ENVIRONMENTAL MONITORING
TECHNICAL SPECIFICATION (5.9.4.b.)

January 1, 1987 to December 31, 1987

IE25
1/1

5.9.4.b Radiological Environmental Operating Report

1(a) The number of sample locations, sample collection frequency and the number of samples collected this period for each class of sample is delineated in Table 1.

A complete summary of the program findings is presented in Table 2. For each type of analysis of each sampled medium this table considers separately all indicator locations, all control locations and the location with the highest annual mean result. For each of these classes, the table specifies the following:

(1) The total number of analyses.

(2) The fraction of these yielding detectable results (i.e., results above the highest lower limit of detection for the period).

(3) The average, lowest, and highest results.

In addition, the distance and direction relative to the Reactor Containment Building are specified for the location with the highest annual mean.

(b) Results obtained show background levels of radioactivity in the environmental samples collected in 1987. The residual effect of previous nuclear tests was detected in one water sample (tritium) and one silt sample (cesium-137). No station effect on the environment was indicated.

(c) See Appendix A.

(d) See Table 3.

(e) The limits of Technical Specification 2.1.3 were not exceeded by the primary coolant during the reporting period.

Table 1. Sample collection program.

Sample Class	Collection Frquency	Sample Locations	Number of Samples Collected This Period
Background Radiation (TLD)	Quarterly	Eleven (11)	43
		Four (4)[a]	16
Air Particulate	Weekly	Five (5)	260
Airborne Iodine	Weekly	Five (5)	260
Well Water[b]	Monthly	Three (3)	27
	Quarterly Composite	Three (3)	9
Milk	Biweekly	Two (2)	20
	Monthly	Two (2)	14
	Biweekly	One (1)[a]	10
	Monthly	One (1)[a]	7
Surface Water	Monthly	Three (3)	36
Fish (four species)	Annually	Two (2)	8
Mud and Silt	Semiannually	One (1)	2
	Semiannually	One (1)[a]	2
		TOTAL:	714

[a] Additional sampling locations not required by the Technical Specifications.
[b] Not required by the Technical Specifications.

Table 2. Environmental Radiological 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, 1987

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Semiannual Mean		Control Locations Mean (F) Range	Number of Non-routine Results[e]
				Location[d]	Mean (F) Range		
Background Radiation (TLD) (mR/week)	Gamma 43[f]	0.5	1.4 (39/40) (0.9-1.9)	OFA, Onsite Station No. 1	1.8 (4/4) (1.7-1.9)	1.6 (4/4) (1.2-1.8)	0
Airborne Particulates (pCi/m^3)	GB 260	0.01	0.029 (208/208) (0.008-0.083)	OAG, Onsite Station No. 2 0.6 mi SW of Reactor	0.031 (52/52) (0.015-0.083)	0.029 (52/52) (0.009-0.045)	0
	GS 60						
	Cs-134	0.007	<LLD	--	--	<LLD	0
	Cs-137	0.010	<LLD	--	--	<LLD	0
	Other gammas[g]	0.010	<LLD	--	--	<LLD	0
Airborne Iodine (pCi/m^3)	I-131 260	0.07[h]	<LLD	--	--	<LLD	0
Milk, Fresh (pCi/l)	I-131 34[f]	0.5	<LLD	--	--	<LLD	0
	GS 34[f]						
	K-40	150	1310 (17/17) (1200-1520)	O-21, Japp Dairy 5.3 mi @ 219°	1330 (17/17) (1070-1480)	1230 (17/17) (1070-1480)	0
	Cs-134	15	<LLD	--	--	<LLD	0
	Cs-137	1	<LLD	--	--	<LLD	0
	Other gammas	15	<LLD	--	--	<LLD	0

Table 2. Environmental Radiological Monitoring Program Summary (continued)

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, 1987

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Semiannual Mean		Control Locations Mean (F) Range	Number of Non-routine Results[e]
				Location[d]	Mean (F) Range		
Surface Water (pCi/l)	GS 36						
	Cs-134	15	<LLD	--	--	<LLD	0
	Cs-137	18	<LLD	--	--	<LLD	0
	Other Gammas	15	<LLD	--	--	<LLD	0
	H-3 36	300	450 (1/24) -	0-13 Downstream 0.5 mi @ 106°	450 (1/12) -	<LLD	0
Fish (pCi/g wet)	GS 8						
	Mn-54	0.036	<LLD	--	--	<LLD	0
	Co-58	0.042	<LLD	--	--	<LLD	0
	Co-60	0.037	<LLD	--	--	<LLD	0
	Zn-65	0.080	<LLD	--	--	<LLD	0
	Cs-134	0.030	<LLD	--	--	<LLD	0
	Cs-137	0.033	<LLD	--	--	<LLD	0
	Other Gammas	0.037	<LLD	--	--	<LLD	0

Table 2. Environmental Radiological Monitoring Program Summary (continued)

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, 1987

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Semiannual Mean		Control Locations Mean (F) Range	Number of Non-routine Results[e]
				Location[d]	Mean (F) Range		
Mud and Silt (pCi/g dry)	GS 1[f]						
	Cs-134	0.05	<LLD	--	--	None	0
	Cs-137	0.05	0.14 (1/1) -	0-13, Downstream 0.5 mi @ 106°	0.14 (1/1) -	None	0
	Other Gammas	0.05	<LLD	--	--	None	0

[a] GB = Gross beta; GS = Gamma scan.
[b] LLD = Lower limit of detection (based on 3 sigma error for background sample unless otherwise indicated).
[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] Results for sites not required by the technical specifications are excluded from this summary.
[g] Value given is for Ru-103.
[h] Four results (<0.125, 0.176, 0.178, and 0.118 pCi/m^3) are excluded from the determination of LLD. They resulted from low volumes.

TABLE 3

Environmental Radiological Monitoring - Land Use Survey

Sector	Date/Time	Location (One Nearest to Plant Site)	Distance/Azimuth	*Within One Mile Radius (X)	**Within One to Five Mile Radius (X)	Breed/Number of Milk Animals	Remarks
A	07-11-87/1530	Bessey, C.	7376 meters/349°30'		X		
B	07-07-86/0845	Rand, J.	3085 meters/11°35'		X		
C	07-07-86/0900	Robbins, J.	2454 meters/41°10'		X		
D	07-07-86/0920	Meades	7759 meters/64°		X		
E	07-07-86/1305	Crispin, C.	7549 meters/89°		X		
F	07-07-86/1350	Seitz	6753 meters/121°10'		X		
G	07-08-86/1020	Galvin	2682 meters/145°		X		
H	07-08-86/1130	Pechnik, A.	1437 meters/164°45'	X			
J	07-08-86/1250	Ellis, T.	1189 meters/181°15'	X			
	07-08-86/1325	Seltz	4445 meters/168°50'		X	Guernseys/4	
K	07-08-86/1440	Booze	1054 meters/204°20'	X			
L	07-09-86/0850	Bender	1190 meters/223°30'	X			
M	07-09-86/1045	Rouse	1676 meters/256°		X		
N	07-09-86/1405	Nielsen	1925 meters/262°15'		X		
P	07-10-86/0915	Schroeder	3226 meters/294°		X		
	07-10-86/0935	Vanacek	3659 meters/293°30'		X	(Goat)/1	Breed Unknown
Q	07-10-86/1430	Hansen	3947 meters/318°		X		
	07-10-86/1510	Flynn	5623 meters/310°		X	Holsteins/205	
R	07-11-86/1305	Mencke	3295 meters/329°80'		X		

NOTE: *Within one mile radius from plant: door to door or equivalent counting technique.

