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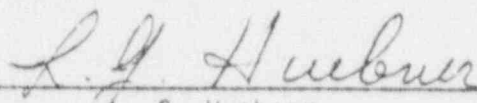
MONTHLY PROGRESS REPORT  
TO  
WISCONSIN ELECTRIC POWER COMPANY  
MILWAUKEE, WISCONSIN

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM  
FOR  
THE POINT BEACH NUCLEAR PLANT  
TWO RIVERS, WISCONSIN

PREPARED AND SUBMITTED BY  
TELEDYNE ISOTOPES MIDWEST LABORATORY  
PROJECT NO. 8006

Reporting Period: January - December, 1990

Approved by:



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General Manager

Date

1-22-91

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## 1.0 INTRODUCTION

The following constitutes the current Monthly Progress Report for the Environmental Radiological Monitoring Program conducted at the Point Beach Nuclear Plant, Two Rivers, Wisconsin. Results of completed analyses are presented in this report. Missing entries indicate analyses that are not completed; the results will appear in subsequent reports.

Data obtained in the program are well within the ranges previously encountered in the program and to be expected in the environmental media samples. None of the media sampled during the current month contained radioactivity attributable to the operation of Point Beach Nuclear Plant.

For all gamma isotopic analyses, the spectrum is computer scanned from 80 to 2048 KeV. Specifically included are Mn-54, Fe-59, Co-58, Co-60, Zn-65, Zr-Nb-95, Ru-103, Ru-106, I-131, Ba-La-140, Cs-134, Cs-137, Ce-141, and Ce-144. Naturally occurring gamma-emitters, such as K-40 and Ra daughters, are frequently detected in soil and sediment samples. Specific isotopes listed are K-40, Tl-208, Pb-212, Bi-214, Ra-226, and Ac-228. Data listed as "<" are at the 4.66 sigma level; others are 2 sigma. Unless otherwise noted, the less than value ("<") is for Ru-103 and may be higher or lower for other radionuclides. Gamma-emitters not specifically required to be identified are to be reported in the category labeled "Other Gammas."

All concentrations, except gross beta, are decay corrected to the time of collection.

All samples were collected as scheduled except as noted in the "Listing of Missed Samples."



## 2.0 LISTING OF MISSED SAMPLES

Sample Type	Location	Collection Period	Comments
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AIRBORNE IODINE-131<sup>a</sup> AND GROSS BETA  
IN AIR PARTICULATE FILTERS

Collection Date	Met Tower E-01		Site Boundary Control Center E-02		West Boundary E-03	
	Volume (m <sup>3</sup> )	Gross Beta (pCi/m <sup>3</sup> )	Volume (m <sup>3</sup> )	Gross Beta (pCi/m <sup>3</sup> )	Volume (m <sup>3</sup> )	Gross Beta (pCi/m <sup>3</sup> )
01-08-90	257	0.05±0.01	237	0.04±0.01	301	0.04±0.01
01-15-90	274	0.03±0.01	278	0.03±0.01	348	0.03±0.01
01-22-90	304	0.03±0.01	277	0.03±0.01	357	0.03±0.01
01-29-90	302	0.02±0.01	277	0.02±0.01	350	0.02±0.01
02-05-90	305	0.02±0.01	292	0.02±0.01	354	0.02±0.01
02-12-90	304	0.04±0.01	303	0.04±0.01	352	0.04±0.01
02-19-90	302	0.03±0.01	303	0.03±0.01	352	0.02±0.01
02-26-90	305	0.03±0.01	303	0.03±0.01	354	0.03±0.01
03-05-90	302	0.03±0.01	303	0.02±0.01	351	0.03±0.01
03-12-90	303	0.02±0.01	303	0.02±0.01	352	0.02±0.01
03-19-90	304	0.02±0.01	304	0.01±0.01	338	0.02±0.01
03-26-90	306	0.02±0.01	306	0.02±0.01	345	0.02±0.01
04-02-90	278	0.02±0.01	299	0.01±0.01	353	0.01±0.01
04-09-90	295	0.02±0.01	310	0.02±0.01	365	0.02±0.01
04-16-90	256	0.01±0.01	269	0.02±0.01	292	0.02±0.01
04-23-90	259	0.02±0.01	267	0.02±0.01	301	0.02±0.01
04-30-90	261	0.02±0.01	260	0.02±0.01	302	0.02±0.01
05-07-90	260	0.02±0.01	262	0.02±0.01	310	0.02±0.01
05-14-90	259	0.02±0.01	259	0.02±0.01	295	0.01±0.01
05-21-90	261	0.01±0.01	269	0.01±0.01	303	0.01±0.01
05-29-90	309	0.01±0.01	309	0.01±0.01	347	0.01±0.01
06-04-90	237	0.01±0.01	221	0.01±0.01	265	0.01±0.01
06-11-90	269	0.01±0.01	262	0.01±0.01	297	0.01±0.01
06-18-90	191	0.02±0.01	292	0.01±0.01	271	0.01±0.01
06-25-90	305	0.01±0.01	292	0.01±0.01	273	0.01±0.01
07-02-90	301	0.01±0.01	297	0.01±0.01	273	0.01±0.01

<sup>a</sup> Iodine-131 is sampled weekly. Concentration is <0.03 pCi/m<sup>3</sup> unless noted otherwise.

AIRBORNE IODINE-131<sup>a</sup> AND GROSS BETA  
IN AIR PARTICULATE FILTERS (continued)

Collection Date	Met Tower E-01		Site Boundary Control Center E-02		West Boundary E-03	
	Volume (m <sup>3</sup> )	Gross Beta (pCi/m <sup>3</sup> )	Volume (m <sup>3</sup> )	Gross Beta (pCi/m <sup>3</sup> )	Volume (m <sup>3</sup> )	Gross Beta (pCi/m <sup>3</sup> )
07-09-90	307	0.01±0.01	290	0.02±0.01	269	0.01±0.01
07-16-90	312	0.01±0.01	269	0.01±0.01	273	0.01±0.01
07-24-90	358	0.02±0.01	253	0.02±0.01	313	0.01±0.01
07-30-90	276	0.02±0.01	250	0.03±0.01	236	0.03±0.01
08-06-90	258	0.02±0.01	309	0.02±0.01	277	0.02±0.01
08-13-90	329	0.02±0.01	286	0.02±0.01	262	0.02±0.01
08-20-90	344	0.02±0.01	300	0.02±0.01	274	0.02±0.01
08-27-90	339	0.02±0.01	291	0.02±0.01	276	0.02±0.01
09-04-90	379	0.03±0.01	336	0.03±0.01	305	0.02±0.01
09-10-90	275	0.04±0.01	260	0.03±0.01	243	0.03±0.01
09-17-90	320	0.03±0.01	312	0.03±0.01	270	0.02±0.01
09-24-90	319	0.02±0.01	312	0.02±0.01	271	0.02±0.01
10-01-90	331	0.03±0.01	314	0.03±0.01	281	0.02±0.01
10-08-90	310	0.03±0.01	283	0.03±0.01	273	0.03±0.01
10-15-90	320	0.03±0.01	305	0.02±0.01	292	0.02±0.01
10-22-90	321	0.02±0.01	311	0.02±0.01	296	0.02±0.01
10-30-90	369	0.03±0.01	360	0.02±0.01	326	0.02±0.01
11-05-90	276	0.03±0.01	270	0.04±0.01	251	0.02±0.01
11-12-90	321	0.02±0.01	313	0.02±0.01	295	0.02±0.01
11-19-90	330	0.03±0.01	319	0.02±0.01	279	0.02±0.01
11-27-90	391	0.03±0.01	350	0.02±0.01	333	0.02±0.01
12-05-90	380	0.02±0.01	348	0.02±0.01	312	0.02±0.01
12-11-90	271	0.03±0.01	249	0.02±0.01	230	0.02±0.01
12-17-90	275	0.03±0.01	252	0.02±0.01	234	0.02±0.01
12-26-90	412	0.04±0.01	377	0.03±0.01	350	0.03±0.01
01-02-91	347	0.03±0.01	308	0.03±0.01	285	0.02±0.01

<sup>a</sup> Iodine-131 is sampled weekly. Concentration is <0.03 pCi/m<sup>3</sup> unless noted otherwise.

