

Omaha Public Power District
444 South 16th Street Mall
Omaha, Nebraska 68102-2247
402/636-2000

April 23, 1992
LIC-92-160R

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Station P1-137
Washington, DC 20555

Reference: Docket No. 50-285

Gentlemen:

SUBJECT: Fort Calhoun Station 1991 Radiological Environmental Operating Report

In accordance with Fort Calhoun Station Technical Specification 5.9.4.b, Omaha Public Power District is enclosing one copy of the 1991 Radiological Environmental Operating Report. This report is for the period from January 1, 1991 through December 31, 1991. The data was taken in accordance with Technical Specification 5.9.4.b and the Offsite Dose Calculation Manual.

If you should have any questions, please contact me.

Sincerely,

W. G. Gates
W. G. Gates
Division Manager
Nuclear Operations

WGG/sel

Enclosure

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1. Table 1 describes for each sample class, the collection frequency, number of sample locations and the number of samples collected during this period.
2. A statistical evaluation of the program findings is presented in Table 2. For each sample type and analysis this table considers all indicator locations, all control locations, and the location with the highest annual mean result. Table 2 contains the following information:
 - A. The total number of analyses.
 - B. The fraction of these analyses yielding detectable results (i.e., results above the highest lower limit of detection (LLD) for the period).
 - C. The average, lowest and highest results.The distance and direction relative to the reactor containment building are specified for the location with the highest annual mean.

No Station effect on the environment was indicated.
3. All analyses of gamma isotopes for fish were below the analysis detection level except for one buffalo and gizzard shad composite sample which indicated 0.057 pCi/gm. No plant attributable effect is indicated, as supported by the lower than LLD results for all the other fish and surface water analyses.
4. Table 3 is a listing of missed samples.
5. Appendix A contains a description of the Interlaboratory Comparison Program Results.
6. The land use survey is conducted biennially. The last survey was completed in 1990; the next survey will be performed during 1992.
7. The limits of Technical Specification 2.1.3 were not exceeded by the primary coolant during the reporting period.

ENVIRONMENTAL MONITORING

TECHNICAL SPECIFICATION (5.9.4.b)

January 1, 1991 to December 31, 1991

TABLE 1.0

Environmental Sample Collection Program

Sample Class	Collection Frequency	Number of Sample Locations	Number of Samples Collected This Period
Background Radiation (TLDs)	Quarterly	Eleven (11)	44
Air Particulates	Weekly	Five (5)	256
Airborne Iodine	Weekly	Five (5)	256
Milk	Semimonthly	Three (3)	33
Surface Water	Monthly	Three (3)	36
Fish	Annually	Two (2)	8
Mud and Silt	Semiannually	One (1)	2
Food Crops	Annually	Four (4)	11
TOTAL			646

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 Reporting Period January - December, 1991
 (County, State)

Sample Type (Units)	Type and Number of Analyses ^a	LLD ^b	Indicator Locations Mean (F) ^c Range ^c	Location with Highest Annual Mean		Control Locations Mean (F) ^c Range ^c	Number of Non-routine Results ^e
				Location ^d	Mean (F) ^c Range ^c		
Background Radiation (TLD) (mR/week)	Gamma 44	0.5	1.4 (40/40) (1.1-1.8)	OFE, E.O.F. Bldg. 17.5 mi SE of Reactor	1.8 (4/4) (1.6-1.9)	1.8 (4/4) (1.6-1.9)	0
Airborne Particulates (pCi/m ³)	GB 256	0.006	0.021 (201/205) (0.006-0.056)	OAG, Onsite Station No. 2	0.023 (50/52) (0.007-0.054)	0.022 (51/51) (0.010-0.047)	0
	GS 20						
	Cs-134	0.002	<LLD	-	-	<LLD	0
	Cs-137	0.002	<LLD	-	-	<LLD	0
	Other gammas	0.002	<LLD	-	-	<LLD	0
Airborne Iodine (pCi/m ³)	I-131 256	0.07 ^f	<LLD	-	-	<LLD	0
Milk, Fresh (pCi/L)	I-131 33	0.5	<LLD	-	-	<LLD	0
	GS 33						
	K-40	150	1190 (22/22) (980-1460)	0-19, Flynn Dairy 0.8 mi @ 206°	1300 (11/11) (1150-1460)	1280 (11/11) (1130-1400)	0
	Cs-134	15	<LLD	-	-	<LLD	0
	Cs-137	15	<LLD	-	-	<LLD	0
	Other gammas	15	<LLD	-	-	<LLD	0

Table 2.0 Radiological Environmental Monitoring Program Summary (continued)

Name of Facility Fort Calhoun Nuclear Power Station - Unit 1 Docket No. 50-285
 Location of Facility Washington, Nebraska Reporting Period January - December, 1991
 (County, State)

Sample Type (Units)	Type and Number of Analyses ^a	LLD ^b	Indicator Locations Mean (F) ^c Range ^c	Location with Highest Annual Mean		Control Locations Mean (F) ^c Range ^c	Number of Non-routine Results ^e
				Location ^d	Mean (F) ^c Range ^c		
Surface Water (p'L)	GS 36						
	Cs-134 15		<LLD	-	-	<LLD	0
	Cs-137 18		<LLD	-	-	<LLD	0
	Other Gammas 15		<LLD	-	-	<LLD	0
	H-3 12 300		<LLD	-	-	<LLD	0
Fish (pCi/g wet)	GS 8						
	Mn-54 0.039		<LLD	-	-	<LLD	0
	Co-58 0.036		<LLD	-	-	<LLD	0
	Co-60 0.036		<LLD	-	-	<LLD	0
	Zn-65 0.073		<LLD	-	-	<LLD	0
	Cs-134 0.028		<LLD	-	-	<LLD	0
	Cs-137 0.023		0.057 (1/1)	Plant Site Area	0.057 (1/1)	<LLD	0
	Other Gammas ⁹ 0.051		<LLD	-	-	<LLD	0
Mud and Silt (pCi/g dry)	GS 2						
	Cs-134 0.026		<LLD	-	-	None	0
	Cs-137 0.030		0.078 (2/2) (0.056-0.10)	0-13, Downstream 0.5 ml @ 106°	0.078 (2/2) (0.056-0.10)	None	0
	Other Gammas 0.037		<LLD	-	-	None	0

Table 2.0 Radiological Environmental Monitoring Program Summary (continued)

Name of Facility Fort Calhoun Nuclear Power Station - Unit 1 Docket No. 50-285
 Location of Facility Washington, Nebraska Reporting Period January - December, 1991
 (County, State)

Sample Type (Units)	Type and Number of Analyses ^a	LLD ^b	Indicator Locations Mean (F) ^c Range ^c	Location with Highest Annual Mean		Control Locations Mean (F) ^c Range ^c	Number of Non-routine Results ^e
				Location ^d	Mean (F) ^c Range ^c		
Food Crops (pCi/g wet)	GS 11						
	Mn-54	0.034	<LLD	-	-	<LLD	0
	Co-58	0.036	<LLD	-	-	<LLD	0
	Co-60	0.039	<LLD	-	-	<LLD	0
	Fe-59	0.094	<LLD	-	-	<LLD	0
	Zn-65	0.074	<LLD	-	-	<LLD	0
	Zr-Nb-95	0.051	<LLD	-	-	<LLD	0
	Cs-134	0.028	<LLD	-	-	<LLD	0
	Cs-137	0.029	<LLD	-	-	<LLD	0
	Ba-La-140	0.060	<LLD	-	-	<LLD	0

^a GB = Gross beta; GS = gamma scan.

^b LLD = Lower limit of detection (based on 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 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 ten times the typical pre-operational value for the medium or location.

^f Six results (1.85, 4.06, 0.17, 0.083, 0.19, and 0.16) are excluded from the determination of LLD. They resulted from low volumes.

^g Value given is for Ru-103.

TABLE 3.0

Listing of Missed Samples

Sample Type	Location	Expected Collection Date	Reason
Air Particulate/Air Iodine	OAF	05/01/91	Out of service temporarily due to procedural holdpoint
Air Particulate/Air Iodine	OAH	06/05/91	Unit out of service for maintenance
Air Particulate/Air Iodine	OAF	12/11/91	Power outage at pump site
Air Particulate/Air Iodine	OAJ	12/18/91	Unit out of service for maintenance

APPENDIX A

INTERLABORATORY COMPARISON PROGRAM RESULTS

NOTE: TIML participates in intercomparison studies administered by U.S. EPA Environmental Monitoring Systems Laboratory, Las Vegas, Nevada. The results are reported in Appendix A. Also reported are results of in-house spikes and blanks. Appendix A is updated twice a year; the complete Appendix is included in January and July monthly reports only. Please refer to January and July reports for information.

January, 1992

Appendix A

Inter-laboratory Comparison Program Results

Teledyne Isotopes Midwest Laboratory (formerly Hazleton Environmental Sciences) 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, air filters, and food samples during the period January 1988 through November 1991. This program has been conducted by the U.S. Environmental Protection Agency intercomparison and Calibration Section, Quality Assurance Branch, Environmental Monitoring and Support Laboratory, Las Vegas, Nevada.

The results in Table A-2 were obtained for thermoluminescent dosimeters (TLDs) during the period 1976-1977, 1979, 1980, 1984, and 1985-86 through participation in the Second, Third, Fourth, Fifth, Seventh, and Eighth International Intercomparison of Environmental Dosimeters under the sponsorships listed in Table A-2. Also Teledyne testing results are listed.

Table A-3 lists results of the analyses on in-house spiked samples.

Table A-4 lists results of the analyses on in-house "blank" samples.

Attachment B lists acceptance criteria for "spiked" samples.

Addendum to Appendix A provides explanation for out-of-limit results.

