	7.350 ± 0.400	7.945 ± 0.370	7.648 ± 0.272
AP-3986, 3987	Jun, 1999	Be-7	0.272 ± 0.147	0.182 ± 0.085	0.227 ± 0.085
G-4007, 4008	Jun, 1999	Be-7	0.830 ± 0.210	0.950 ± 0.200	0.890 ± 0.145
G-4007, 4008	Jun, 1999	K-40	5.790 ± 0.460	4.990 ± 0.400	5.390 ± 0.305
MI-4172, 4173	Jun, 1999	K-40	1,423.600 ± 115.000	1,481.300 ± 129.000	1,452.450 ± 86.409
MI-4293, 4294	Jun, 1999	K-40	1,397.200 ± 179.000	1,388.100 ± 130.000	1,392.650 ± 110.613
AP-4317, 4318	Jun, 1999	Be-7	0.201 ± 0.125	0.213 ± 0.088	0.207 ± 0.076
AP-4894, 4895	Jun, 1999	Be-7	0.092 ± 0.019	0.091 ± 0.014	0.092 ± 0.012
G-4426, 4427	Jun, 1999	Be-7	0.730 ± 0.210	0.630 ± 0.170	0.680 ± 0.135
G-4426, 4427	Jun, 1999	K-40	3.230 ± 0.350	3.400 ± 0.440	3.315 ± 0.281
AP-4454, 4455	Jun, 1999	Be-7	0.205 ± 0.120	0.238 ± 0.087	0.222 ± 0.074
SWU-4601, 4602	Jun, 1999	Gr. Beta	2.209 ± 0.568	1.980 ± 0.589	2.094 ± 0.409
SWU-4601, 4602	Jun, 1999	Gr. Beta	2.209 ± 0.568	1.980 ± 0.589	2.094 ± 0.409
SW-4622, 4623	Jun, 1999	Gr. Beta	2.130 ± 0.854	2.267 ± 0.803	2.198 ± 0.586
AP-4915, 4916	Jun, 1999	Be-7	0.089 ± 0.012	0.094 ± 0.015	0.091 ± 0.010
LW-4974, 4975	Jun, 1999	Gr. Beta	1.916 ± 0.578	2.617 ± 0.644	2.267 ± 0.433
LW-5039, 5040	Jun, 1999	Gr. Beta	2.170 ± 0.610	2.030 ± 0.580	2.100 ± 0.421
LW-5039, 5040	Jun, 1999	H-3	90.659 ± 81.800	162.800 ± 85.000	126.730 ± 58.984
G-4643, 4644	Jul, 1999	Be-7	1.326 ± 0.460	1.555 ± 0.390	1.441 ± 0.302
G-4643, 4644	Jul, 1999	Gr. Beta	5.870 ± 0.151	5.798 ± 0.150	5.834 ± 0.106
G-4643, 4644	Jul, 1999	K-40	5.738 ± 0.780	6.200 ± 0.733	5.969 ± 0.535
SW-4664, 4665	Jul, 1999	Gr. Beta	1.956 ± 0.415	1.836 ± 0.429	1.896 ± 0.298
SW-4664, 4665	Jul, 1999	K-40	1.120	1.120	1.120
WW-4690, 4691	Jul, 1999	Co-60	0.860 ± 1.840	0.374 ± 0.344	0.617 ± 0.936
WW-4690, 4691	Jul, 1999	Cs-137	-0.806 ± 3.130	-2.010 ± 2.610	-1.408 ± 2.038
WW-4690, 4691	Jul, 1999	H-3	399.519 ± 103.570	564.249 ± 109.428	481.884 ± 75.335
WW-4808, 4809	Jul, 1999	Co-60	-0.360 ± 1.910	1.420 ± 25.700	0.530 ± 12.885
WW-4808, 4809	Jul, 1999	Cs-137	0.446 ± 2.260	-1.060 ± 1.720	-0.307 ± 1.420
WW-4808, 4809	Jul, 1999	H-3	72.004 ± 90.621	94.545 ± 91.551	83.274 ± 64.409
MI-4742, 4743	Jul, 1999	K-40	1,344.000 ± 66.000	1,375.000 ± 112.000	1,359.500 ± 65.000
CW-5018, 5019	Jul, 1999	H-3	364.162 ± 92.219	430.163 ± 94.673	397.163 ± 66.082
VE-4873, 4874	Jul, 1999	Be-7	2.023 ± 0.294	1.882 ± 0.338	1.953 ± 0.224
VE-4873, 4874	Jul, 1999	K-40	7.894 ± 0.650	7.394 ± 0.655	7.644 ± 0.461
F-5124, 5125	Jul, 1999	K-40	2.394 ± 0.364	2.802 ± 0.360	2.598 ± 0.256

Table A-5. In-house "duplicate" samples.