**Within one to five mile radius from plant: county agricultural references or equivalent accounting sources.

(Reference Technical Specification 3.11 for further survey details)

Appendix A

Interlaboratory Comparison Program Results

Appendix A

Interlaboratory 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 concentrations 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 May 1984 through December 1987. 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 (TLD's) during the period 1976, 1977, 1979, 1980, 1984, and 1985-1986 through participation in the Second, Third, Fourth, Fifth, Seventh, and Eighth International Intercomparison of Environmental Dosimeters under the sponsorships listed in Table A-2.

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.

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, 1984 through 1987.[a]

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	EPA Result[d] Control Limits
STW-358	Water	May 1984	Gr. alpha	3.0±0.6	3±5.0	0.0-11.7
			Gr. beta	6.7±1.2	6±5.0	0.0-14.7
STM-366	Milk	June 1984	Sr-89	21±3.1	25±5.0	16.3-33.7
			Sr-90	13±2.0	17±1.5	14.4-19.6
			I-131	46±5.3	43±6.0	32.6-53.4
			Cs-137	38±4.0	35±5.0	26.3-43.7
			K-40	1577±172	1496±75	1336-1626
STW-368	Water	July 1984	Gr. alpha	5.1±1.1	6±5.0	0.0-14.7
			Gr. beta	11.9±2.4	13±5.0	4.3-21.7
STW-369	Water	August 1984	I-131	34.?±5.0	34.0±6.0	23.6-44.4
STW-370	Water	August 1984	H-3	3003±253	2817±356	2200-3434
STF-371	Food	July 1984	Sr-89	22.0±5.3	25.0±5.0	14.3-33.7
			Sr-90	14.7±3.1	20.0±1.5	17.4-22.6
			I-131	<172	39.0±6.0	28.6-49.4
			Cs-137	24.0±5.3	25.0±5.0	14.3-33.7
			K-40	2503±132	2605±130	2379-2831
STAF-372	Air Filter	August 1984	Gr. alpha	15.3±1.2	17±5.0	8.3-25.7
			Gr. beta	56.0±0.0	51±5.0	42.3-59.7
			Sr-90	14.3±1.2	18±1.5	15.6-20.4
			Cs-137	21.0±2.0	15±5.0	6.3-23.7
STW-375	Water	Sept 1984	Ra-226	5.1±0.4	4.9±0.7	3.6-6.2
			Ra-228	2.2±0.1	2.3±0.4	1.7-2.9
STW-377	Water	Sept 1984	Gr. alpha	3.3±1.2	5.0±5.0	0.0-13.7
			Gr. beta	12.7±2.3	16.0±5.0	7.3-24.7
STW-379	Water	Oct 1984	H-3	2860±312	2810±205	2454-3166
STW-380	Water	Oct 1984	Cr-51	<36	40±5.	31.3-48.7
			Co-60	20.3±1.2	20±5.0	11.3-28.7
			Zn-65	150±8.1	147±5.0	138.3-155.7
			Ru-106	<30	47±5.0	36.3-55.7
			Cs-134	31.3±7.0	31±5.0	22.3-39.7
			Cs-137	26.7±1.2	24±5.0	15.3-32.7

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	EPA Result[d] Control Limits
STM-382	Milk	Oct 1984	Sr-89	15.7±4.?	22±5.0	13.3-30.7
			Sr-90	12.7±1.2	16±1.5	13.4-18.6
			I-131	41.7±3.1	42±6.0	31.6-42.4
			Cs-137	31.3±6.1	32±5.0	23.3-40.7
			K-40	1447±66	1517±76	1386-1648
STW-384	Water (Blind)	Oct 1984 Sample A	Gr. alpha	9.7±1.2	14±5.0	5.3-22.7
			Ra-226	3.3±0.2	3.0±0.5	2.2-3.8
			Ra-228	3.4±1.6	2.1±0.3	1.6-2.6
			Uranium	NA[e]		0.0-15.4
		Sample B	Gr. beta	48.3±5.0	64±5.0	55.3-72.7
			Sr-89	10.7±4.6	11±5.0	2.3-19.7
			Sr-90	7.3±1.2	12±1.5	9.4-14.6
			Co-60	16.3±1.2	14±5.0	5.3-22.7
			Cs-134	<2	2±5.0	0.0-10.7
			Cs-137	16.7±1.2	14±5.0	5.3-22.7
STAF-387	Air Filter	Nov 1984	Gr. alpha	18.7±1.2	15±5.0	6.3-23.7
			Gr. beta	59.0±5.3	52±5.0	43.3-60.7
			Sr-90	18.3±1.2	21±1.5	18.4-23.6
			Cs-137	10.3±1.2	10±5.0	1.3-18.7
STW-388	Water	Dec 1984	I-131	28.0±?.0	36±6.0	25.6-36.4
STW-389	Water	Dec 1984	H-3	3583±110	3182±360	2558-3806
STW-391	Water	Dec 1984	Ra-226	8.4±1.7	8.6±1.3	6.4-10.8
			Ra-228	3.1±0.2	4.1±0.6	3.0-5.2
STW-392	Water	Jan 1985	Sr-89	<3.0	3.0±5.0	0.0-11.7
			Sr-90	27.3±5.2	30.0±1.5	27.4-32.6
STW-393	Water	Jan 1985	Gr. alpha	3.3±1.2	5±5.0	0.0-13.7
			Gr. beta	17.3±3.0	15±5.0	6.3-23.7
STS-395	Food	Jan 1985	Gr. alpha	4.7±2.3	6.0±5.0	0.0-14.7
			Gr. beta	11.3±1.2	15.0±5.0	6.3-23.7
			Sr-89	25.3±6.4	34.0±5.0	25.3-42.8
			Sr-90	27.0±8.8	26.0±1.5	23.4-28.6
			I-131	38.0±2.0	35.0±6.0	24.6-45.4
			Cs-137	32.7±2.4	29.0±5.0	20.3-37.7
			K-40	1410±212	1382±120	1174-1590