AIRBORNE IODINE-131<sup>a</sup> AND GROSS BETA  
IN AIR PARTICULATE FILTERS (continued)

Collection Date	North Boundary E-04		G. J. Francar Residence E-08		Silver Lake E-20	
	Volume (m <sup>3</sup> )	Gross Beta (pCi/m <sup>3</sup> )	Volume (m <sup>3</sup> )	Gross Beta (pCi/m <sup>3</sup> )	Volume (m <sup>3</sup> )	Gross Beta (pCi/m <sup>3</sup> )
01-08-90	267	0.04±0.01	275	0.03±0.01	294	0.04±0.01
01-15-90	311	0.03±0.01	312	0.03±0.01	330	0.03±0.01
01-22-90	315	0.03±0.01	314	0.03±0.01	336	0.03±0.01
01-29-90	302	0.02±0.01	309	0.02±0.01	320	0.02±0.01
02-05-90	304	0.02±0.01	315	0.02±0.01	312	0.02±0.01
02-12-90	303	0.05±0.01	311	0.04±0.01	309	0.04±0.01
02-19-90	303	0.02±0.01	317	0.02±0.01	322	0.02±0.01
02-26-90	304	0.03±0.01	308	0.03±0.01	323	0.03±0.01
03-05-90	302	0.03±0.01	312	0.02±0.01	309	0.03±0.01
03-12-90	303	0.02±0.01	312	0.02±0.01	305	0.01±0.01
03-19-90	303	0.02±0.01	332	0.01±0.01	300	0.02±0.01
03-26-90	305	0.02±0.01	297	0.02±0.01	268	0.02±0.01
04-02-90	299	0.02±0.01	300	0.01±0.01	250	0.02±0.01
04-09-90	319	0.02±0.01	314	0.02±0.01	255	0.02±0.01
04-16-90	251	0.02±0.01	274	0.02±0.01	299	0.02±0.01
04-23-90	259	0.02±0.01	283	0.02±0.01	304	0.02±0.01
04-30-90	260	0.02±0.01	285	0.02±0.01	300	0.02±0.01
05-07-90	266	0.02±0.01	288	0.01±0.01	308	0.02±0.01
05-14-90	255	0.02±0.01	282	0.01±0.01	297	0.01±0.01
05-21-90	260	0.01±0.01	284	0.01±0.01	301	0.01±0.01
05-29-90	298	0.01±0.01	326	0.01±0.01	349	0.01±0.01
06-04-90	228	0.01±0.01	247	0.01±0.01	256	0.01±0.01
06-11-90	257	0.01±0.01	288	0.01±0.01	307	0.01±0.01
06-18-90	291	0.02±0.01	286	0.02±0.01	301	0.02±0.01
06-25-90	294	0.01±0.01	288	0.01±0.01	300	0.01±0.01
07-02-90	295	0.01±0.01	336	0.01±0.01	305	0.01±0.01

<sup>a</sup> Iodine-131 is sampled weekly. Concentration is <0.03 pCi/m<sup>3</sup> unless noted otherwise.

AIRBORNE IODINE-131<sup>a</sup> AND GROSS BETA  
IN AIR PARTICULATE FILTERS (continued)

Collection Date	North Boundary E-04		G. J. Francar Residence E-08		Silver Lake E-20	
	Volume (m <sup>3</sup> )	Gross Beta (pCi/m <sup>3</sup> )	Volume (m <sup>3</sup> )	Gross Beta (pCi/m <sup>3</sup> )	Volume (m <sup>3</sup> )	Gross Beta (pCi/m <sup>3</sup> )
07-09-90	290	0.01±0.01	252	0.01±0.01	300	0.01±0.01
07-16-90	279	0.01±0.01	300	0.01±0.01	302	0.01±0.01
07-24-90	292	0.02±0.01	331	0.02±0.01	347	0.02±0.01
07-30-90	253	0.03±0.01	252	0.03±0.01	255	0.04±0.01
08-06-90	299	0.02±0.01	299	0.03±0.01	308	0.02±0.01
08-13-90	283	0.02±0.01	284	0.02±0.01	298	0.02±0.01
08-20-90	296	0.02±0.01	295	0.02±0.01	307	0.02±0.01
08-27-90	297	0.02±0.01	295	0.02±0.01	296	0.02±0.01
09-04-90	312	0.03±0.01	332	0.03±0.01	336	0.03±0.01
09-10-90	241	0.04±0.01	253	0.04±0.01	252	0.04±0.01
09-17-90	291	0.03±0.01	291	0.03±0.01	300	0.03±0.01
09-24-90	292	0.02±0.01	292	0.02±0.01	302	0.03±0.01
10-01-90	292	0.03±0.01	300	0.03±0.01	303	0.03±0.01
10-08-90	276	0.03±0.01	287	0.03±0.01	312	0.03±0.01
10-15-90	295	0.02±0.01	305	0.03±0.01	325	0.03±0.01
10-22-90	299	0.02±0.01	313	0.02±0.01	324	0.02±0.01
10-30-90	324	0.02±0.01	347	0.03±0.01	356	0.03±0.01
11-05-90	254	0.03±0.01	270	0.03±0.01	269	0.04±0.01
11-12-90	295	0.02±0.01	305	0.03±0.01	301	0.03±0.01
11-19-90	291	0.02±0.01	291	0.03±0.01	302	0.03±0.01
11-27-90	357	0.02±0.01	357	0.03±0.01	370	0.03±0.01
12-05-90	348	0.02±0.01	326	0.02±0.01	357	0.02±0.01
12-11-90	248	0.03±0.01	248	0.03±0.01	264	0.03±0.01
12-17-90	245	0.03±0.01	255	0.03±0.01	258	0.03±0.01
12-26-90	375	0.03±0.01	373	0.04±0.01	402	0.04±0.01
01-02-91	297	0.03±0.01	295	0.03±0.01	325	0.04±0.01

<sup>a</sup> Iodine-131 is sampled weekly. Concentration is <0.03 pCi/m<sup>3</sup> unless noted otherwise.