Lab Codes	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
VE-5187, 5188	Jul, 1999	K-40	2.990 ± 0.422	3.265 ± 0.446	3.128 ± 0.307
VE-5187, 5188	Jul, 1999	Sr-90	0.005 ± 0.002	0.002 ± 0.002	0.004 ± 0.002
CW-5212, 5213	Jul, 1999	Gr. Beta	2.187 ± 1.449	2.452 ± 1.381	2.320 ± 1.001
CW-5212, 5213	Jul, 1999	Gr. Beta	-0.405 ± 1.220	-0.438 ± 1.196	-0.422 ± 0.854
MI-5260, 5261	Jul, 1999	K-40	1,367.000 ± 172.000	1,462.000 ± 161.000	1,414.500 ± 117.797
MI-5287, 5288	Jul, 1999	K-40	1,417.900 ± 89.000	1,280.700 ± 163.000	1,349.300 ± 92.857
PW-5237, 5238	Jul, 1999	H-3	189.773 ± 96.797	220.943 ± 97.971	205.358 ± 68.862
AP-5329, 5330	Jul, 1999	Be-7	0.168 ± 0.065	0.140 ± 0.122	0.154 ± 0.069
SWU-5379, 5380	Jul, 1999	Gr. Beta	2.571 ± 0.605	2.219 ± 0.611	2.395 ± 0.430
SWU-5379, 5380	Jul, 1999	H-3	484.749 ± 105.455	520.309 ± 106.709	502.529 ± 75.013
G-5354, 5355	Jul, 1999	Be-7	1.120 ± 0.270	1.030 ± 0.160	1.075 ± 0.157
G-5354, 5355	Jul, 1999	K-40	6.160 ± 0.450	5.990 ± 0.530	6.075 ± 0.348
MI-5520, 5521	Jul, 1999	Co-60	-1.180 ± 3.460	-2.330 ± 2.740	-1.755 ± 2.207
MI-5520, 5521	Jul, 1999	Cs-137	1.450 ± 2.200	3.160 ± 2.660	2.305 ± 1.726
MI-5520, 5521	Jul, 1999	I-131	0.184 ± 0.283	0.009 ± 0.285	0.096 ± 0.201
AP-5499, 5500	Jul, 1999	Be-7	0.181 ± 0.070	0.175 ± 0.066	0.178 ± 0.048
CW-5550, 5551	Jul, 1999	Gr. Beta	1.858 ± 1.362	1.361 ± 1.329	1.609 ± 0.952
CW-5550, 5551	Jul, 1999	Gr. Beta	1.208 ± 1.334	-0.174 ± 0.933	0.517 ± 0.814
WW-5575, 5576	Jul, 1999	H-3	224.412 ± 93.866	220.812 ± 93.728	222.612 ± 66.325
MI-5596, 5597	Jul, 1999	K-40	1,355.200 ± 157.000	1,370.900 ± 191.000	1,363.050 ± 123.622
MI-5644, 5645	Jul, 1999	Calcium	0.830 ± 0.083	0.840 ± 0.084	0.835 ± 0.059
MI-5644, 5645	Jul, 1999	K-40	1,327.000 ± 141.000	1,488.000 ± 169.000	1,407.500 ± 110.048
MI-5644, 5645	Jul, 1999	Sr-90	1.300 ± 0.350	1.070 ± 0.350	1.185 ± 0.247
MI-4742, 4743	Aug, 1999	Sr-90	0.502 ± 0.243	0.702 ± 0.303	0.602 ± 0.194
MI-5666, 5667	Aug, 1999	K-40	1,639.000 ± 161.000	1,724.800 ± 207.000	1,681.900 ± 131.120
WW-5756, 5757	Aug, 1999	Gr. Beta	1.704 ± 0.568	2.432 ± 0.567	2.068 ± 0.401
CW-5712, 5713	Aug, 1999	Gr. Beta	1.906 ± 1.360	1.608 ± 1.270	1.757 ± 0.930
CW-5712, 5713	Aug, 1999	Gr. Beta	-0.269 ± 1.174	-0.634 ± 1.076	-0.451 ± 0.796
G-5735, 5736	Aug, 1999	Be-7	2.961 ± 0.296	3.295 ± 0.492	3.128 ± 0.287
G-5735, 5736	Aug, 1999	K-40	6.731 ± 0.548	6.997 ± 0.492	6.864 ± 0.368
LW-8450, 8451	Aug, 1999	Sr-90	0.390 ± 0.310	0.570 ± 0.310	0.480 ± 0.219
SW-5841, 5842	Aug, 1999	Gr. Alpha	2.850 ± 1.675	2.500 ± 1.685	2.675 ± 1.188
SW-5841, 5842	Aug, 1999	Gr. Beta	9.343 ± 1.425	12.378 ± 1.634	10.860 ± 1.084
VE-5905, 5906	Aug, 1999	Co-60	0.013 ± 0.066	-0.000 ± 0.002	0.006 ± 0.033
VE-5905, 5906	Aug, 1999	Cs-137	0.006 ± 0.008	0.001 ± 0.009	0.004 ± 0.006

Table A-5. In-house "duplicate" samples.