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	Control Limits
STW-397	Water	Feb 1985	Cr-51	<29	48±5.0	39.3-56.7
			Co-60	21.3±3.0	20±5.0	11.3-28.7
			Zn-65	53.7±5.0	55±5.0	46.3-63.7
			Ru-106	<23	25±5.0	16.3-33.7
			Cs-134	32.3±1.2	35±5.0	26.3-43.7
			Cs-137	25.3±3.0	25±5.0	16.3-33.7
STW-398	Water	Feb 1985	H-3	3869±319	3796±634	3162-4430
STM-400	Milk	March 1985	I-131	7.3±2.4	9.0±0.9	7.4-10.6
STW-402	Water	March 1985	Ra-226	4.6±0.6	5.0±0.8	3.7-6.3
			Ra-228	<0.8	9.0±1.4	6.7-11.3
		Reanalysis	Ra-228	9.0±0.4		
STW-404	Water	March 1985	Gr. alpha	4.7±2.3	6±5.0	0.0-14.7
			Gr. beta	11.3±1.2	15±5.0	6.3-23.7
STAF-405	Air Filter	March 1985	Gr. alpha	9.3±1.0	10.0±5.0	1.3-18.7
			Gr. beta	42.0±1.1	36.0±5.0	27.3-44.7
			Sr-90	13.3±1.0	15.0±1.5	12.4-17.6
			Cs-137	6.3±1.0	6.0±5.0	0.0-14.7
STW-407	Water	April 1985	I-131	8.0±0.0	7.5±0.8	6.2-8.8
STW-408	Water	April 1985	H-3	3399±150	3559±630	2929-4189
STW-409	Water	April 1985				
	(Blind) Sample A		Gr. alpha	29.7±1.8	32.0±5.0	23.3-40.7
			Ra-226	4.4±0.2	4.1±0.6	3.1-5.1
			Ra-228	NA[e]	6.2±0.9	4.6-7.8
			Uranium	NA[e]	7.0±6.0	0.0-17.4
	Sample B		Gr. beta	74.3±11.8	72.0±5.0	63.3-80.7
			Sr-89	12.3±7.6	10.0±5.0	1.3-18.7
			Sr-90	14.7±2.4	15.0±1.5	12.4-17.6
			Co-60	14.7±2.4	15.0±5.0	6.3-23.7
			Cs-134	12.0±2.0	15.0±5.0	6.3-23.7
			Cs-137	14.0±2.0	12.0±5.0	3.3-20.7

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	Control Limits
STW-413	Water	May 1985	Sr-89	36.0±12.4	39.0±5.0	30.3-47.7
			Sr-90	14.3±4.2	15.0±1.5	12.4-17.6
STW-414	Water	May 1985	Gr. alpha	8.3±4.1	12.0±5.0	3.3-20.7
			Gr. beta	8.7±1.2	11.0±5.0	2.3-19.7
STW-416	Water	June 1985	Cr-51	44.7±6.0	44.0±5.0	45.3-52.7
			Co-60	14.3±1.2	14.0±5.0	5.3-22.7
			Zn-65	50.3±7.0	47.0±5.0	38.3-55.7
			Ru-106	55.3±5.8	62.0±5.0	53.3-70.7
			Cs-134	32.7±1.2	35.0±5.0	26.3-43.7
			Cs-137	22.7±2.4	20.0±5.0	11.3-28.7
STW-418	Water	June 1985	H-3	2446±132	2416±351	1807-3025
STM-421	Milk	June 1985	Sr-89	10.3±4.6	11.0±5.0	2.3-19.7
			Sr-90	9.0±2.0	11.0±1.5	8.4-13.6
			I-131	11.7±1.2	11.0±6.0	0.6-21.4
			Cs-137	12.7±1.2	11.0±5.0	2.3-19.7
			K-40	1512±62	1525±132	1393-1657
STW-423	Water	July 1985	Gr. alpha	5.0±0.0	11.0±5.0	2.3-19.7
			Gr. beta	5.0±2.0	8.0±5.0	0.0-16.7
STW-425	Water	August 1985	I-131	25.7±3.0	33.0±6.0	22.6-43.4
STW-426	Water	August 1985	H-3	4063±83	4480±447	3704-5256
STAF-427	Air Filter	August 1985	Gr. alpha	11.3±0.6	13.0±5.0	4.3-21.7
			Gr. beta	46.0±1.0	44.0±5.0	35.3-52.7
			Sr-90	17.7±0.6	18.0±1.5	15.4-20.6
			Cs-137	10.3±0.6	8.0±5.0	0.0-16.7
STW-429	Water	Sept 1985	Sr-89	15.7±0.6	20.0±5.0	11.3-28.7
			Sr-90	7.0±0.0	7.0±1.5	4.4-9.6
STW-430	Water	Sept 1985	Ra-226	8.2±0.3	8.9±1.3	6.6-11.1
			Ra-228	4.1±0.3	4.6±0.7	3.4-5.8
STW-431	Water	Sept 1985	Gr. alpha	4.7±0.6	8.0±5.0	0.0-16.7
			Gr. beta	4.7±1.2	8.0±5.0	0.0-16.7

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	EPA Result[d] Control Limits
STW-433	Water	Oct 1985	Cr-51	<13	21.0±5.0	12.3-29.7
			Co-60	19.3±0.6	20.0±5.0	11.3-28.7
			Zn-65	19.7±0.6	19.0±5.0	10.3-27.7
			Ru-106	<19	20.0±5.0	11.3-28.7
			Cs-134	17.0±1.0	20.0±5.0	11.3-28.7
			Cs-137	19.3±1.2	20.0±5.0	11.3-28.7
STW-435	Water	Oct 1985	H-3	1957±50	1974±345	1376-2572
STW-436 437	Water (Blind)	Oct 1985				
	Sample A		Gr. alpha	53.0±1.0	52.0±13	29.4-74.6
			Ra-226	5.9±0.1	6.3±1.0	4.1-7.9
			Ra-228	8.2±0.1	10.1±1.5	7.5-12.7
			Uranium	NA[e]	8.0±10.4	0.0-18.4
	Sample B		Gr. beta	85.7±2.5	75.0±5.0	76.3-83.7
			Sr-89	21.3±1.5	27.0±5.0	18.3-35.7
			Sr-90	10.3±0.6	9.0±1.5	6.4-11.6
			Co-60	18.3±1.2	18.0±5.0	9.3-26.7
			Cs-134	16.3±1.2	18.0±5.0	9.3-26.7
			Cs-137	19.0±1.0	18.0±5.0	9.3-26.7
STM-439	Milk	Oct 1985	Sr-89	50.3±0.6	48.0±5.0	39.3-56.7
			Sr-90	23.3±0.6	26.0±1.5	23.4-28.6
			I-131	45.7±3.2	42.0±6.0	31.6-52.4
			Cs-137	60.7±0.6	56.0±5.0	47.3-64.7
			K-40	1547±29	1540±77	1406-1674
STW-441	Water	Nov 1985	Gr. alpha	5.3±0.6	10.0±5.0	1.3-18.7
			Gr. beta	11.7±1.2	13.0±5.0	4.3-21.7
STW-443	Water	Dec 1985	I-131	46.7±2.1	45.0±6.0	34.6-55.4
STW-444	Water	Dec 1985	Ra-226	6.5±0.1	7.1±1.1	5.2-9.0
			Ra-228	6.1±0.1	7.3±1.1	5.4-9.2
STW-445	Water	Jan 1986	Sr-89	29.7±2.5	31.0±5.0	22.3-39.7
			Sr-90	13.7±0.6	15.0±1.5	12.4-17.6
STW-446	Water	Jan 1986	Gr. alpha	3.0±0.0	3.0±5.0	0.0-11.7
			Gr. beta	5.3±0.6	7.0±5.0	0.0-15.7