GAMMA EMITTERS IN QUARTERLY COMPOSITES OF  
AIR PARTICULATE FILTERS  
(pCi/m<sup>3</sup>)

Sample Description	Location					
	E-01	E-02	E-03	E-04	E-08	E-20

1st Quarter, 1990

Lab Code	EAP-1864	EAP-1865	EAP-1866	EAP-1867	EAP-1868	EAP-1869
Be-7	0.06±0.01	0.06±0.01	0.05±0.01	0.06±0.01	0.06±0.01	0.05±0.01
Cs-134	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cs-137	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Other <sup>a</sup>	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

2nd Quarter, 1990

Lab Code	EAP-2091	EAP-2092	EAP-2093	EAP-2094	EAP-2095	EAP-2096
Be-7	0.07±0.01	0.06±0.01	0.05±0.01	0.08±0.02	0.07±0.02	0.06±0.02
Cs-134	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cs-137	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Other <sup>a</sup>	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

3rd Quarter, 1990

Lab Code	EAP-2201	EAP-2202	EAP-2203	EAP-2204	EAP-2205	EAP-2206
Be-7	0.05±0.01	0.06±0.01	0.04±0.01	0.05±0.01	0.05±0.01	0.05±0.01
Cs-134	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cs-137	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Other <sup>a</sup>	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

4th Quarter, 1990

Lab Code	EAP-2413	EAP-2414	EAP-2415	EAP-2416	EAP-2417	EAP-2418
Be-7	0.04±0.01	0.04±0.01	0.03±0.01	0.03±0.01	0.05±0.01	0.04±0.01
Cs-134	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cs-137	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Other <sup>a</sup>	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

<sup>a</sup> See Introduction.

# RADIOACTIVITY IN MILK SAMPLES

(Monthly Collection)

(pCi/L)

Collection Date	Lab Code	Sr-89	Sr-90	I-131	Cs-134	Cs-137	Ba-La-140	Other <sup>a</sup>	K-40



# RADIOACTIVITY IN MILK SAMPLES

(Monthly Collection)

(pCi/L)

Collection Date	Lab Code	Sr-89	Sr-90	I-131	Cs-134	Cs-137	Ba-La-140	Other <sup>a</sup>	K-40
				E-21	Strutz Farm				
01-10-90	EMI-4403	<5	1.9±0.6	<0.5	<5	<5	<5	<5	1320±40
02-07-90	4472	<5	1.1±0.5	<0.5	<5	<5	<5	<5	1230±130
03-06-90	4522	<5	1.4±0.5	<0.5	<5	<5	<5	<5	1270±100
04-03-90	4581	<5	1.3±0.5	<0.5	<5	<5	<5	<5	1340±60
05-09-90	4693	<5	1.0±0.5	<0.5	<5	<5	<5	<5	1300±130
06-06-90	4834	<5	0.8±0.5	<0.5	<5	<5	<5	<5	1560±160
07-11-90	5021	<5	0.9±0.5	<0.5	<5	<5	<5	<5	1270±50
08-08-90	5161	<5	1.3±0.5	<0.5	<5	<5	<5	<5	1420±140
09-05-90	5307	<5	1.9±0.4	<0.5	<5	<5	<5	<5	1310±110
10-03-90	5464	<5	1.5±0.4	<0.5	<5	<5	<5	<5	1320±100
11-07-90	5630	<5	0.9±0.3	<0.5	<5	<5	<5	<5	1200±100
12-12-90	5737	<5	1.1±0.4	<0.5	<5	<5	<5	<5	1480±120

<sup>a</sup> See Introduction.

# RADIOACTIVITY IN WELL WATER SAMPLE E-10

(Quarterly Collections)

(pCi/L)

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Collection Date	01-09-90	04-03-90	07-03-90	10-02-90
Lab Code	EW-4811	EW-5766	EW-6853	EW-8114
Gross Beta	<3.5	4.6±1.9	5.0±1.9	3.9±1.9
H-3	<500	<500	<500	<500
Sr-89	<5	<5	<5	<5
Sr-90	<1	<1	<1	<1
I-131	<0.5	<0.5	<0.5	<0.5
Mn-54	<10	<10	<10	<10
Fe-59	<30	<30	<30	<30
Co-58	<10	<10	<10	<10
Co-60	<10	<10	<10	<10
Zn-65	<30	<30	<30	<30
Zr-Nb-95	<15	<15	<15	<15
Cs-134	<10	<10	<10	<10
Cs-137	<10	<10	<10	<10
Ba-La-140	<15	<15	<15	<15
Other Gammas <sup>a</sup>	<30	<30	<30	<30

<sup>a</sup> See Introduction.

# RADIOACTIVITY IN LAKE WATER SAMPLES

(Monthly Collections)

(pCi/L)

Collection Period	E-01 Met. Tower	E-05 Two Creeks Park	E-06 Coast Guard Station	E-09 Nature Conservancy	E-12 Unit 1 Discharge Flume <sup>a</sup>
Gross Beta					
January 1990	3.0±0.4	2.0±0.5	3.2±0.9	2.6±0.5	2.3±0.4
February 1990	1.9±0.3	2.1±0.3	2.1±0.4	2.1±0.3	2.6±0.5
March 1990	1.7±0.6	6.1±0.8 <sup>b</sup>	2.5±0.6	2.9±0.6	1.7±0.6
April 1990	2.6±0.5	3.0±0.5	2.0±0.4	3.4±0.4	2.2±0.4
May 1990	2.2±0.2	2.0±0.3	2.8±0.3	2.3±0.3	2.1±0.3
June 1990	3.3±0.5	2.8±0.5	2.8±0.5	2.8±0.5	1.7±0.6
July 1990	3.4±0.5	4.0±0.4	3.8±0.5	3.7±0.5	2.4±0.4
August 1990	2.3±0.3	2.0±0.4	2.3±0.5	2.6±0.5	1.8±0.4
September 1990	2.8±0.3	2.2±0.5	2.2±0.5	2.7±0.5	2.3±0.5
October 1990	2.2±0.5	1.7±0.4	2.5±0.5	2.5±0.5	2.0±0.4
November 1990	2.9±0.3	3.9±0.3	2.7±0.3	3.2±0.3	2.3±0.4
December 1990	2.7±0.3	2.4±0.2	3.4±0.3	3.1±0.3	2.3±0.3
Iodine-131					
January 1990	<0.5	<0.5	<0.5	<0.5	<0.5
February 1990	<0.5	<0.5	<0.5	<0.5	<0.5
March 1990	<0.5	<0.5	<0.5	<0.5	<0.5
April 1990	<0.5	<0.5	<0.5	<0.5	<0.5
May 1990	<0.5	<0.5	<0.5	<0.5	<0.5
June 1990	<0.5	<0.5	<0.5	<0.5	<0.5
July 1990	<0.5	<0.5	<0.5	<0.5	<0.5
August 1990	<0.5	<0.5	<0.5	<0.5	<0.5
September 1990	<0.5	<0.5	<0.5	<0.5	<0.5
October 1990	<0.5	<0.5	<0.5	<0.5	<0.5
November 1990	<0.5	<0.5	<0.5	<0.5	<0.5
December 1990	<0.5	<0.5	<0.5	<0.5	<0.5

<sup>a</sup> E-12 Unit 1 Discharge Flume is a monthly composite of weekly grab samples.

<sup>b</sup> Analysis was repeated; result of reanalysis 6.8±0.7 pCi/L.