Lab Codes	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
CW-6148, 6149	Aug, 1999	H-3	141.545 ± 89.443	74.402 ± 86.675	107.974 ± 62.275
PW-5968, 5969	Aug, 1999	H-3	1,625.921 ± 147.401	1,698.481 ± 149.269	1,662.201 ± 104.891
MI-6072, 6073	Aug, 1999	K-40	1,478.600 ± 163.000	1,675.400 ± 202.000	1,577.000 ± 129.782
G-6116, 6117	Aug, 1999	Be-7	4.178 ± 0.306	4.319 ± 0.378	4.248 ± 0.243
G-6116, 6117	Aug, 1999	K-40	5.525 ± 0.548	5.657 ± 0.486	5.591 ± 0.366
AP-6200, 6201	Aug, 1999	K-40	8.465 ± 0.356	8.822 ± 0.666	8.643 ± 0.378
DW-6121, 6122	Aug, 1999	Gr. Beta	1.229 ± 0.325	1.022 ± 0.332	1.126 ± 0.233
SWU-6345, 6346	Aug, 1999	Gr. Beta	2.417 ± 0.582	1.870 ± 0.587	2.144 ± 0.413
MI-6242, 6243	Aug, 1999	Co-60	-1.160 ± 3.210	-0.075 ± 0.105	-0.617 ± 1.606
MI-6242, 6243	Aug, 1999	Cs-137	-0.395 ± 2.610	0.534 ± 2.270	0.070 ± 1.730
MI-6242, 6243	Aug, 1999	I-131	-0.112 ± 0.226	0.119 ± 0.239	0.003 ± 0.164
VE-6263, 6264	Aug, 1999	Co-60	0.001 ± 0.002	0.009 ± 0.027	0.005 ± 0.013
VE-6263, 6264	Aug, 1999	Cs-137	0.010 ± 0.010	-0.004 ± 0.009	0.003 ± 0.007
SW-6389, 6390	Aug, 1999	K-40 (FP)	13.000 ± 1.300	12.000 ± 1.200	12.500 ± 0.885
SWU-6452, 6453	Aug, 1999	Gr. Beta	2.587 ± 0.598	2.053 ± 0.561	2.320 ± 0.410
WW-6604, 6605	Aug, 1999	Gr. Beta	2.199 ± 0.578	1.878 ± 0.594	2.039 ± 0.414
WW-6677, 6678	Aug, 1999	H-3	202.838 ± 101.400	122.240 ± 98.143	162.539 ± 70.559
WW-6506, 6507	Sep, 1999	Co-60	-0.789 ± 7.010	0.416 ± 1.310	-0.187 ± 3.566
WW-6506, 6507	Sep, 1999	Cs-137	0.568 ± 3.270	0.834 ± 3.180	0.701 ± 2.281
WW-6506, 6507	Sep, 1999	H-3	29,273.964 ± 494.519	30,525.051 ± 504.610	29,899.507 ± 353.264
MI-6410, 6411	Sep, 1999	K-40	1,128.500 ± 159.000	1,355.900 ± 174.000	1,242.200 ± 117.853
VE-6431, 6432	Sep, 1999	Gr. Beta	1.880 ± 0.053	1.917 ± 0.053	1.899 ± 0.037
VE-6431, 6432	Sep, 1999	K-40	1.697 ± 0.202	1.603 ± 0.192	1.650 ± 0.139
VE-6558, 6559	Sep, 1999	K-40	2.200 ± 0.204	2.222 ± 0.189	2.211 ± 0.139
AP-6704, 6705	Sep, 1999	Be-7	0.020 ± 0.055	0.018 ± 0.081	0.019 ± 0.049
VE-6649, 6650	Sep, 1999	Co-60	0.008 ± 0.015	-0.001 ± 0.004	0.004 ± 0.008
VE-6649, 6650	Sep, 1999	Cs-137	-0.001 ± 0.007	-0.001 ± 0.007	-0.001 ± 0.005
AP-6727, 6728	Sep, 1999	Be-7	0.109 ± 0.043	0.158 ± 0.089	0.134 ± 0.049
VE-6793, 6794	Sep, 1999	Gr. Beta	1.115 ± 0.037	1.139 ± 0.035	1.127 ± 0.025
SO-6937, 6938	Sep, 1999	Cs-137	0.225 ± 0.027	0.260 ± 0.040	0.243 ± 0.024
SO-6937, 6938	Sep, 1999	K-40	10.450 ± 0.520	10.428 ± 0.760	10.439 ± 0.460
SO-6937, 6938	Sep, 1999	Sr-90	0.041 ± 0.017	0.034 ± 0.014	0.038 ± 0.011
SWU-7045, 7046	Sep, 1999	Gr. Beta	2.623 ± 0.606	2.720 ± 0.593	2.672 ± 0.424
AP-7087, 7088	Sep, 1999	Be-7	0.091 ± 0.068	0.119 ± 0.054	0.105 ± 0.043
PW-7013, 7014	Sep, 1999	H-3	3,002.639 ± 183.527	3,038.815 ± 184.318	3,020.727 ± 130.053

Table A-5. In-house "duplicate" samples.