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	Control Limits
STW-447	Food	Jan 1986	Sr-89	24.3±2.5	25.0±5.0	16.3-33.7
			Sr-90	17.3±0.6	10.0±1.5	7.4-12.6
			I-131	22.7±2.3	20.0±6.0	9.6-30.4
			Cs-137	16.3±0.6	15.0±5.0	6.3-23.7
			K-40	927±46	950±144	701-1199
STW-448	Water	Feb 1986	Cr-51	45.0±3.6	38.0±5.0	29.3-46.7
			Co-60	19.7±1.5	18.0±5.0	9.3-26.7
			Zn-65	44.0±3.5	40.0±5.0	31.3-48.7
			Ru-106	<9.0	0.0±5.0	0.0-8.7
			Cs-134	28.3±2.3	30.0±5.0	21.3-38.7
			Cs-137	23.7±0.6	22.0±5.0	13.3-30.7
STW-449	Water	Feb 1986	H-3	5176±48	5227±525	4317-6137
STW-450	Water	Feb 1986	U total	8.0±0.0	9.0±6.0	0.0-19.4
STW-451	Milk	Feb 1986	I-131	7.0±0.0	9.0±6.0	0.0-19.4
STW-452	Water	March 1986	Ra-226	3.8±0.1	4.1±0.6	3.0-5.2
			Ra-228	11.0±0.5	12.4±1.8	9.2-15.5
STW-453	Water	March 1986	Gr. alpha	6.7±0.6	15.0±5.0	6.3-23.7
			Gr. beta	7.3±0.6	8.0±5.0	0.0-16.7
STW-454	Water	April 1986	I-131	7.0±0.0	9.0±6.0	0.0-19.4
STW-455 456	Water (Blind)	April 1986				
	Sample A		Gr. alpha	15.0±1.0	17.0±5.0	8.3-25.7
			Ra-226	3.1±0.1	2.9±0.4	2.1-3.7
			Ra-228	1.5±0.2	2.0±0.3	1.5-2.5
			Uranium	4.7±0.6	5.0±6.0	0.0-15.4
	Sample B		Gr. beta	28.7±1.2	35.0±5.0	26.3-43.7
			Sr-89	5.7±0.6	7.0±5.0	0.0-15.7
			Sr-90	7.0±0.0	7.0±1.5	4.4-9.6
			Co-60	10.7±1.5	10.0±5.0	1.3-18.7
			Cs-134	4.0±1.7	5.0±5.0	0.0-13.7
			Cs-137	5.3±0.6	5.0±5.0	0.0-13.7

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	EPA Result[d] Control Limits
STAF-457	Air Filter	April 1986	Gr. alpha	13.7±0.6	15.0±5.0	6.3-23.7
			Gr. beta	46.3±0.6	47.0±5.0	38.3-55.7
			Sr-90	14.7±0.6	18.0±1.5	15.4-20.6
			Cs-137	10.7±0.6	10.0±5.0	1.3-18.7
STU-458	Urine	April 1986	Tritium	4313±70	4423±189	4096-4750
STW-459	Water	May 1986	Sr-89	4.3±0.6	5.0±5.0	0.0-13.7
			Sr-90	5.0±0.0	5.0±1.5	2.4-7.6
STW-460	Water	May 1986	Gr. alpha	5.3±0.6	8.0±5.0	0.0-16.7
			Gr. beta	11.3±1.2	15.0±5.0	6.3-23.7
STW-461	Water	June 1986	Cr-51	<9.0	0.0±5.0	0.0-8.7
			Co-60	66.0±1.0	66.0±5.0	57.3-74.7
			Zn-65	87.3±1.5	86.0±5.0	77.3-94.7
			Ru-106	39.7±2.5	50.0±5.0	41.3-58.7
			Cs-134	49.3±2.5	49.0±5.0	40.3-57.7
			Cs-137	10.3±1.5	10.0±5.0	1.3-18.7
STW-462	Water	June 1986	Tritium	3427±25	3125±361	2499-3751
STM-464	Milk	June 1986	Sr-89	<1.0	0.0±5.0	0.0-8.7
			Sr-90	15.3±0.6	16.0±1.5	13.4-18.6
			I-131	48.3±2.3	41.0±6.0	30.6-51.4
			Cs-137	43.7±1.5	31.0±5.0	22.3-39.7
			K-40	1567±114	1600±80	1461-1739
STW-465	Water	July 1986	Gr. alpha	4.7±0.6	6.0±5.0	0.0-14.7
			Gr. beta	13.7±1.2	18.0±5.0	9.3-26.7
STW-467	Water	August 1986	I-131	30.3±0.6	45.0±6.0	34.4-55.4
STW-468	Water	August 1986	Pu-239	11.3±0.6	10.1±1.0	8.3-11.9
STW-469	Water	August 1986	Uranium	4.0±0.0	4.0±6.0	0.0-14.4
STAF-470	Air Filter	Sept 1986	Gr. alpha	19.3±1.5	22.0±5.0	13.3-30.7
471			Gr. beta	64.0±2.6	66.0±5.0	57.3-74.7
472			Sr-90	22.0±1.0	22.0±5.0	19.4-24.6
			Cs-137	25.7±1.5	22.0±5.0	13.3-30.7
STW-473	Water	Sept 1986	Ra-226	6.0±0.1	6.1±0.9	4.5-7.7
			Ra-228	8.7±1.1	9.1±1.4	6.7-11.5

Table A-1. (continued).