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne Isotopes Midwest Laboratory results for milk, water, air filters, and food samples, 1988 through 1991.^a

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^b		
				EPA Result ^d		Control Limits
				TIML Result $\pm 2\sigma^c$	1s, N=1	
STW-521	Water	Jan 1988	Sr-89	27.3 \pm 5.0	30.0 \pm 5.0	21.3-38.7
			Sr-90	15.3 \pm 1.2	15.0 \pm 1.5	12.4-17.6
STW-523	Water	Jan 1988	Gr. alpha	2.3 \pm 1.2	4.0 \pm 5.0	0.0-12.7
			Gr. beta	7.7 \pm 1.2	8.0 \pm 5.0	0.0-16.7
STF-524	Food	Jan 1988	Sr-89	44.0 \pm 4.0	46.0 \pm 5.0	37.3-54.7
			Sr-90	53.0 \pm 2.0	55.0 \pm 2.8	50.2-59.8
			I-131	102.3 \pm 4.2	102.0 \pm 10.2	84.3-119.7
			Cs-137	95.7 \pm 6.4	91.0 \pm 5.0	82.3-99.7
			K	1011 \pm 158	1230 \pm 62	1124-1336
STW-525	Water	Feb 1988	Co-60	69.3 \pm 2.3	69.0 \pm 5.0	60.3-77.7
			Zr-95	99.0 \pm 3.4	94.0 \pm 9.4	77.7-110.3
			Ru-106	92.7 \pm 14.4	105.0 \pm 10.5	86.8-123.2
			Cs-134	61.7 \pm 8.0	64.0 \pm 5.0	55.3-72.7
			Cs-137	99.7 \pm 3.0	94.0 \pm 5.0	85.3-102.7
STW-526	Water	Feb 1988	H-3	3453 \pm 103	3327 \pm 362	2700-3954
STW-527	Water	Feb 1988	Uranium	3.0 \pm 0.0	3.0 \pm 6.0	0.0-13.4
STM-528	Milk	Feb 1988	I-131	4.7 \pm 1.2	4.0 \pm 0.4	3.3-4.7
STW-529	Water	Mar 1988	Ra-226	7.1 \pm 0.6	7.6 \pm 1.1	5.6-9.6
			Ra-228	NA ^e	7.7 \pm 1.2	5.7-9.7
STW-530	Water	Mar 1988	Gr. alpha	4.3 \pm 1.2	6.0 \pm 5.0	0.0-14.7
			Gr. beta	13.3 \pm 1.3	13.0 \pm 5.0	4.3-21.7
STAF-531	Air Filter	Mar 1988	Gr. alpha	21.0 \pm 2.0	20.0 \pm 5.0	11.3-28.7
			Gr. beta	48.0 \pm 0.0	50.0 \pm 5.0	41.3-58.7
			Sr-90	16.7 \pm 1.2	17.0 \pm 1.5	14.4-19.6
			C-137	18.7 \pm 1.3	16.0 \pm 5.0	7.3-24.7
STW-532	Water	Apr 1988	I-131	9.0 \pm 2.0	7.5 \pm 0.8	6.2-8.8

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^b		
				EPA Result ^d		Control Limits
				TIML Result $\pm 2\sigma^c$	1s, N=1	
STW-533 534	Water (Blind)	Apr 1988				
	Sample A		Gr. alpha	ND ^f	46.0 \pm 11.0	27.0-65.0
			Ra-226	ND	6.4 \pm 1.0	4.7-8.1
			Ra-228	ND	5.6 \pm 0.8	4.2-7.0
			Uranium	6.0 \pm 6.0	6.0 \pm 6.0	0.0-16.4
	Sample B		Gr. beta	ND	57.0 \pm 5.0	48.3-65.7
			Sr-89	3.3 \pm 1.2	5.0 \pm 5.0	0.0-13.7
			Sr-90	5.3 \pm 1.2	5.0 \pm 1.5	2.4-7.6
			Co-60	63.3 \pm 1.3	50.0 \pm 5.0	41.3-58.7
			Cs-134	7.7 \pm 1.2	7.0 \pm 5.0	0.0-15.7
			Cs-137	8.3 \pm 1.2	7.0 \pm 5.0	0.0-15.7
STU-535	Urine	Apr 1988	H-3	6483 \pm 155	6202 \pm 620	5128-7276
STW-536	Water	Apr 1988	Sr-89	14.7 \pm 1.3	20.0 \pm 5.0	11.3-28.7
			Sr-90	20.0 \pm 2.0	20.0 \pm 1.5	17.4-22.6
STW-538	Water	Jun 1988	Cr-51	331.7 \pm 13.0	302.0 \pm 30.0	250.0-354.0
			Co-60	16.0 \pm 2.0	15.0 \pm 5.0	6.3-23.7
			Zn-65	107.7 \pm 11.4	101.0 \pm 10.0	83.7-118.3
			Ru-106	191.3 \pm 11.0	195.0 \pm 20.0	160.4-229.6
			Cs-134	18.3 \pm 4.6	20.0 \pm 5.0	11.3-28.7
			Cs-137	26.3 \pm 1.2	25.0 \pm 5.0	16.3-33.7
STW-539	Water	Jun 1988	H-3	5586 \pm 92	5565 \pm 557	4600-6530
STM-541	Milk	Jun 1988	Sr-89	33.7 \pm 11.4	40.0 \pm 5.0	31.3-48.7
			Sr-90	55.3 \pm 5.8	60.0 \pm 3.0	54.8-65.2
			I-131	103.7 \pm 3.1	94.0 \pm 9.0	78.4-109.6
			Cs-137	52.7 \pm 3.1	51.9 \pm 5.0	42.3-59.7
			K	1587 \pm 23	1600 \pm 80	1461-1739
STW-542	Water	Jul 1988	Gr. alpha	8.7 \pm 4.2	15.0 \pm 5.0	6.3-23.7
			Gr. beta	5.3 \pm 1.2	4.0 \pm 5.0	0.0-12.7
STF-543	Food	Jul 1988	Sr-89	ND ^f	33.0 \pm 5.0	24.3-41.7
			Sr-90	ND	34.0 \pm 2.0	30.5-37.5
			I-131	115.0 \pm 5.3	107.0 \pm 11.0	88.0-126.0
			Cs-137	52.7 \pm 6.4	49.0 \pm 5.0	40.3-57.7
			K	1190 \pm 66	1240 \pm 62	1133-1347

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^b		
				EPA Result ^d		Control Limits
				TIML Result $\pm 2\sigma^c$	1s, N=1	
STW-544	Water	Aug 1988	I-131	80.0 \pm 0.0	76.0 \pm 8.0	62.1-89.9
STW-545	Water	Aug 1988	Pu-239	11.0 \pm 0.2	10.2 \pm 1.0	8.5-11.9
STW-546	Water	Aug 1988	Uranium	6.0 \pm 0.0	6.0 \pm 6.0	0.0-16.4
STAF-547	Air Filter	Aug 1988	Gr. alpha	8.0 \pm 0.0	8.0 \pm 5.0	0.0-16.7
			Gr. beta	26.3 \pm 1.2	29.0 \pm 5.0	20.3-37.7
			Sr-90	8.0 \pm 2.0	8.0 \pm 1.5	5.4-10.6
			Cs-137	13.0 \pm 2.0	12.0 \pm 5.0	3.3-20.7
STW-548	Water	Sep 1988	Ra-226	9.3 \pm 0.5	8.4 \pm 2.6	6.2-10.6
			Ra-228	5.8 \pm 0.4	5.4 \pm 1.6	4.0-6.8
STW-549	Water	Sep 1988	Gr. alpha	7.0 \pm 2.0	8.0 \pm 5.0	0.0-16.7
			Gr. beta	11.3 \pm 1.2	10.0 \pm 5.0	1.3-18.7
STW-550	Water	Oct 1988	Cr-51	252.0 \pm 14.0	251.0 \pm 25.0	207.7-294.3
			Co-60	26.0 \pm 2.0	25.0 \pm 5.0	16.3-35
			Zn-65	158.3 \pm 10.2	151.0 \pm 15.0	125.0-177.0
			Ru-106	153.0 \pm 9.2	152.0 \pm 15.0	126.0-178.0
			Cs-134	28.7 \pm 5.0	25.0 \pm 5.0	16.3-33.7
			Cs-137	16.3 \pm 1.2	15.0 \pm 5.0	6.3-23.7
STW-551	Water	Oct 1988	H-3	2333 \pm 127	2316 \pm 350	1710-2927
STW-552 553	Water (Blind)	Oct 1988				
	Sample A		Gr. alpha	38.3 \pm 8.0	41.0 \pm 10.0	23.7-58.3
			Ra-226	4.5 \pm 0.5	5.0 \pm 0.8	3.6-6.4
			Ra-228	4.4 \pm 0.6	5.2 \pm 0.8	3.6-6.4
			Uranium	4.7 \pm 1.2	5.0 \pm 6.0	0.0-15.4
	Sample B		Gr. beta	51.3 \pm 3.0	54.0 \pm 5.0	45.3-62.7
			Sr-89	3.7 \pm 1.2	11.0 \pm 5.0	2.3-19.7
			Sr-90	10.7 \pm 1.2	10.0 \pm 1.5	7.4-12.6
			Cs-134	15.3 \pm 2.3	15.0 \pm 5.0	6.3-23.7
			Cs-137	16.7 \pm 1.2	15.0 \pm 5.0	6.3-23.7