Lab Codes	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
SWT-7964, 7965	Sep, 1999	Sr-90	0.826 ± 0.411	0.501 ± 0.285	0.664 ± 0.250
W-7302, 7303	Sep, 1999	H-3	364.860 ± 109.550	221.740 ± 104.150	293.300 ± 75.578
SS-7432, 7433	Sep, 1999	K-40	8.619 ± 0.487	8.049 ± 0.508	8.334 ± 0.352
AP-7541, 7542	Sep, 1999	Be-7	0.086 ± 0.012	0.092 ± 0.014	0.089 ± 0.009
AP-7520, 7521	Sep, 1999	Be-7	0.087 ± 0.012	0.091 ± 0.011	0.089 ± 0.008
PW-7228, 7229	Oct, 1999	H-3	6,053.000 ± 243.000	6,177.000 ± 245.000	6,115.000 ± 172.536
SW-7252, 7253	Oct, 1999	H-3	544.000 ± 116.000	659.000 ± 120.000	601.500 ± 83.451
SO-7344, 7345	Oct, 1999	Cs-137	0.067 ± 0.020	0.066 ± 0.023	0.067 ± 0.015
SO-7344, 7345	Oct, 1999	Gr. Beta	27.800 ± 3.580	26.320 ± 3.550	27.060 ± 2.521
SO-7344, 7345	Oct, 1999	K-40	18.510 ± 0.690	19.680 ± 0.810	19.095 ± 0.532
SO-7344, 7345	Oct, 1999	Sr-90	0.020 ± 0.009	0.014 ± 0.008	0.017 ± 0.006
WW-7365, 7366	Oct, 1999	Gr. Beta	1.712 ± 0.500	1.341 ± 0.482	1.527 ± 0.347
WW-7365, 7366	Oct, 1999	K-40	1.200 ± 0.120	1.100 ± 0.110	1.150 ± 0.081
MI-7323, 7324	Oct, 1999	K-40	1,404.100 ± 111.000	1,374.200 ± 181.000	1,389.150 ± 106.163
F-7478, 7479	Oct, 1999	Co-60	0.010 ± 0.050	0.000 ± 0.010	0.005 ± 0.025
F-7478, 7479	Oct, 1999	Cs-137	0.000 ± 0.010	-0.010 ± 0.010	-0.005 ± 0.007
MI-7728, 7729	Oct, 1999	K-40	1,567.700 ± 170.000	1,471.900 ± 125.000	1,519.800 ± 105.505
MI-7587, 7588	Oct, 1999	K-40	1,263.200 ± 162.000	1,449.800 ± 122.000	1,356.500 ± 101.400
AP-7619, 7620	Oct, 1999	Be-7	0.166 ± 0.071	0.110 ± 0.090	0.138 ± 0.057
SL-7749, 7750	Oct, 1999	Gr. Beta	3.088 ± 0.278	3.320 ± 0.285	3.204 ± 0.199
SL-7749, 7750	Oct, 1999	K-40	1.190 ± 0.560	2.160 ± 0.500	1.675 ± 0.375
BS-7943, 7944	Oct, 1999	Gr. Beta	13.816 ± 2.943	14.263 ± 2.888	14.040 ± 2.062
BS-7943, 7944	Oct, 1999	K-40	11.681 ± 0.551	12.691 ± 0.754	12.186 ± 0.467
G-7898, 7899	Oct, 1999	Be-7	1.315 ± 0.188	1.342 ± 0.186	1.329 ± 0.132
G-7898, 7899	Oct, 1999	K-40	6.436 ± 0.449	6.292 ± 0.486	6.364 ± 0.331
CW-8058, 8059	Oct, 1999	Gr. Beta	2.520 ± 1.490	2.320 ± 1.490	2.420 ± 1.054
F-8379, 8380	Oct, 1999	K-40	2.980 ± 0.240	3.063 ± 0.262	3.021 ± 0.178
F-8171, 8172	Oct, 1999	Co-60	-0.010 ± 0.020	-0.010 ± 0.010	-0.010 ± 0.011
F-8171, 8172	Oct, 1999	Cs-137	-0.010 ± 0.010	0.000 ± 0.010	-0.005 ± 0.007
SWU-8316, 8317	Oct, 1999	Gr. Beta	2.310 ± 0.690	2.248 ± 0.691	2.279 ± 0.488
SWU-8316, 8317	Oct, 1999	H-3	187.623 ± 94.958	223.391 ± 96.366	205.507 ± 67.645
SP-8954, 8955	Oct, 1999	Gr. Beta	6.535 ± 1.721	4.745 ± 1.412	5.640 ± 1.113
CW-8425, 8426	Oct, 1999	Gr. Beta	1.720 ± 1.430	1.510 ± 1.410	1.615 ± 1.004
SS-8474, 8475	Oct, 1999	K-40	9.117 ± 0.719	9.634 ± 0.542	9.376 ± 0.450
LW-8747, 8748	Oct, 1999	Gr. Beta	1.984 ± 0.431	2.120 ± 0.476	2.052 ± 0.321