# RADIOACTIVITY IN LAKE WATER SAMPLES (continued)

(Monthly Collections)

(pCi/L)

Collection Period	E-01 Met. Tower	E-05 Two Creeks Park	E-06 Coast Guard Station	E-09 Nature Conservancy	E-12 Unit 1 Discharge Flume <sup>a</sup>
Mn-54					
January 1990	<10	<10	<10	<10	<10
February 1990	<10	<10	<10	<10	<10
March 1990	<10	<10	<10	<10	<10
April 1990	<10	<10	<10	<10	<10
May 1990	<10	<10	<10	<10	<10
June 1990	<10	<10	<10	<10	<10
July 1990	<10	<10	<10	<10	<10
August 1990	<10	<10	<10	<10	<10
September 1990	<10	<10	<10	<10	<10
October 1990	<10	<10	<10	<10	<10
November 1990	<10	<10	<10	<10	<10
December 1990	<10	<10	<10	<10	<10
Fe-59					
January 1990	<30	<30	<30	<30	<30
February 1990	<30	<30	<30	<30	<30
March 1990	<30	<30	<30	<30	<30
April 1990	<30	<30	<30	<30	<30
May 1990	<30	<30	<30	<30	<30
June 1990	<30	<30	<30	<30	<30
July 1990	<30	<30	<30	<30	<30
August 1990	<30	<30	<30	<30	<30
September 1990	<30	<30	<30	<30	<30
October 1990	<30	<30	<30	<30	<30
November 1990	<30	<30	<30	<30	<30
December 1990	<30	<30	<30	<30	<30

<sup>a</sup> E-12 Unit 1 Discharge Flume is a monthly composite of weekly grab samples.

# RADIOACTIVITY IN LAKE WATER SAMPLES (continued)

(Monthly Collections)

(pCi/L)

Collection Period	E-01 Met. Tower	E-05 Two Creeks Park	E-06 Coast Guard Station	E-09 Nature Conservancy	E-12 Unit 1 Discharge Flume <sup>a</sup>
Co-58					
January 1990	<10	<10	<10	<10	<10
February 1990	<10	<10	<10	<10	<10
March 1990	<10	<10	<10	<10	<10
April 1990	<10	<10	<10	<10	<10
May 1990	<10	<10	<10	<10	<10
June 1990	<10	<10	<10	<10	<10
July 1990	<10	<10	<10	<10	<10
August 1990	<10	<10	<10	<10	<10
September 1990	<10	<10	<10	<10	<10
October 1990	<10	<10	<10	<10	<10
November 1990	<10	<10	<10	<10	<10
December 1990	<10	<10	<10	<10	<10
Co-60					
January 1990	<10	<10	<10	<10	<10
February 1990	<10	<10	<10	<10	<10
March 1990	<10	<10	<10	<10	<10
April 1990	<10	<10	<10	<10	<10
May 1990	<10	<10	<10	<10	<10
June 1990	<10	<10	<10	<10	<10
July 1990	<10	<10	<10	<10	<10
August 1990	<10	<10	<10	<10	<10
September 1990	<10	<10	<10	<10	<10
October 1990	<10	<10	<10	<10	<10
November 1990	<10	<10	<10	<10	<10
December 1990	<10	<10	<10	<10	<10

<sup>a</sup> E-12 Unit 1 Discharge Flume is a monthly composite of weekly grab samples.

# RADIOACTIVITY IN LAKE WATER SAMPLES (continued)

(Monthly Collections)

(pCi/L)

Collection Period	E-01 Met. Tower	E-05 Two Creeks Park	E-06 Coast Guard Station	E-09 Nature Conservancy	E-12 Unit 1 Discharge Flume <sup>a</sup>
Zn-65					
January 1990	<30	<30	<30	<30	<30
February 1990	<30	<30	<30	<30	<30
March 1990	<30	<30	<30	<30	<30
April 1990	<30	<30	<30	<30	<30
May 1990	<30	<30	<30	<30	<30
June 1990	<30	<30	<30	<30	<30
July 1990	<30	<30	<30	<30	<30
August 1990	<30	<30	<30	<30	<30
September 1990	<30	<30	<30	<30	<30
October 1990	<30	<30	<30	<30	<30
November 1990	<30	<30	<30	<30	<30
December 1990	<30	<30	<30	<30	<30
Zr-Nb-95					
January 1990	<15	<15	<15	<15	<15
February 1990	<15	<15	<15	<15	<15
March 1990	<15	<15	<15	<15	<15
April 1990	<15	<15	<15	<15	<15
May 1990	<15	<15	<15	<15	<15
June 1990	<15	<15	<15	<15	<15
July 1990	<15	<15	<15	<15	<15
August 1990	<15	<15	<15	<15	<15
September 1990	<15	<15	<15	<15	<15
October 1990	<15	<15	<15	<15	<15
November 1990	<15	<15	<15	<15	<15
December 1990	<15	<15	<15	<15	<15

<sup>a</sup> E-12 Unit 1 Discharge Flume is a monthly composite of weekly grab samples.

# RADIOACTIVITY IN LAKE WATER SAMPLES (continued)

(Monthly Collections)

(pCi/L)

Collection Period	E-01 Met. Tower	E-05 Two Creeks Park	E-06 Coast Guard Station	E-09 Nature Conservancy	E-12 Unit 1 Discharge Flume <sup>a</sup>
Cs-134					
January 1990	<10	<10	<10	<10	<10
February 1990	<10	<10	<10	<10	<10
March 1990	<10	<10	<10	<10	<10
April 1990	<10	<10	<10	<10	<10
May 1990	<10	<10	<10	<10	<10
June 1990	<10	<10	<10	<10	<10
July 1990	<10	<10	<10	<10	<10
August 1990	<10	<10	<10	<10	<10
September 1990	<10	<10	<10	<10	<10
October 1990	<10	<10	<10	<10	<10
November 1990	<10	<10	<10	<10	<10
December 1990	<10	<10	<10	<10	<10
Cs-137					
January 1990	<10	<10	<10	<10	<10
February 1990	<10	<10	<10	<10	<10
March 1990	<10	<10	<10	<10	<10
April 1990	<10	<10	<10	<10	<10
May 1990	<10	<10	<10	<10	<10
June 1990	<10	<10	<10	<10	<10
July 1990	<10	<10	<10	<10	<10
August 1990	<10	<10	<10	<10	<10
September 1990	<10	<10	<10	<10	<10
October 1990	<10	<10	<10	<10	<10
November 1990	<10	<10	<10	<10	<10
December 1990	<10	<10	<10	<10	<10

<sup>a</sup> E-12 Unit 1 Discharge Flume is a monthly composite of weekly grab samples.