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TML Result ±2σ[c]	EPA Result[d] 1s, N=1	Control Limits
STW-474	Water	Sept 1986	Gr. alpha	15.3±3.2	15.0±5.0	6.3-23.7
			Gr. beta	4.0±1.0	8.0±5.0	0.0-16.7
STW-475	Water	Oct 1986	Cr-51	63.3±5.5	59.0±5.0	50.3-67.7
			Co-60	31.0±2.0	31.0±5.0	22.3-39.7
			Zn-65	87.3±5.9	85.0±5.0	76.3-93.7
			Ru-106	74.7±7.4	74.0±5.0	65.3-82.7
			Cs-134	25.7±0.6	28.0±5.0	19.3-36.7
			Cs-137	46.3±1.5	44.0±5.0	35.3-52.7
STW-476	Water	Oct 1986	H-3	5918±60	5973±597	4938-7008
SPW-477 478	Water (Blind)	Oct 1986				
	Sample A		Gr. alpha	34.0±6.0	40.0±5.0	31.3-48.7
			Ra-226	5.8±0.2	6.0±0.9	4.4-7.6
			Ra-228	2.7±1.0	5.0±0.8	3.7-6.3
			Uranium	11.0±0.0	10.0±6.0	0.0-20.4
	Sample B		Gr. beta	38.7±1.2	51.0±5.0	42.3-59.7
			Sr-89	5.0±0.0	10.0±5.0	1.3-18.7
			Sr-90	3.0±0.0	4.0±1.5	1.4-6.6
			Co-60	24.7±1.2	24.0±5.0	15.3-32.7
			Cs-134	11.0±2.0	12.0±5.0	3.3-20.7
			Cs-137	9.3±1.2	8.0±5.0	0.0-16.7
STM-479	Milk	Nov 1986	Sr-89	7.7±1.2	9.0±5.0	0.3-17.7
			Sr-90	1.0±0.0	0.0±1.5	0.0-2.6
			I-131	52.3±3.1	49.0±6.0	38.6-59.4
			Cs-137	45.7±3.1	39.0±5.0	30.3-47.7
			K-40	1489±104	1565±78	1430-1700
STU-480	Urine	Nov 1986	H-3	5540±26	5257±912	4345-6169
STW-481	Water	Nov 1986	Gr. alpha	12.0±4.0	20.0±5.0	11.3-28.7
			Gr. beta	20.0±3.5	20.0±5.0	11.3-28.7
STW-482	Water	Dec 1986	Ra-226	6.7±0.2	6.8±1.0	5.0-8.6
			Ra-228	5.2±0.2	11.1±1.7	8.2-14.0
STW-483	Water	Jan 1987	Sr-89	19.7±5.0	25.0±5.0	16.3-33.7
			Sr-90	21.0±2.0	25.0±1.5	22.4-27.6

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	Control Limits
STW-484	Water	Jan 1987	Pu-239	17.0±2.3	16.7±1.7	13.8-19.6
STF-486	Food	Jan 1987	Sr-90	36.0±4.0	49.0±10.0	31.7-66.3
			I-131	78.0±3.4	78.0±8.0	64.1-91.9
			Cs-137	89.7±3.0	84.0±5.0	75.3-92.7
			K-40	942±56	980±49	895-1065
STF-487	Food (Blank)	Jan 1987	SR-90	2.0±0.0	---	
			I-131	<3	---	
			Cs-137	<2	---	
			K-40	993±102	---	
STW-488	Water	Feb 1987	Co-60	49.0±0.0	50.0±5.0	41.3-58.7
			Zn-65	96.0±7.2	91.0±5.0	82.3-99.7
			Ru-106	92.0±20.2	100.0±5.0	91.3-108.7
			Cs-134	53.0±3.4	59.0±5.0	50.3-67.7
			Cs-137	89.3±4.6	87.0±5.0	78.3-95.7
STW-489	Water	Feb 1987	H-3	4130±140	4209±420	3479-4939
STW-490	Water	Feb 1987	Uranium	8.3±1.2	8.0±6.0	0.0-18.4
STM-491	Milk	Feb 1987	I-131	10.0±0.0	9.0±0.9	7.4-10.6
STW-492	Water	Mar 1987	Gr. alpha	3.7±1.2	3.0±5.0	0.0-11.7
			Gr. beta	11.3±1.2	13.0±5.0	4.3-21.7
STW-493	Water	Mar 1987	Ra-226	7.0±0.1	7.3±1.1	5.4-9.2
			Ra-228	7.1±2.3	7.5±1.1	5.5-9.5
STW-494	Water	Apr 1987	I-131	8.0±0.0	7.0±0.7	5.8-8.2
STAF-495	Air Filter	Apr 1987	Gr. alpha	15.0±0.0	14.0±5.0	5.3-22.7
			Gr. beta	41.0±2.0	43.0±5.0	34.3-51.7
			Sr-90	16.3±1.2	17.0±1.5	14.4-19.6
			Cs-137	7.0±0.0	8.0±5.0	0.0-16.7
STW-496 497	Water (Blind)	Apr 1987				
	Sample A		Gr. alpha	30.7±1.2	30.0±8.0	16.1-43.9
			Ra-226	3.9±0.2	3.9±0.6	2.9-4.9
			Ra-228	4.9±0.9	4.0±0.6	3.0-5.0
			Uranium	5.0±0.0	5.0±6.0	0.0-15.4

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TML Result ±2σ[c]	EPA Result[d] 1s, N=1	EPA Result[d] Control Limits
STW-496 497	Water (Blind)	Apr 1987				
	Sample B		Gr. Beta	69.3±9.4	66.0±5.0	57.3-74.7
			Sr-89	16.3±3.0	19.0±5.0	10.3-27.7
			Sr-90	10.0±0.0	10.0±1.5	7.4-12.6
			Co-60	8.3±3.0	8.0±5.0	0.0-16.7
			Cs-134	19.0±2.0	20.0±5.0	11.3-28.7
			Cs-137	14.7±1.2	15.0±5.0	6.3-23.7
STU-498	Urine	Apr 1987	H-3	6017±494	5620±795	4647-6593
STW-499	Water	May 1987	Sr-89	38.0±6.0	41.0±5.0	32.3-49.7
			Sr-90	21.0±2.0	20.0±1.5	17.4-22.6
STW-500	Water	May 1987	Gr. alpha	9.0±3.4	11.0±5.0	2.3-19.7
			Gr. beta	10.3±1.2	7.0±5.0	0.0-15.7
STW-501	Water	June 1987	Cr-51	40.0±8.0	41.0±5.0	32.3-49.7
			Co-60	60.3±3.0	64.0±5.0	55.3-72.7
			Zn-65	11.3±5.0	10.0±5.0	1.3-18.7
			Ru-106	78.3±6.4	75.0±5.0	66.3-83.7
			Cs-134	36.7±3.0	40.0±5.0	31.3-48.7
			Cs-137	80.3±4.2	80.0±5.0	71.3-88.7
STW-502	Water	June 1987	H-3	2906±86	2895±357	2277-3513
STW-503	Water	June 1987	Ra-226	6.9±0.1	7.3±1.1	5.4-9.2
			Ra-228	13.3±1.0	15.2±2.3	11.2-19.2
STW-504	Milk	June 1987	Sr-89	57.0±4.3	69.0±5.0	60.3-77.7
			Sr-90	32.0±1.0	35.0±1.5	32.4-37.6
			I-131	64.0±2.0	59.0±6.0	48.6-69.4
			Cs-137	77.7±0.6	74.0±5.0	65.3-82.7
			K	1383±17	1525±76	1393-1657
STW-505	Water	July 1987	Gr. alpha	2.3±0.7	5.0±5.0	0.0-13.7
			Gr. beta	4.0±1.0	5.0±5.0	0.0-13.7
STF-506	Food	July 1987	I-131	82.7±4.6	80.0±8.0	66.1-93.9
			Cs-137	53.7±3.0	50.0±5.0	41.3-58.7
			K	1548±57	1680±84	1534-1826
STW-507	Water	Aug 1987	I-131	45.7±4.2	48.0±6.0	37.6-58.4
STW-508	Water	Aug 1987	Pu-239	5.8±0.2	5.3±0.5	4.4-6.2