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^b		
				EPA Result ^d		Control Limits
				TIML Result $\pm 2\sigma^c$	1s, N=1	
STM-554	Milk	Oct 1988	Sr-89	40.3 \pm 7.0	40.0 \pm 5.0	31.3-48.7
			Sr-90	51.0 \pm 2.0	60.0 \pm 3.0	54.8-65.2
			I-131	94.0 \pm 3.4	91.0 \pm 9.0	75.4-106.6
			Cs-137	45.0 \pm 4.0	50.0 \pm 5.0	41.3-58.7
			K	1500 \pm 45	1600 \pm 80	1461-1739
STU-555	Urine	Nov 1988	H-3	3030 \pm 209	3025 \pm 359	2403-3647
STW-556	Water	Nov 1988	Gr. alpha	9.0 \pm 3.5	9.0 \pm 5.0	0.3-17.7
			Gr. beta	9.7 \pm 1.2	9.0 \pm 5.0	0.3-17.7
STW-557	Water	Dec 1988	I-131	108.7 \pm 3.0	115.0 \pm 12.0	94.2-135.8
STW-559	Water	Jan 1989	Sr-89	40.0 \pm 8.7	40.0 \pm 5.0	31.3-48.7
			Sr-90	24.3 \pm 3.1	25.0 \pm 1.5	22.4-27.6
STW-560	Water	Jan 1989	Pu-239	5.8 \pm 1.1	4.2 \pm 0.4	3.5-4.9
STW-561	Water	Jan 1989	Gr. alpha	7.3 \pm 1.2	8.0 \pm 5.0	0.0-16.7
			Gr. beta	5.3 \pm 1.2	4.0 \pm 5.0	0.0-12.7
STW-562	Water	Feb 1989	Cr-51	245 \pm 46	235 \pm 24	193.4-276.6
			Co-60	10.0 \pm 2.0	10.0 \pm 5.0	1.3-18.7
			Zn-65	170 \pm 10	159 \pm 16	139.2-186.7
			Ru-106	181 \pm 7.6	178 \pm 18	146.3-209.2
			Cs-134	9.7 \pm 3.0	10.0 \pm 5.0	1.3-18.7
			Cs-137	11.7 \pm 1.2	10.0 \pm 5.0	1.3-18.7
STW-563	Water	Feb 1989	I-131	109.0 \pm 4.0	106.0 \pm 11.0	86.9-125.1
STW-564	Water	Feb 1989	H-3	2820 \pm 20	2754 \pm 356	2137-3371
STW-565	Water	Mar 1989	Ra-226	4.2 \pm 0.3	4.9 \pm 0.7	3.7-6.1
			Ra-228	1.9 \pm 1.0	1.7 \pm 0.3	1.2-2.2
STW-566	Water	Mar 1989	U	5.0 \pm 0.0	5.0 \pm 6.0	0.0-15.4
STAF-567	Air Filter	Mar 1989	Gr. alpha	21.7 \pm 1.2	21.0 \pm 5.0	12.3-29.7
			Gr. beta	68.3 \pm 4.2	62.0 \pm 5.0	53.3-70.7
			Sr-90	20.0 \pm 2.0	20.0 \pm 1.5	17.4-22.6
			Cs-137	21.3 \pm 1.2	20.0 \pm 5.0	11.3-28.7

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^b		
				TIML Result $\pm 2\sigma^c$	EPA Result ^d 1 σ , N=1	Control Limits
STW-568 569	Water (Blind)	Apr 1989				
	Sample A		Gr. alpha	22.7 \pm 2.3	29.0 \pm 7.0	16.9-41.2
			Ra-226	3.6 \pm 0.6	3.5 \pm 0.5	2.6-4.4
			Ra-228	2.6 \pm 1.0	3.6 \pm 0.5	2.7-4.5
			U	3.0 \pm 0.0	3.0 \pm 6.0	0.0-13.4
	Sample B		Gr. beta	52.3 \pm 6.1	57.0 \pm 5.0	43.3-65.7
			Sr-89	9.3 \pm 5.4	8.0 \pm 5.0	0.0-16.7
			Sr-90	7.0 \pm 0.0	8.0 \pm 1.5	5.4-10.6
			Cs-134	21.0 \pm 5.2	20.0 \pm 5.0	11.3-23.7
			Cs-137	23.0 \pm 2.0	20.0 \pm 5.0	11.3-28.7
STM-570	Milk	Apr 1989	Sr-89	26.0 \pm 10.0	39.0 \pm 5.0	30.3-47.7
			Sr-90	45.7 \pm 4.2	55.0 \pm 3.0	49.8-60.2
			Cs-137	54.0 \pm 6.9	50.0 \pm 5.0	41.3-58.7
			K-40	1521 \pm 208	1600 \pm 80	1461-1739
STW-571B	Water	May 1989	Sr-89	<0.7	6.0 \pm 5.0	0.0-14.1
			Sr-90	5.0 \pm 1.0	6.0 \pm 1.5	3.4-8.6
STW-572	Water	May 1989	Gr. alpha	24.0 \pm 2.0	30.0 \pm 8.0	16.1-43.9
			Gr. beta	49.3 \pm 15.6	50.0 \pm 5.0	41.3-58.7
STW-573	Water	Jun 1989	Ba-133	50.7 \pm 1.2	49.0 \pm 5.0	40.3-57.7
			Co-60	31.3 \pm 2.3	31.0 \pm 5.0	22.3-39.7
			Zn-65	167 \pm 10	165 \pm 17	135.6-194.4
			Ru-106	123 \pm 9.2	128 \pm 13	105.5-150.5
			Cs-134	40.3 \pm 1.2	39 \pm 5	30.3-47.7
			Cs-137	22.3 \pm 1.2	20 \pm 5	11.3-28.7
STW-574	Water	Jun 1989	H-3	4513 \pm 136	4503 \pm 450	3724-5282
STW-575	Water	Jul 1989	Ra-226	16.8 \pm 3.1	17.7 \pm 2.7	13.0-22.4
			Ra-228	13.8 \pm 3.7	18.3 \pm 2.7	13.6-23.0
STW-576	Water	Jul 1989	U	40.3 \pm 1.2	41.0 \pm 6.0	30.6 \pm 51.4
STW-577	Water	Aug 1989	I-131	84.7 \pm 5.8	83.0 \pm 8.0	69.1-96.9
STAF-579	Air Filter	Aug 1989	Gr. alpha	6.0 \pm 0.0	0 \pm 5.0	0.0-14.7
			Cs-137	10.3 \pm 2.3	15.0	1.3-18.7

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^b				
				TIML Result $\pm 2\sigma^c$	EPA Result ^d			
					1s, N=1	Control Limits		
STW-580	Water	Sep 1989	Sr-89	14.7 \pm 1.2	14.0 \pm 5.0	5.3-22.7		
			Sr-90	9.7 \pm 1.2	10.0 \pm 1.5	7.4-12.6		
STW-581	Water	Sep 1989	Gr. alpha	5.0 \pm 0.0	4.0 \pm 5.0	0.0-12.7		
			Gr. beta	8.7 \pm 2.3	6.0 \pm 5.0	0.0-14.7		
STW-583	Water	Oct 1989	Ba-133	60.3 \pm 10.0	59.0 \pm 6.0	48.6-69.4		
			Co-60	29.0 \pm 4.0	30.0 \pm 5.0	21.1-38.7		
			Zn-65	132.3 \pm 6.0	129.0 \pm 13.0	106.5-151.5		
			Ru-106	155.3 \pm 6.1	161.0 \pm 16.0	133.3-188.7		
			Cs-134	30.7 \pm 6.1	29.0 \pm 5.0	20.3-37.7		
			Cs-137	66.3 \pm 4.6	59.0 \pm 5.0	50.3 \pm 67.7		
STW-584	Water	Oct 1989	H-3	3407 \pm 150	3496 \pm 364	2866 \pm 4126		
STW-585 536	Water (Blind)	Oct 1989						
	Sample A		Gr. alpha	41.7 \pm 9.4	49.0 \pm 12.0	28.2-69.8		
			Ra-226	7.9 \pm 0.4	8.4 \pm 1.3	6.2-10.6		
			Ra-228	4.4 \pm 0.8	4.1 \pm 0.6	3.1-5.1		
			U	12.0 \pm 0.0	12.0 \pm 0.0	1.6-22.4		
	Sample B		Gr. beta	31.7 \pm 2.3	32.0 \pm 5.0	23.3-40.7		
			Sr-89	13.3 \pm 4.2	15.0 \pm 5.0	6.3-23.7		
			Sr-90	7.0 \pm 2.0	7.0 \pm 3.0	4.4-9.6		
			Cs-134	5.0 \pm 0.0	5.0 \pm 5.0	0.0-13.7		
			Cs-137	7.0 \pm 0.0	5.0 \pm 5.0	0.0-13.7		
	STW-587		Water	Nov 1989	Ra-226	7.9 \pm 0.4	8.7 \pm 1.3	6.4-11.0
					Ra-228	8.9 \pm 1.2	9.3 \pm 1.2	6.9-11.7
	STW-588		Water	Nov 1989	U	15.0 \pm 0.08	15.0 \pm 6.0	4.6-25.4
	STW-589		Water	Jan 1990	Sr-89	22.7 \pm 5.0	25.0 \pm 5.0	16.3-33.7
					Sr-90	17.3 \pm 1.2	20.0 \pm 1.5	17.4-22.6
STW-591	Water	Jan 1990	Gr. alpha	10.3 \pm 3.0	12.0 \pm 5.0	3.3-20.7		
			Gr. beta	12.3 \pm 1.2	12.0 \pm 5.0	3.3-20.7		