# RADIOACTIVITY IN LAKE WATER SAMPLES (continued)

(Monthly Collections)

(pCi/L)

Collection Period	E-01 Met. Tower	E-05 Two Creeks Park	E-06 Coast Guard Station	E-09 Nature Conservancy	E-12 Unit 1 Discharge Flume <sup>a</sup>
Ba-La-140					
January 1990	<15	<15	<15	<15	<15
February 1990	<15	<15	<15	<15	<15
March 1990	<15	<15	<15	<15	<15
April 1990	<15	<15	<15	<15	<15
May 1990	<15	<15	<15	<15	<15
June 1990	<15	<15	<15	<15	<15
July 1990	<15	<15	<15	<15	<15
August 1990	<15	<15	<15	<15	<15
September 1990	<15	<15	<15	<15	<15
October 1990	<15	<15	<15	<15	<15
November 1990	<15	<15	<15	<15	<15
December 1990	<15	<15	<15	<15	<15
Other Gammas <sup>b</sup>					
January 1990	<30	<30	<30	<30	<30
February 1990	<30	<30	<30	<30	<30
March 1990	<30	<30	<30	<30	<30
April 1990	<30	<30	<30	<30	<30
May 1990	<30	<30	<30	<30	<30
June 1990	<30	<30	<30	<30	<30
July 1990	<30	<30	<30	<30	<30
August 1990	<30	<30	<30	<30	<30
September 1990	<30	<30	<30	<30	<30
October 1990	<30	<30	<30	<30	<30
November 1990	<30	<30	<30	<30	<30
December 1990	<30	<30	<30	<30	<30

<sup>a</sup> E-12 Unit 1 Discharge Flume is a monthly composite of weekly grab samples.

<sup>b</sup> See Introduction.

# RADIOACTIVITY IN LAKE WATER SAMPLES

(Quarterly Analyses on Composites of Monthly Collections)

(pCi/L)

Collection Period	E-01 Met. Tower	E-05 Two Creeks Park	E-06 Coast Guard Station	E-09 Nature Conservancy	E-12 Unit 1 Discharge Flume <sup>a</sup>
Sr-89					
1st Qtr., 1990	<5	<5	<5	<5	<5
2nd Qtr., 1990	<5	<5	<5	<5	<5
3rd Qtr., 1990	<5	<5	<5	<5	<5
4th Qtr., 1990	<5	<5	<5	<5	<5
Sr-90					
1st Qtr., 1990	<1	<1	<1	<1	<1
2nd Qtr., 1990	<1	<1	<1	<1	<1
3rd Qtr., 1990	<1	<1	<1	<1	<1
4th Qtr., 1990	<1	<1	<1	<1	<1
H-3					
1st Qtr., 1990	<500	914±85	<500	1856±146 <sup>b</sup>	<500
2nd Qtr., 1990	<500	<500	<500	<500	<500
3rd Qtr., 1990	<500	<500	<500	<500	<500
4th Qtr., 1990	<500	<500	<500	<500	<500

<sup>a</sup> E-12 Unit 1 Discharge Flume is a quarterly composite of weekly grab samples.

<sup>b</sup> Analysis was repeated; result of reanalysis 1945±152 pCi/L.

RADIOACTIVITY IN FISH SAMPLES  
EDIBLE PORTIONS ONLY - COLLECTED AT E-13

(Collected 3x/year)  
(pCi/g wet)

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Sample Description and Activity (pCi/g wet)			
Collection Date	03-21-90	03-21-90	03-22-90
Lab Code	EF-996	EF-997	EF-998
Type	Lake Trout	Lake Trout	Brown Trout
Ratio (wet wt./dry wt.)	3.25	3.84	5.69
Gross Beta	2.9±0.1	3.7±0.2	2.1±0.1
K-40	1.58±0.31	1.85±0.29	1.99±0.35
Mn-54	<0.13	<0.13	<0.13
Fe-59	<0.26	<0.26	<0.26
Co-58	<0.13	<0.13	<0.13
Co-60	<0.13	<0.13	<0.13
Zn-65	<0.26	<0.26	<0.26
Cs-134	<0.13	<0.13	<0.13
Cs-137	<0.15	<0.15	0.22±0.02
Other gamma emitters <sup>a</sup>	<0.5	<0.5	<0.5

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<sup>a</sup> See Introduction.

RADIOACTIVITY IN FISH SAMPLES (continued)

EDIBLE PORTIONS ONLY - COLLECTED AT E-13

(Collected 3x/year)  
(pCi/g wet)

Sample Description and Concentration		
Collection Date	08-21-90	08-21-90
Lab Code	EF-1202,3	EF-1204
Type	Salmon	Brown Trout
Ratio (wet wt./dry wt.)	3.34	4.61
Gross Beta	2.0±0.05	2.2±0.10
K-40	1.63±0.21	2.32±0.31
Mn-54	<0.13	<0.13
Fe-59	<0.26	<0.26
Co-58	<0.13	<0.13
Co-60	<0.13	<0.13
Zn-65	<0.26	<0.26
Cs-134	<0.13	<0.13
Cs-137	0.06±0.02	<0.15
Other gamma emitters <sup>a</sup>	<0.5	<0.5

<sup>a</sup> See Introduction.

RADIOACTIVITY IN FISH SAMPLES (continued)

EDIBLE PORTIONS ONLY - COLLECTED AT E-13

(Collected 3x/year)  
(pCi/g wet)

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Sample Description and Activity (pCi/g wet)

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Collection Date	12-19-90	12-19-90
Lab Code	EF-1359	EF-1360
Type	Lake Trout	Brown Trout
Ratio (wet wt./dry wt.)	4.29	3.11
Gross Beta	1.52±0.06	1.85±0.08
K-40	1.86±0.38	2.09±0.38
Mn-54	<0.13	<0.13
Fe-59	<0.26	<0.26
Co-58	<0.13	<0.13
Co-60	<0.13	<0.13
Zn-65	<0.26	<0.26
Cs-134	<0.13	<0.13
Cs-137	0.11±0.021	0.08±0.022
Other gamma emitters <sup>a</sup>	<0.05	<0.05

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<sup>a</sup> See Introduction.

# RADIOACTIVITY IN SHORELINE SEDIMENT SAMPLES

(Semiannual Collections)

## Sample Description and Concentration (pCi/g dry)

Lab Code	ESS-735	ESS-736	ESS-737	ESS-738	ESS-739
Location	E-01	E-05	E-06	E-09	E-12
Date Collected	04-11-90	04-12-90	04-11-90	04-12-90	04-11-90
Gross Beta	7.1±2.6	6.4±2.4	7.6±2.2	8.8±2.6	8.0±2.4
Be-7	<0.12	<0.12	<0.18	<0.15	<0.17
K-40	4.40±0.28	7.22±0.46	6.40±0.39	9.64±0.58	6.11±0.48
Cs-137	0.063±0.012	<0.017	<0.021	<0.020	0.054±0.024
Tl-208	0.25±0.037	<0.046	<0.055	<0.052	0.16±0.062
Pb-212	0.38±0.030	0.13±0.020	0.18±0.025	0.17±0.024	0.12±0.038
Bi-214	<0.028	<0.031	<0.043	<0.037	<0.064
Ra-226	0.24±0.027	<0.026	<0.035	0.18±0.030	0.12±0.048
Ac-228	<0.056	<0.066	<0.074	<0.070	<0.095