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	Control Limits
STW-509	Water	Aug 1987	Uranium	13.3±0.3	13.0±6.0	2.6-23.4
STAF-510	Air Filter	Aug 1987	Gr. alpha	9.7±0.4	10.0±5.0	1.3-18.7
			Gr. beta	28.3±0.6	30.0±5.0	21.3-38.7
			Sr-90	10.0±0.9	10.0±1.5	7.4-12.6
			Cs-137	10.0±1.0	10.0±5.0	1.3-18.7
STW-511	Water	Sept 1987	Ra-226	9.9±0.1	9.7±1.5	7.2-12.2
			Ra-228	8.1±1.4	6.3±1.0	4.6-8.0
STW-512	Water	Sept 1987	Gr. alpha	2.0±0.6	4.0±5.0	0.0-12.7
			Gr. beta	11.3±1.3	12.0±5.0	3.3-20.7
STW-513	Water	Oct 1987	H-3	4473±100	4492±449	3714-5270
STW-514	Water A	Oct 1987	Gr. alpha	29.3±2.6	28.0±7.0	15.9-40.1
			Ra-226	4.9±0.1	4.8±0.7	3.6-6.1
			Ra-228	4.2±1.0	3.6±0.5	2.7-4.5
			Uranium	3.0±0.1	3.0±6.0	0.0-13.4
STW-515	Water B	Oct 1987	Gr. beta	72.3±2.7	72.0±5.0	63.3-80.7
			Sr-89	14.3±1.3	16.0±5.0	7.3-24.7
			Sr-90	9.7±0.4	10.0±1.5	7.4-12.6
			Co-60	16.7±3.0	16.0±5.0	7.3-24.7
			Cs-134	16.7±2.3	16.0±5.0	7.3-24.7
			Cs-137	24.3±3.3	24.0±5.0	15.3-32.7
STW-516	Water	Oct 1987	Cr-51	80.3±17.5	70.0±5.0	61.3-78.7
			Co-60	16.0±2.3	15.0±5.0	6.3-23.7
			Zn-65	46.3±5.6	46.0±5.0	37.3-54.7
			Ru-106	57.3±15.4	61.0±5.0	52.3-69.7
			Cs-134	23.7±2.5	25.0±5.0	16.3-33.7
			Cs-137	51.7±3.2	51.0±5.0	42.3-59.7
STU-517	Urine	Nov 1987	H-3	7267±100	7432±743	6145-8719
STW-519	Water	Dec 1987	I-131	26.0±3.0	26.0±6.0	15.6-36.4

[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 Vegan, Nevada.

[b] All results are in the pCi/l, except for elemental potassium (K) data, which are in mg/l; air filter samples, which are in pCi/filter; and food, which is in pCi/kg.

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

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

Lab Code	TLD Type	Measurement	Teledyne Result ±2σ[a] (mR)	Known Value[c] (mR)	Average ±2 σ[d] (all participants) (mR)
2nd International Intercomparison[b]					
115-2	CaF_2:Mn Bulb	Field	17.0±1.9	17.1	16.4±7.7
		Lab	20.8±4.1	21.3	18.8±7.6
3rd International Intercomparison[e]					
115-3	CaF_2:Mn Bulb	Field	30.7±3.2	34.9±4.8	31.5±3.0
		Lab	89.6±6.4	91.7±14.6	86.2±24.0
4th International Intercomparison[f]					
115-4	CaF_2:Mn Bulb	Field	14.1±1.1	14.1±1.4	16.0±9.0
		Lab (Low)	9.3±1.3	12.2±2.4	12.0±7.6
		Lab (High)	40.4±1.4	45.8±9.2	43.9±13.2
5th International Intercomparison[g]					
115-5A	CaF_2:Mn Bulb	Field	31.4±1.8	30.0±6.0	30.2±14.6
		Lab at beginning	77.4±5.8	75.2±7.6	75.8±40.4
		Lab at end	96.6±5.8	88.4±8.8	90.7±31.2

Table A-2. (Continued)

Lab Code	TLD Type	Measurement	mR Teledyne Result ±2σ[a]	mR Known Value[c]	mR Average ±2σ [d] (all participants)
115-5B	LiF-100 Chips	Field	30.3±4.8	30.0±6.0	30.2±14.6
		Lab at beginning	81.1±7.4	75.2±7.6	75.8±40.4
		Lab at the end	85.4±11.7	88.4±8.8	90.7±31.2
7th International Intercomparison[h]					
115-7A	LiF-100 Chips	Field	75.4±2.6	75.8±6.0	75.1±29.8
		Lab (Co-60)	80.0±3.5	79.9±4.0	77.2±27.6
		Lab (Cs-137)	66.6±2.5	75.0±3.8	73.0±22.2
115-7B	CaF_2:Mn Bulbs	Field	71.5±2.6	75.8±6.0	75.1±29.8
		Lab (Co-60)	84.8±6.4	79.9±4.0	77.9±27.6
		Lab (Cs-137)	78.8±1.6	75.0±3.8	73.0±22.2
115-7C	$CaSO_4$:Dy Cards	Field	76.8±2.7	75.8±6.0	75.1±29.8
		Lab (Co-60)	82.5±3.7	79.9±4.0	77.9±27.6
		Lab (Cs-137	79.0±3.2	75.0±3.8	73.0±22.2