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^b		
				EPA Result ^d		Control Limits
				TIML Result $\pm 2\sigma^c$	1s, N=1	
STW-592	Water	Jan 1990	Co-60	14.7 \pm 2.3	15 \pm 5.0	6.3-23.7
			Zn-65	135.0 \pm 6.9	139.0 \pm 14.0	114.8-163.2
			Ru-106	133.3 \pm 13.4	139.0 \pm 14.0	114.8-163.2
			Cs-134	17.3 \pm 1.2	18.0 \pm 5.0	9.3-26.7
			Cs-137	19.3 \pm 1.2	18.0 \pm 5.0	9.3-26.7
			Ba-133	78.0 \pm 0.0	74.0 \pm 7.0	61.9-86.1
STW-593	Water	Feb 1990	H-3	4827 \pm 83	4976 \pm 498	4113-5839
STW-594	Water	Mar 1990	Ra-226	5.0 \pm 0.2	4.9 \pm 0.7	4.1-5.7
			Ra-228	13.5 \pm 0.7	12.7 \pm 1.9	9.4-16.0
STW-595	Water	Mar 1990	U	4.0 \pm 0.0	4.0 \pm 6.0	0.0-14.4
STAF-596	Air Filter	Mar 1990	Gr. alpha	7.3 \pm 1.2	5.0 \pm 5.0	0.0-13.7
			Gr. beta	34.0 \pm 0.0	31.0 \pm 5.0	22.3-39.7
			Sr-90	10.0 \pm 0.0	10.0 \pm 1.5	7.4-12.6
			Cs-137	9.3 \pm 1.2	10.0 \pm 5.0	1.3-18.7
STW-597 598	Water (Blind)	Apr 1990				
	Sample A		Gr. alpha	81.0 \pm 3.5	90.0 \pm 23.0	50.1-129.9
			Ra-226	4.9 \pm 0.4	5.0 \pm 0.0	3.6-6.4
			Ra-228	10.6 \pm 0.3	10.2 \pm 1.5	7.6-12.8
			U	18.7 \pm 3.0	20.0 \pm 6.0	9.6-30.4
	Sample B		Gr. beta	51.0 \pm 10.1	52.0 \pm 5.0	43.3-60.7
			Sr-89	9.3 \pm 1.2	10.0 \pm 5.0	1.3-18.7
			Sr-90	10.3 \pm 3.1	10.0 \pm 1.5	8.3-11.7
			Cs-134	16.0 \pm 0.0	15.0 \pm 5.0	6.3-23.7
			Cs-137	19.0 \pm 2.0	15.0 \pm 5.0	6.3-23.7
STM-599	Milk	Apr 1990	Sr-89	21.7 \pm 3.1	23.0 \pm 5.0	14.3-31.7
			Sr-90	21.0 \pm 7.0	23.0 \pm 5.0	14.3-31.7
			I-131	98.7 \pm 1.2	99.0 \pm 10.0	81.7-116.3
			Cs-137	26.0 \pm 6.0	24.0 \pm 5.0	15.3-32.7
			K	1300.0 \pm 69.2	1550.0 \pm 78.0	1414.7-1685.3
STW-600	Water	May 1990	Sr-89	6.0 \pm 2.0	7.0 \pm 5.0	0.0-15.7
			Sr-90	6.7 \pm 1.2	7.0 \pm 5.0	0.0-15.7
STW-601	Water	May 1990	Gr. alpha	11.0 \pm 2.0	22.0 \pm 6.0	11.6-32.
			Gr. beta	12.3 \pm 1.2	15.0 \pm 5.0	6.3-23.7

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^b		
				TIML Result $\pm 2\sigma^c$	EPA Result ^d 1s, N=1	Control Limits
STW-602	Water	Jun 1990	Co-60	25.3 \pm 2.3	24.0 \pm 5.0	15.3-32.7
			Zn-65	155.0 \pm 10.6	148.0 \pm 15.0	130.6-165.4
			Ru-106	202.7 \pm 17.2	210.0 \pm 21.0	173.6-246.4
			Cs-134	23.7 \pm 1.2	24.0 \pm 5.0	18.2-29.8
			Cs-137	27.7 \pm 3.1	25.0 \pm 5.0	16.3-33.7
			Ba-133	100.7 \pm 8.1	99.0 \pm 10.0	81.7-116.3
STW-603	Water	Jun 1990	H-3	2927 \pm 306	2933 \pm 358	2312-3554
STW-604	Water	Jul 1990	Ra-226	11.8 \pm 0.9	12.1 \pm 1.8	9.0-15.2
			Ra-228	4.1 \pm 1.4	5.1 \pm 1.3	2.8-7.4
STW-605	Water	Jul 1990	U	20.3 \pm 1.7	20.8 \pm 3.0	15.6-26.0
STW-606	Water	Aug 1990	I-131	43.0 \pm 1.2	39.0 \pm 6.0	28.6 \pm 49.4
STW-607	Water	Aug 1990	Pu-239	10.0 \pm 1.7	9.1 \pm 0.9	7.5-10.7
STAF-608	Air Filter	Aug 1990	Gr. alpha	14.0 \pm 0.0	10.0 \pm 5.0	1.3-18.7
			Gr. beta	65.3 \pm 1.2	62.0 \pm 5.0	53.3-70.7
			Sr-90	19.0 \pm 6.9	20.0 \pm 5.0	11.3-28.7
			Cs-137	19.0 \pm 2.0	20.0 \pm 5.0	11.3-28.7
STW-609	Water	Sep 1990	Sr-89	9.0 \pm 2.0	10.0 \pm 5.0	1.3-18.7
			Sr-90	9.0 \pm 2.0	9.0 \pm 5.0	0.3-17.7
STW-610	Water	Sep 1990	Gr. alpha	8.3 \pm 1.2	10.0 \pm 5.0	1.3-18.7
			Gr. beta	10.3 \pm 1.2	10.0 \pm 5.0	1.3-18.7
STM-611	Milk	Sep 1990	Sr-89	11.7 \pm 3.1	16.0 \pm 5.0	7.3-24.7
			Sr-90	15.0 \pm 0.0	20.0 \pm 5.0	11.3-28.7
			I-131	63.0 \pm 6.0	58.0 \pm 6.0	47.6-68.4
			Cs-137	20.0 \pm 2.0	20.0 \pm 5.0	11.3-28.7
			K	1673.3 \pm 70.2	1700.0 \pm 85.0	1552.5-1847.5
STW-612	Water	Oct 1990	Co-60	20.3 \pm 1.1	20.0 \pm 5.0	11.3-28.7
			Zn-65	115.3 \pm 12.2	115.0 \pm 12.0	94.2-135.8
			Ru-106	152.0 \pm 8.0	151.0 \pm 15.0	125.0-177.0
			Cs-134	11.0 \pm 0.0	12.0 \pm 5.0	3.3-20.7
			Cs-137	14.0 \pm 2.0	12.0 \pm 5.0	3.3-20.7
			Ba-133	116.7 \pm 9.9	110.0 \pm 11.0	90.9-129.
STW-613	Water	Oct 1990	H-3	7167 \pm 330	7203 \pm 720	5954-8452

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^b		
				TIML Result $\pm 2\sigma^c$	EPA Result ^d	
					1s, N=1	Control Limits
STW-614 615	Water	Oct 1990				
	Sample A		Gr. alpha	68.7 \pm 7.2	62.0 \pm 16.0	34.2-89.8
			Ra-226	12.9 \pm 0.3	13.6 \pm 2.0	10.1-17.1
			Ra-228	4.2 \pm 0.6	5.0 \pm 1.3	2.7-7.3
			U	10.4 \pm 0.6	10.2 \pm 3.0	5.0-15.4
	Sample B		Gr. beta	55.0 \pm 8.7	53.0 \pm 5.0	44.3-61.7
			Sr-89	15.7 \pm 2.9	20.0 \pm 5.0	11.3-28.7
			Sr-90	12.0 \pm 2.0	15.0 \pm 5.0	6.3-23.7
			Cs-134	9.0 \pm 1.7	7.0 \pm 5.0	0.0-15.7
			Cs-137	7.7 \pm 1.2	5.0 \pm 5.0	0.0-13.7
STW-616	Water	Nov 1990	Ra-226	6.8 \pm 1.0	7.4 \pm 1.1	5.5-9.3
			Ra-228	5.3 \pm 1.7	7.7 \pm 1.9	4.4-11.0
STW-6178	Water	Nov 1990	U	35.0 \pm 0.4	35.5 \pm 3.6	29.3 \pm 41.7
STW-618	Water	Jan 1991	Sr-89	4.3 \pm 1.2	5.0 \pm 5.0	0.0-13.7
			Sr-90	4.7 \pm 1.2	5.0 \pm 5.0	0.0-13.7
STW-619	Water	Jan 1991	Pu-239	3.6 \pm 0.2	3.3 \pm 0.3	2.8-3.8
STW-620	Water	Jan 1991	Gr. alpha	6.7 \pm 3.0	5.0 \pm 5.0	0.0-13.7
			Gr. beta	6.3 \pm 1.2	5.0 \pm 5.0	0.0-13.7
STW-621	Water	Feb 1991	Co-60	41.3 \pm 8.4	40.0 \pm 5.0	31.3-48.7
			Zn-65	166.7 \pm 19.7	149.0 \pm 15.0	123.0- 75.0
			Ru-106	209.7 \pm 18.6	186.0 \pm 19.0	153.0-219.0
			Cs-134	9.0 \pm 2.0	8.0 \pm 5.0	0.0-16.7
			Cs-137	9.7 \pm 1.2	8.0 \pm 5.0	0.0-16.7
			Ba-133	85.7 \pm 9.2	75.0 \pm 8.0	61.1-88.9
STW-622	Water	Feb 1991	I-131	81.3 \pm 6.1	75.0 \pm 8.0	61.1-88.9
STW-623	Water	Feb 1991	H-3	4310.0 \pm 144.2	4418.0 \pm 442.0	3651.2-5184.8
STW-624	Water	Mar 1991	Ra-226	31.4 \pm 3.2	31.8 \pm 4.8	23.5-40.1
			Ra-228	ND ^h	21.1 \pm 5.3	11.9-30.3
STW-625	Water	Mar 1991	U	6.7 \pm 0.4	7.6 \pm 3.0	2.4-12.8