Lab Code	ESS-827	ESS-828	ESS-829	ESS-830	ESS-831
Location	E-01	E-05	E-06	E-09	E-12
Date Collected	10-02-90	10-03-90	10-03-90	10-02-90	10-03-90
Gross Beta	5.4±1.8	5.8±1.8	8.4±1.5	8.0±1.3	6.1±1.3
Be-7	<0.31	<0.17	<0.22	<0.27	<0.24
K-40	4.35±0.42	4.26±0.40	3.12±0.26	1.82±0.31	3.86±0.28
Cs-137	0.082±0.037	0.032±0.018	0.10±0.017	<0.028	<0.021
Tl-208	0.64±0.096	0.31±0.057	0.58±0.058	0.54±0.10	0.44±0.054
Pb-212	0.72±0.044	0.28±0.038	0.91±0.045	0.51±0.052	0.57±0.036
Bi-214	0.48±0.064	0.19±0.038	<0.041	0.36±0.063	<0.037
Ra-226	0.53±0.055	0.21±0.040	0.59±0.045	0.40±0.063	0.33±0.032
Ac-228	0.59±0.10	0.36±0.075	<0.075	0.49±0.098	<0.074

# RADIOACTIVITY IN SOIL SAMPLES

(Semiannual Collections)

## Sample Description and Concentration (pCi/g dry)

Lab Code	ESO-424	ESO-425	ESO-426	ESO-427
Location	E-01	E-02	E-03	E-04
Date Collected	05-07-90	05-07-90	05-07-90	05-07-90
Gross Beta	26.0±4.1	24.7±3.7	26.2±4.3	35.0±4.6
Be-7	<0.22	<0.31	<0.19	<0.32
K-40	17.18±0.69	17.80±0.82	20.40±0.66	19.71±1.06
Cs-137	0.41±0.039	0.28±0.034	0.38±0.026	0.36±0.056
Tl-208	0.83±0.11	0.63±0.086	0.67±0.060	0.74±0.16
Pb-212	0.74±0.13	0.86±0.066	0.99±0.046	0.77±0.066
Bi-214	0.55±0.078	<0.075	<0.043	0.55±0.12
Ra-226	0.62±0.074	0.42±0.052	0.64±0.046	0.58±0.094
Ac-228	0.75±0.13	0.73±0.13	0.73±0.09	0.66±0.18
Lab Code	ESO-428	ESO-429,30	ESO-431	ESO-432
Location	E-06	E-08	E-09	E-20
Date Collected	05-07-90	05-07-90	05-07-90	05-07-90
Gross Beta	19.7±4.0	17.3±2.6	25.5±3.7	21.3±3.9
Be-7	<0.22	<0.17	<0.25	<0.17
K-40	12.10±0.72	10.70±0.48	19.21±1.14	18.60±0.63
Cs-137	0.78±0.050	0.17±0.021	0.19±0.047	0.32±0.026
Tl-208	0.20±0.051	0.22±0.040	0.49±0.13	0.57±0.070
Pb-212	0.26±0.032	0.26±0.028	0.65±0.056	0.66±0.032
Bi-214	<0.043	<0.041	<0.15	0.51±0.054
Ra-226	0.23±0.039	0.21±0.048	0.54±0.082	0.54±0.057
Ac-228	<0.079	<0.089	0.66±0.17	0.50±0.11



# RADIOACTIVITY IN SOIL SAMPLES

(Semiannual Collections)

Sample Description and Concentration (pCi/g dry)				
Lab Code	ESO-470	ESO-471	ESO-472,3	ESO-474
Location	E-01	E-02	E-03	E-04
Date Collected	10-02-90	10-02-90	10-03-90	10-02-90
Gross Beta	9.6±2.0	24.0±2.5	22.1±1.9	24.6±2.6
Be-7	<0.29	<0.083	<0.32	<0.35
K-40	6.54±0.62	14.74±0.29	17.32±0.67	18.89±1.00
Cs-137	0.13±0.035	0.28±0.013	0.55±0.041	0.62±0.061
Tl-208	0.35±0.12	0.50±0.032	0.68±0.082	0.64±0.12
Pb-212	0.37±0.065	0.59±0.024	0.66±0.043	0.67±0.069
Bi-214	<0.10	0.39±0.023	0.51±0.056	0.57±0.085
Ra-226	0.28±0.060	0.46±0.023	0.58±0.064	0.61±0.083
Ac-228	0.41±0.11	0.54±0.042	0.68±0.12	0.71±0.15
Lab Code	ESO-475	ESO-476	ESO-477	ESO-478
Location	E-06	E-08	E-09	E-20
Date Collected	10-03-90	10-02-90	10-02-90	10-01-90
Gross Beta	9.0±2.0	15.6±1.9	19.9±2.1	20.4±2.6
Be-7	<0.16	<0.36	<0.44	<0.34
K-40	5.09±0.32	13.10±0.64	18.42±1.10	15.27±0.90
Cs-137	0.065±0.013	0.44±0.036	0.26±0.058	0.28±0.055
Tl-208	0.19±0.036	0.34±0.061	0.63±0.14	0.75±0.17
Pb-212	0.25±0.026	0.49±0.048	0.60±0.11	0.74±0.082
Bi-214	<0.041	<0.052	<0.14	0.53±0.084
Ra-226	0.20±0.028	0.27±0.039	0.58±0.10	0.57±0.091
Ac-228	<0.075	<0.11	0.59±0.18	0.59±0.17

# RADIOACTIVITY IN VEGETATION SAMPLES

(Tri-Annual Collections)

(pCi/g wet)

Location	Collection Date	Lab Code	Ratio Wet Wt./ Dry Wt.)	Gross Beta	Be-7	Cs-137	Cs-134	I-131	K-40	Other <sup>a</sup>
E-01	05-07-90	EG-1517,8	4.51	5.7±0.2	0.60±0.32	<0.08	<0.06	<0.06	7.04±0.62	<0.25
E-02	05-07-90	1519	4.69	7.5±0.3	0.21±0.07	<0.08	<0.06	<0.06	8.41±0.34	<0.25
E-03	05-07-90	1520	4.42	7.3±0.3	0.37±0.08	<0.08	<0.06	<0.06	7.33±0.30	<0.25
E-04	05-07-90	1521	5.26	5.1±0.2	0.31±0.11	<0.08	<0.06	<0.06	4.90±0.44	<0.25
E-06	05-07-90	1522	4.11	5.0±0.2	0.22±0.08	<0.08	<0.06	<0.06	4.92±0.27	<0.25
E-08	05-07-90	1523	4.61	6.0±0.2	0.42±0.17	<0.08	<0.06	<0.06	7.37±0.49	<0.25
E-09	05-07-90	1524	4.76	6.2±0.3	<0.10	<0.08	<0.06	<0.06	5.63±0.24	<0.25
E-20	05-07-90	1525	4.92	6.6±0.3	0.27±0.08	<0.08	<0.06	<0.06	7.67±0.29	<0.25
E-01	07-02-90	EG-1577	5.43	7.0±0.3	0.66±0.07	<0.08	<0.06	<0.06	5.56±0.29	<0.25
E-02	07-02-90	1578,9	3.77	5.9±0.2	0.77±0.16	<0.08	<0.06	<0.06	5.31±0.41	<0.25
E-03	07-02-90	1580	3.20	8.3±0.4	0.84±0.20	<0.08	<0.06	<0.06	5.90±0.45	<0.25
E-04	07-02-90	1581	4.56	5.1±0.2	0.96±0.21	<0.08	<0.06	<0.06	5.61±0.62	<0.25
E-06	07-02-90	1582	5.15	7.3±0.3	0.76±0.14	<0.08	<0.06	<0.06	6.13±0.46	<0.25
E-08	07-02-90	1583	2.58	7.0±0.4	2.04±0.11	<0.08	<0.06	<0.06	5.12±0.20	<0.25
E-09	07-03-90	1584	3.98	6.1±0.2	0.91±0.15	<0.08	<0.06	<0.06	4.46±0.39	<0.25
E-20	07-02-90	1585	3.97	6.1±0.3	0.84±0.08	<0.08	<0.06	<0.06	5.44±0.25	<0.25
E-01	10-02-90	EG-1645	2.79	5.6±0.3	3.51±0.18	<0.08	<0.06	<0.06	5.30±0.33	<0.25
E-02	10-03-90	1646	4.84	3.6±0.2	2.65±0.30	<0.08	<0.06	<0.06	3.43±0.45	<0.25
E-03	10-03-90	1647	5.42	4.2±0.2	3.38±0.15	<0.08	<0.06	<0.06	7.06±0.32	<0.25
E-04	10-03-90	1648	5.88	4.4±0.2	1.96±0.24	<0.08	<0.06	<0.06	4.49±0.52	<0.25
E-06	10-02-90	1649,50	6.11	4.3±0.1	0.58±0.11	<0.08	<0.06	<0.06	4.13±0.32	<0.25
E-08	10-02-90	1651	2.54	5.4±0.4	4.27±0.16	<0.08	<0.06	<0.06	5.11±0.31	<0.25
E-09	10-02-90	1652	3.82	4.4±0.3	1.95±0.13	<0.08	<0.06	<0.06	4.52±0.35	<0.25
E-20	10-01-90	1653	4.33	6.1±0.2	1.29±0.18	<0.08	<0.06	<0.06	5.34±0.44	<0.25