Table A-5. In-house "duplicate" samples.

Lab Codes	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
G-8572, 8573	Oct, 1999	Be-7	3.500 ± 0.338	3.410 ± 0.235	3.455 ± 0.206
G-8572, 8573	Oct, 1999	Gr. Beta	6.249 ± 0.167	6.679 ± 0.171	6.464 ± 0.120
G-8572, 8573	Oct, 1999	K-40	6.900 ± 0.518	6.961 ± 0.374	6.930 ± 0.319
SW-8506, 8507	Oct, 1999	H-3	5,114.000 ± 212.000	5,279.000 ± 215.000	5,196.500 ± 150.971
LW-8747, 8748	Oct, 1999	H-3	4,144.300 ± 194.900	4,392.700 ± 199.513	4,268.500 ± 139.456
SW-8614, 8615	Nov, 1999	Gr. Beta	3.884 ± 0.886	3.386 ± 0.836	3.635 ± 0.609
CW-8641, 8642	Nov, 1999	Gr. Beta	1.310 ± 1.400	2.250 ± 1.470	1.780 ± 1.015
AP-8688, 8689	Nov, 1999	Be-7	0.153 ± 0.083	0.144 ± 0.058	0.149 ± 0.051
SW-8975, 8976	Nov, 1999	H-3	-70.000 ± 85.000	-68.000 ± 85.000	-69.000 ± 60.104
MI-8928, 8929	Nov, 1999	K-40	1,328.300 ± 144.000	1,366.000 ± 163.000	1,347.150 ± 108.749
AP-9179, 9180	Nov, 1999	Be-7	0.145 ± 0.097	0.103 ± 0.055	0.124 ± 0.056
SW-9151, 9152	Nov, 1999	H-3	3,208.000 ± 174.000	3,517.000 ± 180.000	3,362.500 ± 125.176
SW-9227, 9228	Nov, 1999	Co-60	-1.320 ± 12.400	0.120 ± 0.330	-0.600 ± 6.202
SW-9227, 9228	Nov, 1999	Cs-137	0.060 ± 2.330	-0.530 ± 1.660	-0.235 ± 1.430
SW-9227, 9228	Nov, 1999	Gr. Beta	8.590 ± 1.880	9.810 ± 1.980	9.200 ± 1.365
SWU-9275, 9276	Nov, 1999	Gr. Beta	1.590 ± 0.586	1.404 ± 0.529	1.497 ± 0.395
CW-9307, 9308	Dec, 1999	Gr. Beta	0.700 ± 1.500	2.050 ± 1.630	1.375 ± 1.108
CW-9358, 9359	Dec, 1999	Gr. Beta	3.610 ± 0.460	4.210 ± 0.510	3.910 ± 0.343
CW-9358, 9359	Dec, 1999	H-3	14,646.000 ± 339.000	14,764.000 ± 340.000	14,705.000 ± 240.063
MI-9402, 9403	Dec, 1999	K-40	2,074.100 ± 174.000	1,967.700 ± 134.000	2,020.900 ± 109.809
CW-9423, 9424	Dec, 1999	Gr. Beta	1.870 ± 1.610	1.930 ± 1.610	1.900 ± 1.138
AP-9478, 9479	Dec, 1999	Be-7	0.156 ± 0.098	0.091 ± 0.058	0.123 ± 0.057
BS-9587, 9588	Dec, 1999	K-40	11.890 ± 0.550	11.624 ± 0.740	11.757 ± 0.461
LW-9525, 9526	Dec, 1999	Be-7	2.690 ± 0.630	2.340 ± 0.620	2.515 ± 0.442
AP-9767, 9768	Dec, 1999	Be-7	0.104 ± 0.072	0.144 ± 0.085	0.124 ± 0.056
SWU-9837, 9838	Dec, 1999	Gr. Beta	1.530 ± 0.530	2.504 ± 0.607	2.017 ± 0.403
CW-9870, 9871	Dec, 1999	H-3	1,221.000 ± 123.000	1,027.000 ± 117.000	1,124.000 ± 84.879
SW-9964, 9965	Dec, 1999	Co-60	-0.740 ± 2.710	0.950 ± 2.110	0.105 ± 1.717
SW-9964, 9965	Dec, 1999	Cs-137	-2.910 ± 3.140	1.830 ± 2.230	-0.540 ± 1.926
AP-10027, 10028	Dec, 1999	Be-7	0.059 ± 0.008	0.064 ± 0.011	0.062 ± 0.007
SW-9912, 9913	Dec, 1999	H-3	29.000 ± 87.000	113.000 ± 91.000	71.000 ± 62.948
WW-10069, 10070	Dec, 1999	Gr. Beta	2.539 ± 0.664	2.223 ± 0.591	2.381 ± 0.445