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^b			
				TLM Result ±2σ ^c	EPA Result ^d		
					1s, N=1	Control Limits	
STAF-626	Filter	Mar 1991	Gr. alpha	38.7±1.2	25.0±6.0	14.6-35.4	
			Gr. beta	130.0±4.0	124.0±6.0	113.6-134.4	
			Sr-90	35.7±1.2	40.0±5.0	31.3-48.7	
			Cs-137	33.7±4.2	40.0±5.0	31.3-48.7	
STW-627 628	Water	Apr 1991	Sample A	Gr. alpha	51.0±6.0	54.0±14.0	29.7-78.3
			Ra-226	7.0±0.8	8.0±1.2	5.9-10.1	
	Ra-228		9.7±1.9	15.2±3.8	8.6-21.8		
	U		27.7±2.4	29.8±3.0	24.6-35.0		
	Sample B		Gr. beta	93.3±6.4	115.0±17.0	85.5-144.5	
	Sr-89		21.0±3.5	28.0±5.0	19.3-36.7		
	Sr-90		23.0±0.0	26.0±5.0	17.3-34.7		
	Cs-134		27.3±1.2	24.0±5.0	15.3-32.7		
	Cs-137		29.0±2.0	25.0±5.0	16.3-33.7		
	STM-629		Milk	Sr-89	24.0±8.7	32.0±5.0	23.3-40.7
				Sr-90	28.0±2.0	32.0±5.0	23.3-40.7
				I-131	65.3±14.7	60.0±6.0	49.6-70.4
Cs-137		54.7±11.0		49.0±5.0	40.3-57.7		
K		1591.7±180.1		1550.0±83.0	1506.0-1794.0		
STW-630	Water	May 1991	Sr-89	40.7±2.3	39.0±5.0	30.3-47.7	
			Sr-90	23.7±1.2	24.0±5.0	15.3-32.7	
STW-631	Water	May 1991	Gr. alpha	27.7±5.8	24.0±6.0	13.6-34.4	
			Gr. beta	46.0±0.0	46.0±5.0	37.3-54.7	
STW-632	Water	Jun 1991	Co-60	11.3±1.2	10.0±5.0	1.3-18.7	
			Zn-65	119.3±16.3	108.0±11.0	88.9-127.1	
			Ru-106	162.3±19.0	149.0±15.0	123.0-175.0	
			Cs-134	15.3±1.2	15.0±5.0	6.3-23.7	
			Cs-137	16.3±1.2	14.0±5.0	5.3-22.7	
			Ba-133	74.0±6.9	62.0±6.0	51.6-72.4	
STW-633	Water	Jun 1991	H-3	13470.0±385.8	12480.0±1248.0	10314.8-14645	
STW-634	Water	Jul 1991	Ra-226	14.9±0.4	15.9±2.4	11.7-20.1	
			Ra-228	17.6±1.8	16.7±4.2	9.4-24.0	

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^b		
				EPA Result ^d		Control Limits
				TIML Result $\pm 2\sigma^c$	1 σ , N=1	
STW-635	Water	Jul 1991	U	12.8 \pm 0.1	14.2 \pm 3.0	9.0-19.4
STW-636	Water	Aug 1991	I-131	19.3 \pm 1.2	20.0 \pm 6.0	9.6-30.4
STW-637	Water	Aug 1991	Pu-239	21.4 \pm 0.5	19.4 \pm 1.9	16.1-22.7
STAF-638	Air Filter	Aug 1991	Gr. alpha	33.0 \pm 2.0	25.0 \pm 6.0	14.6-35.4
			Gr. beta	88.7 \pm 1.2	92.0 \pm 10.0	80.4-103.6
			Sr-90	27.0 \pm 4.0	30.0 \pm 5.0	21.3-38.7
			Cs-137	26.3 \pm 1.2	30.0 \pm 5.0	21.3-38.7
STW-639	Water	Sep 1991	Sr-89	47.0 \pm 10.4	49.0 \pm 5.0	40.3-57.7
			Sr-90	24.0 \pm 2.0	25.0 \pm 5.0	16.3-33.7
STW-640	Water	Sep 1991	Gr. alpha	12.0 \pm 4.0	10.0 \pm 5.0	1.3-18.7
			Gr. beta	20.3 \pm 1.2	20.0 \pm 5.0	11.3-28.7
STM-641	Milk	Sep 1991	Sr-89	20.3 \pm 5.0	25.0 \pm 5.0	16.3-33.7
			Sr-90	19.7 \pm 3.1	25.0 \pm 5.0	16.3-33.7
			I-131	130.7 \pm 16.8	108.0 \pm 11.0	88.9-127.1
			Cs-137	33.7 \pm 3.2	30.0 \pm 5.0	21.3-38.7
			K	1743.3 \pm 340.8	1740.0 \pm 87.0	1589.1-1890.9
STW-642	Water	Oct 1991	Co-60	29.7 \pm 1.2	29.0 \pm 5.0	20.3-37.7
			Zn-65	75.7 \pm 8.3	73.0 \pm 7.0	60.9-85.1
			Ru-106	196.3 \pm 15.1	199.0 \pm 20.0	164.3-233.7
			Cs-134	9.7 \pm 1.2	10.0 \pm 5.0	1.3-18.7
			Cs-137	11.0 \pm 2.0	10.0 \pm 5.0	1.3-18.7
			Ba-133	94.7 \pm 3.1	98.0 \pm 10.0	80.7-115.3
STW-643	Water	Oct 1991	H-3	2640.0 \pm 156.2	2454.0 \pm 352.0	1843.3-3064.7
STW-644 645	Water Sample A	Oct 1991	Gr. alpha	73.0 \pm 13.1	82.0 \pm 21.0	45.6-118.4
			Ra-226	20.9 \pm 2.0	22.0 \pm 3.3	16.3-27.7
			Ra-228	19.6 \pm 2.3	22.2 \pm 5.6	12.5-31.9
			U	13.5 \pm 0.6	13.5 \pm 3.0	8.3-18.7
	Sample B		Gr. beta	55.3 \pm 3.1	65.0 \pm 10.0	47.7-82.3
			Sr-89	9.7 \pm 3.1	10.0 \pm 5.0	1.3-18.7
			Sr-90	8.7 \pm 1.2	10.0 \pm 5.0	1.3-18.7
			Co-60	20.3 \pm 1.2	20.0 \pm 5.0	11.3-28.7
			Cs-134	9.0 \pm 5.3	10.0 \pm 5.0	1.3-18.7
			Cs-137	14.7 \pm 5.0	11.0 \pm 5.0	2.3-19.7

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^b		
				TIML Result $\pm 2\sigma^c$	EPA Result ^d 1s, N=1	Control Limits
STW-646	Water	Nov 1991	Ra-226	5.6 \pm 1.2	6.5 \pm 1.0	4.8-8.2
			Ra-228	9.6 \pm 0.5	8.1 \pm 2.0	4.6-11.6
STW-647	Water	Nov 1991	U	24.7 \pm 2.3	24.9 \pm 3.0	19.7-30.1

^a Results obtained by Teledyne Isotopes Midwest Laboratory as a participant in the environmental sample crosscheck program operated by the Intercomparison and Calibration Section, Quality Assurance Branch, Environmental Monitoring and Support Laboratory, U.S. Environmental Protection Agency (EPA), Las Vegas, Nevada.

^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; and food, which is in mg/kg.

^c Unless otherwise indicated, the TIML results are given as the mean \pm 2 standard deviations for three determinations.

^d USEPA results are presented as the known values and expected laboratory precision (1s, 1 determination) and control limits as defined by EPA.

^e NA = Not analyzed.

^f ND = No data; not analyzed due to relocation of lab.

^g Sample was analyzed but the results not submitted to EPA because deadline was missed (all data on file).

^h ND = No data; sample lost during analyses.

Table A-2. Crosscheck program results, thermoluminescent dosimeters (TLDs).

Lab Code	TLD Type	Measurement $\pm 2\sigma^a$	mR		
			Teledyne Result Value ^c	Known Participants)	Average ± 2 (All)
<u>2nd International Intercomparison^b</u>					
115-2	CaF ₂ :Mn Bulb	Field	17.0 \pm 1.9	17.1	16.4 \pm 7.7
		Lab	20.8 \pm 4.1	21.3	18.8 \pm 7.6
<u>3rd International Intercomparison^e</u>					
115-3	CaF ₂ :Mn Bulb	Field	30.7 \pm 3.2	34.9 \pm 4.8	31.5 \pm 3.0
		Lab	89.6 \pm 6.4	91.7 \pm 14.6	86.2 \pm 24.0
<u>4th International Intercomparison^f</u>					
115-4	CaF ₂ :Mn Bulb	Field	14.1 \pm 1.1	14.1 \pm 1.4	16.0 \pm 9.0
		Lab (Low)	9.3 \pm 1.3	12.2 \pm 2.4	12.0 \pm 7.4
		Lab (High)	40.4 \pm 1.4	45.8 \pm 9.2	43.9 \pm 13.4
<u>5th International Intercomparison^g</u>					
115-5A	CaF ₂ :Mn Bulb	Field	31.4 \pm 1.8	30.0 \pm 6.0	30.2 \pm 14.6
		Lab at beginning	77.4 \pm 5.8	75.2 \pm 7.6	75.8 \pm 40.4
		Lab at the end	96.6 \pm 5.8	88.4 \pm 8.8	90.7 \pm 31.2
115-5B	LiF-100 Chips	Field	30.3 \pm 4.8	30.0 \pm 6.0	30.2 \pm 14.6
		Field at beginning	81.1 \pm 7.4	75.2 \pm 7.6	75.8 \pm 40.4
		Lab at the end	85.4 \pm 11.7	88.4 \pm 8.8	90.7 \pm 31.2
<u>7th International Comparison^h</u>					
115-7A	LiF-100 Chips	Field	75.4 \pm 2.6	75.8 \pm 6.0	75.1 \pm 29.8
		Lab (Co-60)	80.0 \pm 3.5	79.9 \pm 4.0	77.9 \pm 27.6
		Lab (Cs-137)	66.6 \pm 2.5	75.0 \pm 3.8	73.0 \pm 22.7

Table A-2. Crosscheck program results, thermoluminescent dosimeters (TLDs).