<sup>a</sup> See Introduction.

# RADIOACTIVITY IN AQUATIC VEGETATION SAMPLES

(Triennial Collections)

## Sample Description and Concentration (pCi/g wet)

Lab Code	ESL-217	ESL-233	ESL-251
Location	E-5	E-5	E-5
Date Collected	06-26-90	08-08-90	10-03-90
Ratio (wet wt./dry wt.)	2.49	3.59	4.76
Gross Beta	5.0±1.1	1.1±0.4	1.2±0.2
Be-7	0.56±0.16	<0.54	<0.23
K-40	1.90±0.28	1.53±0.46	1.06±0.33
Co-58	<0.019	<0.061	<0.027
Co-60	<0.016	<0.045	<0.020
Cs-134	<0.013	<0.047	<0.022
Cs-137	<0.019	<0.049	<0.021

Lab Code	ESL-218	ESL-234,5	ESL-252
Location	E-12	E-12	E-12
Date Collected	06-26-90	08-13-90	10-04-90
Ratio (wet wt./dry wt.)	3.45	3.26	4.50
Gross Beta	4.7±0.7	2.7±0.4	3.5±0.3
Be-7	0.89±0.18	1.00±0.26	<0.30
K-40	1.70±0.24	1.94±0.56	2.89±0.60
Co-58	<0.018	<0.043	<0.029
Co-60	<0.017	<0.056	<0.025
Cs-134	<0.011	<0.031	<0.021
Cs-137	0.058±0.013	0.079±0.030	<0.026

# AMBIENT GAMMA RADIATION (TLD)

1st Quarter, 1990

Date Annealed	12-20-89
Date Placed	01-03-90
Date Removed	03-28-90
Date Read	04-04-90
Days in the Field	84
Days from Annealing to Readout	105

Location	Days in the Field	Total mR	Net mR	Net mR per 7 days
<u>Indicator</u>				
E-1	84	16.8±0.2	12.0±1.5	1.00±0.13
E-2	84	18.7±1.2	13.9±1.9	1.16±0.16
E-3	84	20.8±0.8	16.0±1.7	1.33±0.14
E-4	84	18.0±0.8	13.2±1.7	1.10±0.14
E-5	84	18.8±0.7	14.0±1.7	1.17±0.14
E-6	84	17.8±0.6	13.0±1.6	1.08±0.13
E-7	84	15.0±0.7	10.2±1.7	0.85±0.14
E-8	84	17.3±0.3	12.5±1.5	1.04±0.13
E-9	84	18.2±1.2	13.4±1.9	1.12±0.16
E-12	84	12.4±0.8	7.6±1.7	0.63±0.14
E-14	84	19.2±1.5	14.4±2.1	1.20±0.18
E-15	84	22.0±0.5	17.2±1.6	1.42±0.13
E-16	84	19.0±0.7	14.2±1.7	1.18±0.14
E-17	84	17.5±0.9	12.7±1.8	1.06±0.15
E-18	84	19.7±0.3	14.9±1.5	1.24±0.13
E-22	84	20.2±1.1	15.4±1.9	1.28±0.16
E-23	84	19.2±0.6	14.4±1.6	1.20±0.13
E-24	84	18.7±0.9	13.9±1.8	1.16±0.15
E-25	84	19.6±1.0	14.8±1.8	1.23±0.15
E-26	84	19.1±0.8	14.3±1.7	1.19±0.14
E-27	84	17.4±1.0	12.6±1.8	1.05±0.15

## Control

E-20	84	17.9±0.9	13.1±1.8	1.09±0.15
Mean ± s.d.		18.3±2.0	13.5±2.0	1.13±0.17

## In-Transit Exposure

Date Annealed	12-20-89	03-22-90
Date Read	01-10-90	04-04-90

## Total mR

ITC-1	3.5±0.1	6.3±0.3
ITC-2	3.5±0.2	6.0±0.2

# AMBIENT GAMMA RADIATION (TLD)

2nd Quarter, 1990

Date Annealed	03-22-90
Date Placed	03-28-90
Date Removed	07-03-90
Date Read	07-13-90
Days in the Field	97
Days from Annealing to Readout	113

Location	Days in the Field	Total mR	Net mR	Net mR per 7 days
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## Indicator

E-1	97	17.2±1.1	12.4±1.9	0.89±0.14
E-2	97	18.7±0.7	13.9±1.7	1.00±0.13
E-3	97	20.1±0.4	15.3±1.6	1.10±0.12
E-4	97	19.6±1.3	14.8±2.1	1.07±0.15
E-5	97	18.7±1.3	13.9±2.1	1.00±0.15
E-6	97	16.1±0.2	11.3±1.6	0.82±0.12
E-7	97	15.2±0.6	10.4±1.7	0.75±0.12
E-8	97	17.7±0.4	12.9±1.6	0.93±0.12
E-9	97	19.4±0.8	14.6±1.8	1.05±0.13
E-12	97	12.9±0.4	8.1±1.6	0.58±0.12
F-14	97	18.5±0.2	13.7±1.6	0.99±0.12
E-15	97	18.7±0.2	13.9±1.6	1.00±0.12
E-16	97	20.2±0.3	15.4±1.6	1.11±0.12
E-17	97	16.6±0.5	11.8±1.7	0.85±0.12
E-18	97	21.6±0.6	16.8±1.7	1.21±0.12
E-22	97	19.7±1.0	14.9±1.9	1.08±0.14
E-23	97	22.5±0.5	17.7±1.7	1.28±0.12
E-24	97	18.9±0.5	14.1±1.7	1.02±0.12
E-25	97	18.3±0.5	13.5±1.7	0.97±0.12
E-26	97	15.8±0.3	11.0±1.6	0.79±0.12
E-27	97	19.2±0.2	14.4±1.6	1.04±0.12