Table A-2. (Continued)

Lab Code	TLD Type	Measurement	Teledyne Result ±2σ[a] (mR)	Known Value[c] (mR)	Average ±2σ[d] (all participants) (mR)
8th International Intercomparison[i]					
115-8A	LiF-100 Chips	Field Site 1	29.5±1.4	29.7±1.5	28.9±12.4
		Field Site 2	11.3±0.8	10.4±0.5	10.1±9.06
		Lab (Cs 137)	13.7±0.9	17.2±0.9	16.2±6.8
115-8B	CaF_2:Mn Bulbs	Field Site 1	32.3±1.2	29.7±1.5	28.9±12.4
		Field Site 2	9.0±1.0	10.4±0.5	10.1±9.0
		Lab (Cs-137)	15.8±0.9	17.2±0.9	16.2±6.8
115-8C	$CaSO_4$:Dy Cards	Field Site 1	32.3±0.7	29.7±1.5	28.9±12.4
		Field Site 2	10.6±0.6	10.4±0.5	10.1±9.0
		Lab (Cs-137	18.1±0.8	17.2±0.9	16.2±6.8

[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 the Health and Safety Laboratory (GASL), 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 Dosimeter 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.

Table A-3. In-house spiked samples.

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l TIML Result n=3	Known Activity	Expected Precision 1s, n=3[a]
QC-MI-6	Milk	Feb. 1986	Sr-89	6.0±1.9	6.4±3.0	8.7
			Sr-90	14.2±1.7	12.9±2.0	5.2
			I-131	34.2±3.8	35.2±3.5	10.4
			Cs-134	32.0±1.8	27.3±5.0	8.7
			Cs-137	35.8±2.1	35.0±5.0	8.7
QC-W-14	Water	Mar. 1986	Sr-89	1.6±0.4	1.6±1.0	7.1
			Sr-90	2.4±0.2	2.4±2.0	4.2
QC-W-15	Water	Apr. 1986	I-131	44.9±2.4	41.5±7.0	10.6
			Co-60	10.6±1.7	12.1±5.0	7.1[b]
			Cs-134	30.2±2.4	25.8±8.0	7.1[b]
			Cs-137	21.9±1.9	19.9±5.0	7.1[b]
QC-MI-7	Milk	Apr. 1986	I-131	39.7±3.3	41.5±7.0	10.4
			Cs-134	28.7±2.8	25.8±8.0	8.7
			Cs-137	21.2±2.8	19.9±5.0	8.7
SPW-1	Water	May 1986	Gross alpha	15.8±1.8	18.0±5.0	5[c]
QC-W-16	Water	June 1986	Gross alpha	16.2±0.7	16.9±2.5	8.7
			Gross beta	38.4±3.5	30.2±5.0	8.7
QC-MI-9	Milk	June 1986	Sr-89	<1.0	0.0	7.1[b]
			Sr-90	12.6±1.8	13.3±3.0	4.2[b]
			I-131	38.9±7.0	34.8±7.0	10.4
			Cs-134	33.0±3.4	36.1±5.0	8.7
			Cs-137	38.5±2.8	39.0±5.0	8.7
SPW-2	Water	June 1986	Gross alpha	16.8±1.8	18.0±5.0	5[c]
SPW-3	Water	June 1986	Gross alpha	17.7±0.8	18.0±5.0	5[c]
QC-W-18	Water	Sep. 1986	Cs-134	34.7±5.6	31.3±5.0	8.7
			Cs-137	51.1±7.0	43.3±8.0	8.7
QC-W-19	Water	Sep. 1986	Sr-89	13.6±4.1	15.6±3.5	7.1[b]
			Sr-90	6.4±1.6	6.2±2.0	4.2[b]

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

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l TML Result n=3	Known Activity	Expected Precision 1s, n=3[a]
QC-W-21	Water	Oct. 1986	Co-60	19.2±2.2	18.5±3.0	8.7
			Cs-134	31.7±5.2	25.6±8.0	8.7
			Cs-137	23.8±1.0	21.6±5.0	8.7
QC-MI-11	Milk	Oct 1986	Sr-89	12.3±1.8	14.3±3.0	8.7
QC-W-20	Water	Nov. 1986	H-3	3855±180	3960±350	520[b]
QC-W-22	Water	Dec. 1986	Gross alpha	9.8±1.4	11.2±4.0	8.7
			Gross beta	21.7±2.0	23.8±5.0	8.7
QC-W-23	Water	Jan. 1987	I-131	29.8±2.5	27.9±3.0	10.4
QC-MI-12	Milk	Jan. 1987	I-131	36.5±1.3	32.6±5.0	10.4
			Cs-137	32.6±4.2	27.4±8.0	8.7
SPM-13	Milk	Jan 1987	Sr-89	10.4±2.1	12.2±4.0	8.7
			Sr-90	14.6±1.6	12.6±3.0	5.2
			I-131	49.5±1.2	54.9±8.0	10.4
			Cs-134	<1.6	0.0	8.7
			Cs-137	33.3±0.6	27.4±8.0	8.7
SPW-24	Water	Mar 1987	Sr-89	24.7±3.6	25.9±5.0	8.7
			Sr-90	23.9±3.8	22.8±8.0	5.2
SPW-25	Water	Apr 1987	I-131	28.0±1.9	29.3±5.0	10.6
SPM-14	Milk	Apr 1987	I-131	25.0±2.2	23.9±5.0	10.4
			Cs-134	<2.1	0.0	8.7
			Cs-137	34.2±2.0	27.2±7.0	8.7
SPW-26	Water	Jun 1987	H-3	3422±100	3362±300	520
			Co-60	24.8±1.4	26.5±7.0	8.7
			Cs-134	<2.0	0.0	8.7
			Cs-137	21.2±0.5	21.6±7.0	8.7
SPW-27	Water	Jun 1987	Gr. alpha	8.5±1.9	10.1±4.0	8.7
			Gr. beta	22.6±1.9	21.2±5.0	8.7
SPW-28	Water	Jun 1987	Gr. alpha	8.7±1.3	10.1±4.0	8.7
			Gr. beta	12.2±5.2	9.4±3.0	8.7

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

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l TIML Result n=3	Known Activity	Expected Precision 1s, n=3[a]
SPW-29	Water	Jun 1987	Gr. alpha	16.4±1.3	18.9±5.0	8.7
			Gr. beta	15.9±4.0	11.8±4.0	8.7
SPM-15	Milk	Jul 1987	Sr-89	19.4±1.6	18.8±3.5	5.2
			I-131	43.5±0.7	45.3±7.0	10.4
			Cs-134	17.9±2.2	16.0±5.3	8.7
			Cs-137	25.4±1.8	22.7±5.0	8.7
SPW-30	Water	Sep 1987	Sr-89	17.5±3.0	14.3±5.0	8.7
			Sr-90	18.4±2.2	17.5±2.2	5.2
SPW-31	Water	Oct 1987	H-3	2053±93	2059±306	520

[a] n=3 unless noted otherwise.
[b] n=2.
[c] n=1.