Lab Code	TLD Type	Measurement $\pm 2\sigma^a$	Teledyne Result Value ^c	mR	
				Known Participants)	Average $\pm 2\sigma^d$ (All
115-7B	CaF ₂ :Mn Bulbs	Field	71.5 \pm 2.6	75.8 \pm 6.0	75.1 \pm 29.8
		Lab (Co-60)	84.8 \pm 6.4	79.9 \pm 4.0	77.9 \pm 27.6
		Lab (Cs-137)	78.8 \pm 1.6	75.0 \pm 3.8	73.0 \pm 22.2
115-7C	CaSO ₄ :Dy Cards	Field	76.8 \pm 2.7	75.8 \pm 6.0	75.1 \pm 29.8
		Lab (Co-60)	82.5 \pm 3.7	79.9 \pm 4.0	77.9 \pm 27.6
		Lab (Cs-137)	79.0 \pm 3.2	75.0 \pm 3.8	73.0 \pm 22.2
<u>8th International Intercomparisonⁱ</u>					
115-8A	LiF-100 Chips	Field Site 1	29.5 \pm 1.4	29.7 \pm 1.5	28.9 \pm 12.4
		Field Site 2	11.3 \pm 0.8	10.4 \pm 0.5	10.1 \pm 9.06
		Lab (Cs-137)	13.7 \pm 0.9	17.2 \pm 0.9	16.2 \pm 6.8
115-8B	CaF ₂ :Mn Bulbs	Field Site 1	32.3 \pm 1.2	29.7 \pm 1.5	28.9 \pm 12.4
		Field Site 2	9.0 \pm 1.0	10.4 \pm 0.5	10.1 \pm 9.0
		Lab (Cs-137)	15.8 \pm 0.9	17.2 \pm 0.9	16.2 \pm 6.8
115-8C	CaSO ₄ :Dy Cards	Field Site 1	32.2 \pm 0.7	29.7 \pm 1.5	28.9 \pm 12.4
		Field Site 2	10.6 \pm 0.6	10.4 \pm 0.5	10.1 \pm 9.0
		Lab (Cs-137)	18.1 \pm 0.8	17.2 \pm 0.9	16.2 \pm 6.8
<u>Teledyne Testing^j</u>					
89-1	LiF-100 Chips	Lab	21.0 \pm 0.4	22.4	--
89-2	Teledyne CaSO ₄ :Dy Cards	Lab	20.9 \pm 1.0	20.3	--

Table A-2. (continued)

Lab Code	TLD Type	Measurement $\pm 2\sigma^a$	mR		
			Teledyne Result Value ^c	Known Participants)	Average $\pm 2\sigma$ (All
<u>Teledyne Testing^j</u>					
90-1 ^k	Teledyne CaSO ₄ :Dy Cards	Lab	20.6 \pm 1.4	19.6	—
90-1 ^l	Teledyne CaSO ₄ :Dy Cards	Lab	100.8 \pm 4.3	100.0	—
91-1 ^m	Teledyne CaSO ₄ :Dy Cards	Lab	33.4 \pm 2.0	32.0	—
			55.2 \pm 4.7	58.8	—
			87.8 \pm 6.2	85.5	—

^a Lab result given is the mean ± 2 standard deviations of three determinations.

^b Second International Intercomparison of Environmental Dosimeters conducted in April of 1976 by Health and Safety Laboratory (HASL), New York, New York, and the School of Public Health of the University of Texas, Houston, Texas.

^c Value determined by sponsor of the intercomparison using continuously operated pressurized ion chamber.

^d Mean ± 2 standard deviations of results obtained by all laboratories participating in the program.

^e Third International Intercomparison of Environmental Dosimeters conducted in summer of 1977 by Oak Ridge National Laboratory and the School of Public Health of the University of Texas, Houston, Texas.

^f Fourth International Intercomparison of Environmental Dosimeters conducted in summer of 1979 by the School of Public Health of the University of Texas Houston, Texas.

^g Fifth International Intercomparison of Environmental Dosimeters conducted in fall of 1980 at Idaho Falls, Idaho and sponsored by the School of Public Health of the University of Texas, Houston, Texas and Environmental Measurements Laboratory, New York, New York, U.S. Department of Energy.

^h Seventh International Intercomparison of Environmental Dosimeters conducted in the spring and summer of 1984 at Las Vegas, Nevada, and sponsored by the U.S. Department of Energy, The U.S. Nuclear Regulatory Commission, and the U.S. Environmental Protection Agency.

ⁱ Eighth International Intercomparison of Environmental Dosimeters conducted in the fall and winter of 1985-1986 at New York, New York, and sponsored by the U.S. Department of Energy.

^j Chips were submitted in September 1989 and cards were submitted in November 1989 to Teledyne Isotopes, Inc., Westwood, NJ for irradiation.

^k Cards were irradiated by Teledyne Isotopes, Inc., Westwood, NJ on June 19, 1990.

^l Cards were irradiated by Dosimetry Associates, Inc., Northville, MI on October 30, 1990.

^m Irradiated cards were provided by Teledyne Isotopes, INC., Westwood, NJ. Irradiated on October 8, 1991.

Table A-3. In-house spiked samples.

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L		Expected Precision 1s, n=1 ^a
				TIML Result n=1	Known Activity	
QC-MI-16	Milk	Feb 1988	Sr-89	31.8±4.7	31.7±6.0	8.7
			Sr-90	25.5±2.7	27.8±3.5	5.2
			I-131	26.4±0.5	23.2±5.0	10.4
			Cs-134	23.8±2.3	24.2±6.0	8.7
			Cs-137	26.5±0.8	25.1±6.0	8.7
QC-MI-17	Milk	Feb 1988	I-131	10.6±1.2	14.3±1.6	10.4
QC-W-35	Water	Feb 1988	I-131	9.7±1.1	11.6±1.1	10.4
QC-W-36	Water	Mar 1988	I-131	10.5±1.3	11.6±1.0	10.4
QC-W-37	Water	Mar 1988	Sr-89	17.1±2.0	19.8±8.0	8.7
			Sr-90	18.7±0.9	17.3±5.0	5.2
QC-MI-18	Milk	Mar 1988	I-131	33.2±2.3	26.7±5.0	10.4
			Cs-134	31.3±2.1	30.2±5.0	8.7
			Cs-137	29.9±1.4	26.2±5.0	8.7
QC-W-38	Water	Apr 1988	I-131	17.1±1.1	14.2±5.0	10.4
QC-W-39	Water	Apr 1988	H-3	4439±21	4176±500	724
QC-W-40	Water	Apr 1988	Co-60	23.7±0.5	26.1±4.0	8.7
			Cs-134	25.4±2.6	29.2±4.5	8.7
			Cs-137	26.6±2.3	26.2±4.0	8.7
QC-W-41	Water	Jun 1988	Gr. alpha	12.3±0.4	13.1±5.0	8.7
			Gr. beta	22.6±1.0	20.1±5.0	8.7
QC-MI-19	Milk	Jul 1988	Sr-89	15.1±1.6	16.4±5.0	8.7
			Sr-90	18.0±0.6	18.3±5.0	5.2
			I-131	88.4±4.9	86.6±8.0	10.4
			Cs-137	22.7±0.8	20.8±6.0	8.7
QC-W-42	Water	Sep 1988	Sr-89	48.5±3.3	50.8±8.0	8.7
			Sr-90	10.9±1.0	11.4±3.5	5.2
QC-W-43	Water	Oct 1988	Co-60	20.9±3.2	21.4±3.5	8.7
			Cs-134	38.7±1.6	38.0±6.0	8.7
			Cs-137	19.0±2.4	21.0±3.5	8.7
QC-W-44	Water	Oct 1988	I-131	22.2±0.6	23.3±3.5	10.4

Table A-3. In-house spiked samples(continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L		Expected Precision 1s, n=1 ^a
				TIML Result n=1	Known Activity	
QC-W-45	Water	Oct 1988	H-3	4109±43	4153±500	724
QC-MI-20	Milk	Oct 1988	I-131	59.8±0.9	60.6±9.0	10.4
			Cs-134	49.6±1.8	48.6±7.5	8.7
			Cs-137	25.8±4.6	24.7±4.0	8.7
QC-W-46	Water	Dec 1988	Gr. alpha	11.5±2.3	15.2±5.0	8.7
			Gr. beta	26.5±2.0	25.7±5.0	8.7
QC-MI-21	Milk	Jan 1989	Sr-89	25.5±10.3	34.0±10.0	8.7
			Sr-90	28.3±3.2	27.1±3.0	5.2
			I-131	540±13	550±20	10.4
			Cs-134	24.5±2.6	22.6±5.5	8.7
			Cs-137	24.0±0.6	20.5±5.0	8.7
QC-W-47	Water	Mar 1989	Sr-89	15.2±3.8	16.1±5.0	8.7
			Sr-90	16.4±1.7	16.9±3.0	5.2
QC-MI-22	Milk	Apr 1989	I-131	36.3±1.1	37.2±5.0	10.4
			Cs-134	20.8±2.8	20.7±8.0	8.7
			Cs-137	22.2±2.4	20.4±8.0	8.7
QC-W-48	Water	Apr 1989	Co-60	23.5±2.0	25.1±8.0	8.7
			Cs-134	24.2±1.1	25.9±8.0	8.7
			Cs-137	23.6±1.2	23.0±8.0	8.7
QC-W-49	Water	Apr 1989	I-131	37.2±3.7	37.2±5.0	10.4
QC-W-50	Water	Apr 1989	H-3	3011±59	3089±500	724
QC-W-51	Water	Jun 1989	Gr. alpha	13.0±1.8	15.0±5.0	8.7
			Gr. beta	26.0±1.2	25.5±8.0	8.7
QC-MI-23	Milk	Jul 1989	Sr-89	19.4±6.5	22.0±10.0	8.7
			Sr-90	27.6±3.5	28.6±3.0	5.2
			I-131	46.8±3.2	43.4±5.0	10.4
			Cs-134	27.4±1.8	28.3±6.0	8.7
			Cs-137	24.1±1.8	20.8±6.0	8.7
QC-MI-24	Milk	Aug 1989	Sr-89	25.4±2.7	27.2±10.0	8.7
			Sr-90	46.0±1.1	47.8±9.6	8.3
QC-W-52	Water	Sep 1989	I-131	9.6±0.3	9.7±1.9	10.4