[a] All concentrations are reported in pCi/liter, except solid samples, which are reported in pCi/gram.
[b] Lab codes are comprised of the sample media and the sample numbers. Client codes have been eliminated to protect client anonymity.

Table A-6. Department of Energy's Mixed Analyte Performance Evaluation Program (MAPEP), comparison of MAPEP and Teledyne's Midwest Laboratory results for various sample media[a].

Lab Code	Sample Type	Date Collected	Analysis	Concentration[b] Teledyne Result[c]	MAPEP Result[d] 1s, N=1	Control Limits
SPW-846	WATER	Jan, 1999	Co-57	337.60 ± 33.76	358.00	250.60 - 465.40
SPW-846	WATER	Jan, 1999	Cs-137	656.60 ± 65.66	637.00	445.90 - 828.10
SPW-846	WATER	Jan, 1999	Fe-55	724.50 ± 72.45	664.00	464.80 - 863.20
SPW-846	WATER	Jan, 1999	Mn-54	234.20 ± 23.42	229.00	160.30 - 297.70
SPW-846	WATER	Jan, 1999	Pu-238	1.10 ± 0.11	1.45	1.02 - 1.89
SPW-846	WATER	Jan, 1999	Pu-239/40	3.20 ± 0.32	4.04	2.83 - 5.25
SPW-846	WATER	Jan, 1999	Sr-90	40.90 ± 4.09	39.50	27.65 - 51.35
SPW-846	WATER	Jan, 1999	U-233/4	2.70 ± 0.27	2.67	1.87 - 3.47
SPW-846	WATER	Jan, 1999	U-238	20.80 ± 2.08	21.20	14.84 - 27.56
SPW-846	WATER	Jan, 1999	Zn-65	1,508.90 ± 150.90	1,560.00	1,092.00 - 2,028.00
STSO-854	SOIL	Jan, 1999	Am-241	6.16 ± 0.70	6.55	4.59 - 8.52
STSO-854	SOIL	Jan, 1999	Co-57	311.11 ± 3.60	360.00	252.00 - 468.00
STSO-854	SOIL	Jan, 1999	Co-60	134.57 ± 2.15	131.00	91.70 - 170.30
STSO-854	SOIL	Jan, 1999	Cs-134	682.35 ± 4.50	752.00	526.40 - 977.60
STSO-854	SOIL	Jan, 1999	Cs-137	319.50 ± 3.60	331.00	231.70 - 430.30
STSO-854	SOIL	Jan, 1999	K-40	667.04 ± 21.50	652.00	456.40 - 847.60
STSO-854	SOIL	Jan, 1999	Mn-54	349.01 ± 7.00	345.00	241.50 - 448.50
STSO-854	SOIL	Jan, 1999	Pu-238	25.28 ± 1.00	27.50	19.25 - 35.75
STSO-854	SOIL	Jan, 1999	Pu-239/40	45.66 ± 1.00	48.10	33.67 - 62.53
STSO-854	SOIL	Jan, 1999	U-233/4	139.56 ± 1.80	157.00	109.90 - 204.10
STSO-854	SOIL	Jan, 1999	U-238	23.47 ± 0.75	40.70	28.49 - 52.91
No errors were found in the calculations or the analytical process. The analysis is being repeated.						
STSO-854	SOIL	Jan, 1999	Zn-65	2,697.20 ± 25.00	2,840.00	1,988.00 - 3,692.00

[a] Results obtained by Teledyne Brown Engineering Environmental Services Midwest Laboratory as a participant in the Department of Energy's Mixed Analyte Performance Evaluation Program, Idaho Operations office, Idaho Falls, Idaho.

[b] All results are in Bq/kg or Bq/L as requested by the Department of Energy.

[c] Unless otherwise indicated, the TBEESML results are given as the mean ± 1 standard deviations for three determinations.

[d] MAPEP results are presented as the known values and expected laboratory precision (1 sigma, 1 determination) and control limits as defined by the MAPEP.

Table A-7. Environmental Measurements Laboratory Quality Assessment Program (EML), comparison of EML and Teledyne's Midwest Laboratory results for various sample media[a].