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

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l Results (4.66σ)	Concentration in pCi/l Acceptance Criteria (4.66σ)
BL-1	D.I. Water	Nov. 1985	Gross alpha	<0.1	<1
			Gross beta	<0.4	<4
BL-2	D.I. Water	Nov. 1985	Cs-137 (gamma)	<1.9	<10
BL-3	D.I. Water	Nov. 1985	Sr-89	<0.5	<5
			Sr-90	<0.6	<1
BL-5	D.I. Water	Nov. 1985	Ra-226	<0.4	<1
			Ra-228	<0.4	<1
SPW-2265	D.I. Water	Apr. 1985	Gross alpha	<0.6	<1
			Gross beta	<2.2	<4
			Sr-89	<0.2	<5
			Sr-90	<0.4	<1
			I-131	<0.2	<1
			Cs-137 (gamma)	<7.4	<10
BL-6	D.I. Water	Apr. 1986	Gross alpha	<0.4	<1
BL-7	D.I. Water	Apr. 1986	Gross alpha	<0.4	<1
BL-8	D.I. Water	June 1986	Gross alpha	<0.4	<1
BL-9	D.I. Water	June 1986	Gross alpha	<0.3	<1
SPW-3185	D.I. Water	Jan 1987	Ra-226	<0.1	<1
			Ra-228	<0.9	<1
SPS-3292	Milk	Jan 1987	I-131	<0.1	<1
			Cs-134	<6.2	<10
			Cs-137	<6.4	<10
SPW-3554	D.I. Water	Feb 1987	H-3	<180	<300
			Gross beta	<2.6	<4
SPS-3555	Milk	Feb 1987	Sr-89	<0.6	<5
			Sr-90	1.9±0.4[a]	<1
SPS-3731	Milk	Mar 1987	Cs-134	<2.2	<10
			Cs-137	<2.5	<10

[a] Low level (1 - 4 pCi/l) of Sr-90 concentration in milk is not unusual.

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

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l Results (4.66σ)	Concentration in pCi/l Acceptance Criteria (4.66σ)
SPS-3732	D.I. Water	Mar 1987	Sr-89	<0.9	<5
			Sr-90	<0.8	<1
			I-131	<0.3	<1
			Co-60	<2.3	<10
			Cs-134(G)	<2.2	<10
			Cs-137(G)	<2.4	<10
			Ra-226	<0.1	<1
			Ra-228	<1.0	<1
			Np-237	<0.04	<1
			Th-230	<0.05	<0.1
			Th-232	<0.02	<0.1
			U-234	<0.05	<0.1
			U-235	<0.03	<0.1
			U-238	<0.03	<0.1
SPS-4023	Milk	May 1987	I-131	<0.1	<1
SPS-4203	D.I. Water	May 1987	Gross alpha	<0.7	<1
			Gross beta	<1.7	<4
SPS-4204	Milk	May 1987	Sr-89	<0.5	<5
			Sr-90	2.4±0.6[a]	<1
SPS-4390	Milk	Jun 1987	Cs-134	<4.7	<10
			Cs-137	<5.2	<10
SPS-4391	D.I. Water	Jun 1987	Sr-89	<0.4	<5
			Sr-90	<0.4	<1
			I-121	<0.1	<1
			Co-60	<3.8	<10
			Cs-137	<5.7	<10
			Ra-226	<0.1	<1
			Ra-228	<0.9	<1
SPW-4627	D.I. Water	Aug 1987	Gross alpha	<0.6	<1
			Gross beta	<1.4	<4
			Tritium	<150	
SPS-4628	Milk	Aug 1987	Sr-89	<0.6	<5
			Sr-90	2.4±0.6	<1
SPS-4847	Milk	Sep 1987	Cs-134	<4.4	<10
			Cs-137	<5.3	<10

[a] Low level (1 - 4 pCi/l) of Sr-90 concentration in milk is not unusual.

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

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l Results (4.66 σ)	Concentration in pCi/l Acceptance Criteria (4.66 σ)
SPS-4848	D.I. Water	Sep 1987	I-131	<0.2	<1
SPW-4849	D.I. Water	Sep 1987	Co-60	<4.1	<10
			Cs-134	<4.8	<10
			Cs-137	<4.0	<10
			Sr-89	<0.7	<5
			Sr-90	<0.7	<1
SPW-4850	D.I. Water	Sep 1987	Th-228	<0.04	<1
			Th-232	<0.8	<1
			U-234	<0.03	<1
			U-235	<0.03	<1
			U-238	<0.02	<1
			Am-241	<0.06	<1
			Cm-242	<0.04	<1
			Ra-226	<0.1	<1
			Ra-228	<1.0	<2
SPW-4859	D.I. Water	Oct 1987	Fe-55	<0.5	<1
SPS-5348	Milk	Dec 1987	Cs-134	<2.3	<10
			Cs-137	<2.5	<10
SPW-5384	Water	Dec 1987	Co-60	<2.8	<10
			Cs-134	<2.6	<10
			Cs-137	<2.8	<10
			I-131	<0.2	<1
			Ra-226	<0.1	<1
			Ra-228	<1.2	<2
			Sr-89	<0.5	<1
			Sr-90	<0.4	<1
SPW-5385	Water	Nov 1987	Gr. alpha	<0.4	<1
			Gr. beta	<2.2	<4
			Fe-55	<0.3	<1
SPS-5386	Milk	Jan 1988	I-131	<0.1	<1
SPW-5448	"Dead" Water	Jan 1988	H-3	<177	<300

Omaha Public Power District
1623 Harney Omaha, Nebraska 68102-2247
402/536-4000

May 2, 1988
LIC-88-327

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Reference: Docket No. 50-285

Gentlemen:

SUBJECT: Radiological Environmental Operating Report for 1987

Please find enclosed one (1) copy of the Radiological Environmental Operating Report for the period January 1, 1987 to December 31, 1987. This report is submitted in accordance with the Fort Calhoun Station Technical Specifications 5.9.4b.

Sincerely,

R L Jaworski for

R. L. Andrews
Division Manager
Nuclear Production

RLA/me

cc: LeBoeuf, Lamb, Leiby & MacRae
1333 New Hampshire Ave., N.W.
Washington, DC 20036

R. D. Martin, NRC Regional Administrator
A. Bournia, NRC Project Manager
P. H. Harrell, NRC Senior Resident Inspector
American Nuclear Insurers
Roger Cochran, University of Iowa Hygienic Lab

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