Table A-3. In-house spiked samples (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L		Expected Precision 1s, n=1 ^a
				TIML Result n=1	Known Activity	
QC-W-53	Water	Sep 1989	I-131	19.0±0.2	20.9±4.2	10.4
QC-W-54	Water	Sep 1989	Sr-89	25.8±4.6	24.7±4.0	8.7
			Sr-90	26.5±5.3	29.7±5.0	5.2
QC-MI-25	Milk	Oct 1989	I-131	70.0±3.3	73.5±20.0	10.4
			Cs-134	22.1±2.6	22.6±8.0	8.7
			Cs-137	29.4±1.5	27.5±8.0	8.7
QC-W-55	Water	Oct 1989	I-131	33.3±1.3	35.3±10.0	10.4
QC-W-56	Water	Oct 1989	Co-60	15.2±0.9	17.4±5.0	8.7
			Cs-134	22.1±4.4	18.9±8.0	8.7
			Cs-137	27.2±1.2	22.9±8.0	8.7
QC-W-57	Water	Oct 1989	H-3	3334±22	3379±500	724
QC-W-58	Water	Nov 1989	Sr-89	10.9±1.4 ^d	11.1±1.0 ^d	8.7
			Sr-90	10.4±1.0 ^d	10.3±1.0 ^d	5.2
QC-W-59	Water	Nov 1989	Sr-89	101.0±6.0 ^d	104.1±10.5 ^d	17.5
			Sr-90	98.0±3.0 ^d	95.0±10.0 ^d	17.0
QC-W-60	Water	Dec 1989	Gr. alpha	10.8±1.1	10.6±4.0	8.7
			Gr. beta	11.6±0.5	11.4±4.0	8.7
QC-MI-26	Milk	Jan 1990	Cs-134	19.3±1.0	20.8±8.0	8.7
			Cs-137	25.2±1.2	22.8±8.0	8.7
QC-MI-27	Milk	Feb 1990	Sr-90	18.0±1.6	18.8±5.0	5.2
QC-MI-28	Milk	Mar 1990	I-131	63.8±2.2	62.6±6.0	6.3
QC-MI-61	Water	Apr 1990	Sr-89	17.9±5.5	23.1±8.7	8.7
			Sr-90	19.4±2.5	23.5±5.2	5.2
QC-MI-29	Milk	Apr 1990	I-131	90.7±9.2	82.5±8.5	10.4
			Cs-134	18.3±1.0	19.7±5.0	8.7
			Cs-137	20.3±1.0	18.2±5.0	8.7
QC-W-62	Water	Apr 1990	Co-60	8.7±0.4	9.4±5.0	8.7
			Cs-134	20.0±0.2	19.7±5.0	8.7
			Cs-137	28.7±1.4	22.7±5.0	8.7

Table A-3. In-house spiked samples (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L		Expected Precision 1s, n=1 ^a
				TIML Result n=1	Known Activity	
QC-W-63	Water	Apr 1990	I-131	63.5±8.0	66.0±6.7	6.6
QC-W-64	Water	Apr 1990	H-3	1941±130	1826.0±350.0	724
QC-W-65	Water	Jun 1990	Ra-226	6.4±0.2	6.9±1.0	1.0
QC-W-66	Water	Jun 1990	U	6.2±0.2	6.0±6.0	6.0
QC-MI-30	Milk	Jul 1990	Sr-89	12.8±0.4	18.4±10.0	8.7
			Sr-90	18.2±1.4	18.7±6.0	5.2
			Cs-134	46.0±1.3	49.0±5.0	8.7
			Cs-137	27.6±1.3	25.3±5.0	8.7
QC-W-68	Water	Jun 1990	Gr. alpha	9.8±0.3	10.6±6.0	8.7
			Gr. beta	11.4±0.6	11.3±7.0	8.7
QC-MI-31	Milk	Aug 1990	I-131	68.8±1.6	61.4±12.3	10.4
QC-W-69	Water	Sep 1990	Sr-89	17.7±1.6	19.2±10.0	8.7
			Sr-90	13.9±1.6	17.4±10.0	5.2
QC-MI-32	Milk	Oct 1990	I-131	34.8±0.2	32.4±6.5	8.7
			Cs-134	25.8±1.2	27.3±10.0	8.7
			Cs-137	25.3±2.0	22.4±10.0	8.7
QC-W-70	Water	Oct 1990	H-3	2355±59	2276±455	605
QC-W-71	Water	Oct 1990	I-131	55.9±0.9	51.8±10.4	10.4
QC-W-73	Water	Oct 1990	Co-60	18.3±2.7	16.8±5.0	8.7
			Cs-134	28.3±2.3	27.0±5.0	8.7
			Cs-137	22.7±1.3	22.4±5.0	8.7
QC-W-74	Water	Dec 1990	Gr. alpha	21.4±1.0	26.1±6.5	11.3
			Gr. beta	25.9±1.0	22.3±5.6	9.7
QC-MI-33	Milk	Jan 1991	Sr-89	20.7±3.3	21.6±5.0	5.0
			Sr-90	19.0±1.4	23.0±3.0	3.0
			Cs-134	22.2±1.7	19.6±5.0	5.0
			Cs-137	26.1±1.6	22.3±5.0	5.0
QC-MI-34	Milk	Feb 1991	I-131	40.7±1.8	40.1±6.0	6.0
QC-W-75	Water	Mar 1991	Sr-89	18.8±1.5	23.3±5.0	5.0
			Sr-90	16.0±0.8	17.2±3.0	3.0

Table A-3. In-house spiked samples (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L		Expected Precision 1s, n=1 ^a
				TIML Result n=1	Known Activity	
QC-W-76	Water	Apr 1991	I-131	56.5±1.7	59.0±5.9	5.9
QC-W-77	Water	Apr 1991	Co-60	16.4±2.2	15.7±5.0	5.0
			Cs-134	23.8±2.5	22.6±5.0	5.0
			Cs-137	25.0±2.4	21.1±5.0	5.0
QC-W-78	Water	Apr 1991	H-3	4027±188	4080±408	408
QC-MI-35	Milk	Apr 1991	I-131	48.0±0.8	49.2±6.0	6.0
			Cs-134	19.2±2.0	22.6±5.0	5.0
			Cs-137	22.8±2.2	22.1±5.0	5.0
QC-W-79	Water	Jun 1991	Gr. alpha	7.4±0.7	7.8±5.0	5.0
			Gr. beta	11.0±0.7	11.0±5.0	5.0
QC-MI-36	Milk	Jul 1991	Sr-89	28.1±2.1	34.0±10.0	10.0
			Sr-90	11.6±0.7	11.5±3.0	3.0
			I-131	14.4±1.9	18.3±5.0	5.0
			Cs-137	34.3±3.0	35.1±5.0	5.0
QC-W-80	Water	Oct 1991	Sr-89	27.4±6.9	24.4±5.0	5.0
			Sr-90	11.7±1.4	14.1±5.0	5.0
QC-W-81	Water	Oct 1991	I-131	19.1±0.7	20.6±4.2	4.2
QC-W-82	Water	Oct 1991	Co-60	22.6±2.7	22.1±5.0	5.0
			Cs-134	15.5±1.8	17.6±5.0	5.0
			Cs-137	17.5±2.1	17.6±5.0	5.0
QC-W-83	Water	Oct 1991	H-3	4639±137	4382±438	438
QC-MI-37	Milk	Oct 1991	I-131	22.6±3.2	25.8±5.0	5.0
			Cs-134	22.7±2.8	22.1±5.0	5.0
			Cs-137	38.3±3.0	35.1±5.0	5.0
QC-W-84	Water	Dec 1991	Gr. alpha	6.2±0.6	7.8±5.0	5.0
			Gr. beta	11.0±0.7	11.0±5.0	5.0

^a n=3 unless noted otherwise.^b n=2 unless noted otherwise.^c n=1 unless noted otherwise.^d Concentration in pCi/ml.

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

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L)	
				Results (4.66 σ)	Acceptance Criteria (4.66 σ)
SPS-5386	Milk	Jan 1988	I-131	<0.1	<1
SPW-5448	"Dead" Water	Jan 1988	H-3	<177	<300
SPS-5615	Milk	Mar 1988	Cs-134	<2.4	<10
			Cs-137	<2.5	<10
			I-131	<0.3	<1
			Sr-89	<0.4	<5
			Sr-90	2.4 \pm 0.5 ^a	<1
SPS-5650	D.I. Water	Mar 1988	Th-228	<0.3	<1
			Th-230	<0.04	<1
			Th-232	<0.05	<1
			U-234	<0.03	<1
			U-235	<0.03	<1
			U-238	<0.03	<1
			Am-241	<0.06	<1
			Cm-241	<0.01	<1
			Pu-238	<0.08	<1
			Pu-240	<0.02	<1
SPS-6090	Milk	Jul 1988	Sr-89	<0.5	<1
			Sr-90	1.8 \pm 0.5	<1
			I-131	<0.4	<1
			Cs-137	<0.4	<10
SPW-6209	Water	Jul 1988	Fe-55	<0.8	<1
SPW-6292	Water	Sep 1988	Sr-89	<0.7	<1
			Sr-90	<0.7	<1
SPS-6477	Milk	Oct 1988	I-131	<0.2	<1
			Cs-134	<6.1	<10
			Cs-137	<5.9	<10
SPW-6478	Water	Oct 1988	I-131	<0.2	<1
SPW-6479	Water	Oct 1988	Co-60	<5.7	<10
			Cs-134	<3.7	<10
			Cs-137	<4.3	<10
SPW-6480	Water	Oct 1988	H-3	<170	<300

Table A-4. In-house "blank" samples (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L)	
				Results (4.66 σ)	Acceptance Criteria (4.66 σ)
SPW-6625	Water	Dec 1988	Gr. alpha Gr. beta	<0.7 <1.9	<1 <4
SPS-6723	Milk	Jan 1989	Sr-89 Sr-90 I-131 Cs-134 Cs-137	<0.6 1.9 \pm 0.5 ^a <0.2 <4.3 <4.4	<5 <1 <1 <10 <10
SPW-6877	Water	Mar 1989	Sr-89 Sr-90	<0.4 <0.6	<5 <1
SPS-6963	Milk	Apr 1989	I-131 Cs-134 Cs-137	<0.3 <5.9 <6.2	<1 <10 <10
SPW-7561	Water	Apr 1989	H-3	<150	<300
SPW-7707	Water	Jun 1989	Ra-226 Ra-228	<0.2 <0.6	<1 <1
SPS-7208	Milk	Jun 1989	Sr-89 Sr-90 I-131 Cs-134 Cs-137	<0.6 2.1 \pm 0.5 ^a <0.3 <6.4 <7.2	<5 <1 <1 <10 <10
SPW-7568	Water	Jun 1989	Gr. alpha Gr. beta	<0.2 <1.0	<1 <4
SPS-7322	Milk	Aug 1989	Sr-89 Sr-90 I-131 Cs-134 Cs-137	<1.4 4.8 \pm 1.0 ^a <0.2 <6.9 <8.2	<5 <1 <1 <10 <10
SPW-7559	Water	Sep 1989	Sr-89 Sr-90	<2.0 <0.7	<5 <1
SPW-7560	Water	Oct 1989	I-131	<0.1	<1
SPW-7562	Water	Oct 1989	H-3	<140	<300