Lab Code	Sample Type	Date Collected	Analysis	Concentration[b] Teledyne Result[c]	Concentration[b] EML Result[d]	Control Limits[e]
STAF-848	AIR FILTER	Mar, 1999	Gr. Alpha	1.24 ± 0.03	1.61 ± 0.16	0.60 - 1.64
STAF-848	AIR FILTER	Mar, 1999	Gr. Beta	1.98 ± 0.04	1.56 ± 0.16	0.60 - 1.64
STW-850	WATER	Mar, 1999	Am-241	1.22 ± 0.16	1.15 ± 0.05	0.50 - 1.50
STW-850	WATER	Mar, 1999	Co-60	54.40 ± 2.00	51.10 ± 3.00	0.92 - 1.18
STW-850	WATER	Mar, 1999	Cs-137	43.50 ± 2.00	39.38 ± 2.41	0.90 - 1.28
STW-850	WATER	Mar, 1999	Fe-55	81.50 ± 19.50	97.40 ± 1.65	0.31 - 1.54
STW-850	WATER	Mar, 1999	Gr. Alpha	1,169.00 ± 37.00	1,090.00 ± 20.00	0.50 - 1.29
STW-850	WATER	Mar, 1999	Gr. Beta	1,274.60 ± 33.30	1,100.00 ± 40.00	0.50 - 1.29
STW-850	WATER	Mar, 1999	H-3	90.30 ± 24.80	121.08 ± 6.78	0.65 - 1.91
STW-850	WATER	Mar, 1999	Ni-63	125.80 ± 6.30	114.00 ± 10.00	0.50 - 1.50
STW-850	WATER	Mar, 1999	Pu-238	0.80 ± 0.01	0.77 ± 0.04	0.78 - 1.42
STW-850	WATER	Mar, 1999	Pu-239/40	1.03 ± 0.07	1.01 ± 0.06	0.78 - 1.42
STW-850	WATER	Mar, 1999	Sr-90	3.63 ± 1.20	4.10 ± 0.05	0.50 - 1.50
STW-850	WATER	Mar, 1999	U-233/4	0.33 ± 0.08	0.27 ± 0.02	0.77 - 1.35
STW-850	WATER	Mar, 1999	U-238	0.33 ± 0.08	0.26 ± 0.02	0.77 - 1.35
STVE-851	VEGETATION	Mar, 1999	Am-241	3.35 ± 0.85	3.52 ± 0.59	0.68 - 2.78
STVE-851	VEGETATION	Mar, 1999	Cm-244	0.56 ± 0.41	1.67 ± 0.54	0.49 - 1.69
STVE-851	VEGETATION	Mar, 1999	Co-60	21.00 ± 1.90	21.45 ± 1.00	0.62 - 1.42
STVE-851	VEGETATION	Mar, 1999	Cs-137	453.90 ± 5.70	467.00 ± 20.00	0.81 - 1.45
STVE-851	VEGETATION	Mar, 1999	K-40	667.60 ± 33.70	656.50 ± 20.00	0.79 - 1.50
STVE-851	VEGETATION	Mar, 1999	Sr-90	704.80 ± 27.80	736.10 ± 7.70	0.48 - 1.29
STSO-852	SOIL	Mar, 1999	Ac-228	45.10 ± 7.40	47.15 ± 2.99	0.50 - 1.50
STSO-852	SOIL	Mar, 1999	Am-241	5.65 ± 2.41	4.89 ± 0.97	0.52 - 2.65
STSO-852	SOIL	Mar, 1999	Bi-214	67.30 ± 3.30	69.90 ± 5.66	0.50 - 1.50
STSO-852	SOIL	Mar, 1999	Cs-137	620.50 ± 5.90	659.50 ± 24.95	0.80 - 1.34
STSO-852	SOIL	Mar, 1999	K-40	355.70 ± 24.60	362.75 ± 20.16	0.73 - 1.67
STSO-852	SOIL	Mar, 1999	Pb-212	47.90 ± 3.00	47.93 ± 2.57	0.50 - 1.50
STSO-852	SOIL	Mar, 1999	Pb-214	70.10 ± 4.80	71.00 ± 7.04	0.50 - 1.50
STSO-852	SOIL	Mar, 1999	Pu-239/40	7.32 ± 1.32	8.11 ± 1.07	0.66 - 1.93
STSO-852	SOIL	Mar, 1999	Sr-90	28.30 ± 3.50	32.40 ± 0.53	0.46 - 2.84
STSO-852	SOIL	Mar, 1999	Th-234	227.40 ± 35.20	138.00 ± 4.08	0.50 - 2.00
STSO-852	SOIL	Mar, 1999	U-233/4	132.90 ± 6.90	140.67 ± 1.16	0.35 - 1.55
STSO-852	SOIL	Mar, 1999	U-238	139.40 ± 7.00	145.00 ± 1.73	0.35 - 1.55
STAF-853	AIR FILTER	Mar, 1999	Am-241	0.14 ± 0.02	0.13 ± 0.01	0.68 - 2.41
STAF-853	AIR FILTER	Mar, 1999	Co-57	3.32 ± 0.06	3.01 ± 0.14	0.62 - 1.22
STAF-853	AIR FILTER	Mar, 1999	Co-60	5.28 ± 0.15	4.96 ± 0.28	0.62 - 1.42
STAF-853	AIR FILTER	Mar, 1999	Cs-137	6.96 ± 0.15	6.05 ± 0.30	0.72 - 1.32
STAF-853	AIR FILTER	Mar, 1999	Pu-238	0.26 ± 0.02	0.27 ± 0.00	0.62 - 1.46