Table A-4. In-house "blank" samples (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L)	
				Results (4.66 σ)	Acceptance Criteria (4.66 σ)
SPS-7605	Milk	Nov 1989	I-131	<0.2	<1
			Cs-134	<8.6	<10
			Cs-137	<10	<10
SPW-7971	Water	Dec 1989	Gr. alpha	<0.4	<1
			Gr. beta	<0.8	<4
SPW-8039	Water	Jan 1990	Ra-226	<0.2	<1
SPS-8040	Milk	Jan 1990	Sr-89	<0.8	<5
			Sr-90	<1.0	<1
SPS-8208	Milk	Jan 1990	Sr-89	<0.8	<5
			Sr-90	1.6 \pm 0.5 ^a	<1
			Cs-134	<3.6	<10
			Cs-137	<4.7	<10
SPS-8312	Milk	Feb 1990	Sr-89	<0.3	<5
			Sr-90	1.2 \pm 0.3 ^a	<1
SPW-8312A	Water	Feb 1990	Sr-89	<0.6	<5
			Sr-90	<0.7	<5
SPS-8314	Milk	Mar 1990	I-131	<0.3	<1
SPS-8510	Milk	May 1990	I-131	<0.2	<1
			Cs-134	<4.6	<10
			Cs-137	<4.8	<10
SPW-8511A	Water	May 1990	H-3	<200	<300
SPS-8600	Milk	Jul 1990	Sr-89	<0.8	<5
			Sr-90	1.7 \pm 0.6 ^a	<1
			I-131	<0.3	<1
			Cs-134	<5.0	<10
			Cs-137	<7.0	<10
SPM-8877	Milk	Aug 1990	I-131	<0.2	<1
SPW-8925	Water	Aug 1990	H-3	<200	<300

Table A-4. In-house "blank" samples (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L)	
				Results (4.66 σ)	Acceptance Criteria (4.66 σ)
SPW-8926	Water	Aug 1990	Gr. alpha	<0.3	<1
			Gr. beta	<0.7	<4
SPW-8927	Water	Aug 1990	U-234	<0.01	<1
			U-235	<0.02	<1
			U-238	<0.01	<1
SPW-8928	Water	Aug 1990	Mn-54	<4.0	<5
			Co-58	<4.1	<5
			Co-60	<2.4	<5
			Cs-134	<3.3	<5
			Cs-137	<3.7	<5
SPW-8929	Water	Aug 1990	Sr-89	<1.4	<5
			Sr-90	<0.6	<1
SPW-69	Water	Sep 1990	Sr-89	<1.8	<5
			Sr-90	<0.8	<1
SPW-106	Water	Oct 1990	H-3	<180	<300
			I-131	<0.3	<1
SPM-107	Milk	Oct 1990	I-131	<0.4	<1
			Cs-134	<3.3	<5
			Cs-137	<4.3	<5
SPW-370	Water	Oct 1990	Mn-54	<1.7	<5
			Co-58	<2.6	<5
			Co-60	<1.6	<5
			Cs-134	<1.7	<5
			Cs-137	<1.8	<5
SPW-372	Water	Dec 1990	Gr. alpha	<0.3	<1
			Gr. beta	<0.8	<4
SPS-406	Milk	Jan 1991	Sr-89	<0.4	<5
			Sr-90	1.8 \pm 0.4 ^a	<1
			Cs-134	<3.7	<5
			Cs-137	<5.2	<5
SPS-421	Milk	Feb 1991	I-131	<0.3	<1
SPW-451	Water	Feb 1991	Ra-226	<0.1	<1
			Ra-228	<0.9	<1

Table A-4. In-house "blank" samples (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L)	
				Results (4.66 σ)	Acceptance Criteria (4.66 σ)
SPW-514	Water	Mar 1991	Sr-89	<1.1	<5
			Sr-90	<0.9	<1
SPW-586	Water	Apr 1991	I-131	<0.2	<1
			Co-60	<2.5	<5
			Cs-134	<2.4	<5
			Cs-137	<2.2	<5
SPS-587	Milk	Apr 1991	I-131	<0.2	<1
			Cs-134	<1.7	<5
			Cs-137	<1.9	<5
SPW-837	Water	Jun 1991	Gr. alpha	<0.6	<1
			Gr. beta	<1.1	<4
SPM-953	Milk	Jul 1991	Sr-89	<0.7	<5
			Sr-90	0.4±0.3 ^a	<1
			I-131	<0.2	<1
			Cs-137	<4.9	<5
SPM-1236	Milk	Oct 1991	I-131	<0.2	<1
			Cs-134	<3.7	<5
			Cs-137	<4.6	<5
SPW-1254	Water	Oct 1991	Sr-89	<2.8	<5
			Sr-90	<0.7	<1
SPW-1256	Water	Oct 1991	I-131	<0.4	<1
			Co-60	<3.6	<5
			Cs-134	<4.0	<5
			Cs-137	<3.6	<5
SPW-1259	Water	Oct 1991	H-3	<160	<300
SPW-1444	Water	Dec 1991	Gr. alpha	<0.4	<1
			Gr. beta	<0.8	<4

^a Low level of Sr-90 concentration in milk (1 - 5 pCi/L) is not unusual.

ATTACHMENT B

ACCEPTANCE CRITERIA FOR "SPIKED" SAMPLES

LABORATORY PRECISION: ONE STANDARD DEVIATION VALUES FOR VARIOUS ANALYSES^a

Analysis	Level	One Standard Deviation for Single Determination
Gamma Emitters	5 to 100 pCi/liter or kg >100 pCi/liter or kg	5 pCi/liter 5% of known value
Cerium-89 ^b	5 to 50 pCi/liter or kg >50 pCi/liter or kg	5 pCi/liter 10% of known value
Strontium-90 ^b	2 to 30 pCi/liter or kg >30 pCi/liter or kg	3.0 pCi/liter 10% of known value
Potassium	>0.1 g/liter or kg	5% of known value
Gross alpha	<20 pCi/liter >20 pCi/liter	5 pCi/liter 25% of known value
Gross beta	<100 pCi/liter >100 pCi/liter	5 pCi/liter 5% of known value
Tritium	<4,000 pCi/liter >4,000 pCi/liter	1s = (pCi/liter) = 169.85 x (known) .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 pCi/liter 10% of known value
Uranium-238, Nickel-64 ^b , Technetium-99 ^b	<35 pCi/liter >35 pCi/liter	6 pCi/liter 15% of known value
Iron-55 ^b	50 to 100 pCi/liter >100 pCi/liter	10 pCi/liter 10% of known value

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

^b TIML limit.

ADDENDUM TO APPENDIX A

The following is an explanation of the reasons why certain samples were outside the control limit specified by the Environmental Protection Agency for the Interlaboratory Comparisons Program starting January 1988.

Lab Code	Analysis	TML Result (pCi/L) ^a	EPA Control Limit (pCi/L) ^a	Explanation
524	K	1010.7±158.5 ^b	1123.5-1336.5	Error in transference of data. Correct data was 1105±33 mg/kg. Results in the past have been within the limits and TIML will monitor the situation in the future.
W-532	I-131	9.0±2.0	6.2-8.8	Sample recounted after 12 days. The average result was 8.8±1.7 pCi/L (within EPA control limits). The sample was recounted in order to check the decay. Results in the past have been within the limits and TIML will continue to monitor the situation in the future.
STW-534	Co-60	63.3±1.3	41.3-58.7	High level of Co-60 was due to contamination of beaker. Beaker was discarded upon discovery of contamination and sample was recounted. Recount results were 53.2±3.6 and 50.9±2 pCi/L.
STM-554	Sr-90	51.0±2.0	54.8-65.2	The cause of low result is due to the high fat content of milk. It was noted that 63% of all participants failed this test. Also, the average for all participants was 54.0 pCi/L before the Grubb and 55.8 pCi/L after the Grubb.
STW-560	Pu-239	5.8±1.1	3.5-4.9	The cause of high results is not known though it is suspected that the standard was not properly calibrated by supplier and is under investigation. New Pu-239 standard was obtained and will be used for the next test.
STW-568	Ra-228	2.6±1.0	2.7-4.5	The cause of low results is not known. Next EPA cross check results were within the control limits. No further action planned.

ADDENDUM TO APPENDIX A (continued)

Lab Code	Analysis	TIML Result (pCi/L) ^a	EPA Control Limit (pCi/L) ^a	Explanation
STM-570	Sr-89 Sr-90	26.0±10.0 45.7±4.2	30.3-47.7 49.8-60.2	The cause of low results was falsely high recovery due to suspected incomplete calcium removal. Since EPA sample was used up, internal spike was prepared and analyzed. The results were within control limits (See table A-3, sample QC-MI-24). No further action is planned.
STW-589	Sr-90	17.3±1.2	17.4-22.6	Sample was reanalyzed in triplicate; results of reanalyses were 18.8±1.5 pCi/L. No further action is planned.
STM-599	K	1300.0±69.2 ^c	1414.7-1685.3 ^c	Sample was reanalyzed in triplicate. Results of reanalyses were 1421.7±95.3 mg/L. The cause of low results is unknown.
STW-601	Gr. alpha	11.0±2.0	11.6-32.4	Sample was reanalyzed in triplicate. Results of reanalyses were 13.4±1.0 pCi/L.
STAF-626	Gr. alpha	38.7±1.2	14.6-35.4	The cause of high results is the difference in geometry between standard used in the TIML lab and EPA filter.
STW-632	Ba-133	74.0±6.9	51.6-72.4	Sample was reanalyzed. Results of the reanalyses were 63.8±6.9 pCi/L within EPA limit.
STM-641	I-131	130.7±16.8	88.9-127.1	The cause of high result is unknown. In-house spike sample was prepared with activity of I-131 68.3±6.8 pCi/L. Result of the analysis was 69.1±9.7 pCi/L.

^a Reported in pCi/L unless otherwise noted.

^b Concentrations are reported in mg/kg.

^c Concentrations are reported in mg/L.