Table A-7. Environmental Measurements Laboratory Quality Assessment Program (EML), comparison of EML and Teledyne's Midwest Laboratory results for various sample media[a].

Lab Code	Sample Type	Date Collected	Analysis	Concentration[b] Teledyne Result[c]	EML Result[d]	Control Limits[e]
STAF-853	AIR FILTER	Mar, 1999	Pu-239/40	0.12 ± 0.02	0.12 ± 0.00	0.62 - 1.46
STAF-853	AIR FILTER	Mar, 1999	Sb-125	4.35 ± 0.30	3.59 ± 0.31	0.62 - 1.39
STAF-853	AIR FILTER	Mar, 1999	Sr-90	0.65 ± 0.19	0.64 ± 0.01	0.66 - 2.65
STAF-853	AIR FILTER	Mar, 1999	U-233/4	0.07 ± 0.03	0.06 ± 0.00	0.78 - 3.00
STAF-853	AIR FILTER	Mar, 1999	U-238	0.07 ± 0.03	0.06 ± 0.00	0.78 - 3.00

[a] The Environmental Measurements Laboratory provides the following nuclear species : Air Filters, Soil, Vegetation and Water.

[b] Results are reported in Bq/L with the following exceptions: Air Filter results are reported in Bq/Filter, Soil results are reported in Bq/Kg, Vegetation results are reported in Bq/Kg.

[c] Teledyne results are reported as the mean of three determinations±standard deviation.

[d] The EML result listed is the mean of replicate determinations for each nuclide±the standard error of the mean.

[e] The control limits are reported by EML as the ratio of Reported Value / EML value and are established from percentiles of historic data distributions (1982-1992). The evaluation of this historic data and the development of the control limits is presented in DOE report EML-564.

APPENDIX B

DATA REPORTING CONVENTIONS

Data Reporting Conventions

1.0. All activities, except gross alpha and gross beta, are decay corrected to collection time or the end of the collection period.

2.0. Single Measurements

Each single measurement is reported as follows: $x \pm s$

where: x = value of the measurement;

s = 2s counting uncertainty (corresponding to the 95% confidence level).

In cases where the activity is less than the lower limit of detection L, it is reported as: <L,

where L = the lower limit of detection based on 4.66s uncertainty for a background sample.

3.0. Duplicate analyses

3.1 Individual results: For two analysis results; $x_1 \pm s_1$ and $x_2 \pm s_2$

Reported result: $x \pm s$; where $x = (1/2)(x_1 + x_2)$ and $s = (1/2)\sqrt{s_1^2 + s_2^2}$

3.2. Individual results: $<L_1$, $<L_2$ Reported result: <L, where L = lower of L_1 and L_2

3.3. Individual results: $x \pm s$, <L Reported result: $x \pm s$ if $x \geq L$; <L otherwise.

4.0. Computation of Averages and Standard Deviations

4.1 Averages and standard deviations listed in the tables are computed from all of the individual measurements over the period averaged; for example, an annual standard deviation would not be the average of quarterly standard deviations. The average $\bar{x}$ and standard deviation s of a set of n numbers $x_1, x_2 \ldots x_n$ are defined as follows:

$$\bar{x} = \frac{1}{n} \sum x \qquad s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$$

4.2 Values below the highest lower limit of detection are not included in the average.

4.3 If all values in the averaging group are less than the highest LLD, the highest LLD is reported.

4.4 If all but one of the values are less than the highest LLD, the single value x and associated two sigma error are reported.

4.5 In rounding off, the following rules are followed:

4.5.1. If the figure following those to be retained is less than 5, the figure is dropped, and the retained figures are kept unchanged. As an example, 11.443 is rounded off to 11.44.

4.5.2. If the figure following those to be retained is equal to or greater than 5, the figure is dropped and the last retained figure is raised by 1. As an example, 11.445 is rounded off to 11.45.

APPENDIX C

During the reporting period, the radioactivity of the primary coolant did not exceed the limits of Technical Specification 2.1.3.