## Control

E-20	97	18.6±0.5	13.8±1.7	1.00±0.12
Mean ± s.d.		18.4±2.1	13.6±2.1	0.98±0.16

## In-Transit Exposure

Date Annealed	03-22-90	06-27-90
Date Read	04-04-90	07-13-90

## Total mR

ITC-1	6.3±0.3	3.2±0.2
ITC-2	6.0±0.2	3.7±0.2

# AMBIENT GAMMA RADIATION (TLD)

3rd Quarter, 1990

Date Annealed	06-27-90			
Date Placed	07-03-90			
Date Removed	10-04-90			
Date Read	10-15-90			
Days in the Field	93			
Days from Annealing to Readout	110			

Location	Days in the Field	Total mR	Net mR	Net mR per 7 days
<u>Indicator</u>				
E-1	93	16.5±1.1	11.7±1.9	0.88±0.14
E-2	93	19.7±0.4	14.9±1.6	1.12±0.12
E-3	93	20.6±0.9	15.8±1.8	1.19±0.14
E-4	93	19.5±0.6	14.7±1.7	1.11±0.13
E-5	93	19.2±1.0	14.4±1.9	1.08±0.14
E-6	93	17.1±0.4	12.3±1.6	0.93±0.12
E-7	93	16.0±0.5	11.2±1.7	0.84±0.13
E-8	93	17.7±0.3	12.9±1.6	0.97±0.12
E-9	93	20.6±1.4	15.8±2.1	1.19±0.16
E-12	93	14.5±0.5	9.7±1.7	0.73±0.13
E-14	93	19.9±0.4	15.1±1.6	1.14±0.12
E-15	93	21.1±0.7	16.3±1.8	1.23±0.14
E-16	93	20.7±0.5	15.9±1.7	1.20±0.13
E-17	93	17.1±1.0	12.3±1.9	0.93±0.14
E-18	93	21.3±0.8	16.5±1.8	1.24±0.14
E-22	93	21.1±1.0	16.3±1.9	1.23±0.14
E-23	93	21.5±1.0	16.7±1.9	1.26±0.14
E-24	93	20.9±1.3	16.1±2.1	1.21±0.16
E-25	93	19.9±1.4	15.1±2.1	1.14±0.16
E-26	93	17.2±1.1	12.4±1.9	0.93±0.14
E-27	93	17.0±0.7	12.2±1.8	0.92±0.14
<u>Control</u>				
E-20	93	20.0±0.8	15.2±1.8	1.14±0.14
Mean ± s.d.		19.0±2.0	14.2±2.0	1.07±0.15

<u>In-Transit Exposure</u>			
Date Annealed	06-27-90	09-21-90	
Date Read	07-13-90	10-15-90	
<u>Total mR</u>			
ITC-1	3.2±0.2	5.9±0.4	
ITC-2	3.7±0.2	6.6±0.4	



# AMBIENT GAMMA RADIATION (TLD)

4th Quarter, 1990

Date Annealed		09-21-90		
Date Placed		10-04-90		
Date Removed		01-03-91		
Date Read		01-12-91		
Days in the Field		91		
Days from Annealing to Readout		113		

Location	Days in the Field	Total mR	Net mR	Net mR per 7 days
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<u>Indicator</u>				
E-1	91	19.0±0.5	13.9±1.5	1.07±0.11
E-2	91	19.4±0.4	14.3±1.5	1.10±0.11
E-3	91	21.3±0.6	16.2±1.5	1.25±0.11
E-4	91	19.2±0.6	14.1±1.5	1.08±0.11
E-5	91	19.6±1.2	14.5±1.8	1.12±0.14
E-6	91	18.1±0.4	13.0±1.5	1.00±0.11
E-7	91	15.9±0.5	10.8±1.5	0.83±0.11
E-8	91	17.0±0.8	11.9±1.6	0.92±0.12
E-9	91	19.8±0.4	14.7±1.5	1.13±0.11
E-12	91	16.0±0.6	10.9±1.5	0.84±0.11
E-14	91	20.2±0.6	15.1±1.5	1.16±0.11
E-15	91	22.7±1.0	17.6±1.7	1.35±0.13
E-16	91	20.6±0.8	15.5±1.6	1.19±0.12
E-17	91	17.4±0.6	12.3±1.5	0.95±0.11
E-18	91	21.1±0.6	16.0±1.5	1.23±0.11
E-22	91	20.4±1.0	15.3±1.7	1.18±0.13
E-23	91	21.9±0.9	16.8±1.7	1.29±0.13
E-24	91	19.7±1.0	14.6±1.7	1.12±0.13
E-25	91	18.8±0.6	13.7±1.5	1.05±0.11
E-26	91	17.0±0.2	11.9±1.4	0.92±0.11
E-27	91	18.8±0.7	13.7±1.6	1.05±0.12

<u>Control</u>				
E-20	91	19.6±0.6	14.5±1.5	1.12±0.11
Mean ± s.d.		19.2±1.8	14.2±1.8	1.09±0.14

<u>In-Transit Exposure</u>			
Date Annealed	09-21-90	12-24-90	
Date Read	10-15-90	01-12-91	
<u>Total mR</u>			
ITC-1	5.9±0.4	4.2±0.2	
ITC-2	6.6±0.4	3.6±0.2	





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## 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.

July, 1990

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;

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

In cases where the activity is found to be below the lower limit of detection  $L$  it is reported as

$$<L$$

where  $L$  = is the lower limit of detection based on  $4.66\sigma$  uncertainty for a background sample.

### 3.0. Duplicate Analyses

3.1. Individual results:  $x_1 \pm s_1$   
 $x_2 \pm s_2$

Reported result:  $x \pm s$

where  $x = (1/2) (x_1 + x_2)$

$$s = (1/2) \sqrt{s_1^2 + s_2^2}$$

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  $x_1, x_2, \dots, x_n$  are defined as follows:

$$\bar{x} = \frac{1}{n} \sum x$$

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

- 4.2 Values below the highest lower limit of detection are not included in the average.
- 4.3 If all of the 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 is 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 greater than 5, the figure is dropped, and the last retained figure is raised by 1. As an example, 11.446 is rounded off to 11.45.
- 4.5.3. If the figure following those to be retained is 5, and if there are no figures other than zeros beyond the five, the figure 5 is dropped, and the last-place figure retained is increased by one if it is an odd number or it is kept unchanged if an even number. As an example, 11.435 is rounded off to 11.44, while 11.425 is rounded off to 11.42.

Appendix C

Sampling Program and Locations

Table C-1. Sample collection and analysis program

Sample Type	Locations		Collection Type (and Frequency) <sup>b</sup>	Analysis (and Frequency) <sup>b</sup>
	No.	Codes (and Type) <sup>a</sup>		
Airborne Filters	6	E-1-4,8,20	Weekly	GB,GS on QC for each location
Airborne Iodine	6	E-1-4,8,20	Weekly	I-131
Ambient Radiation (TLDs)	22	E-1,2,3,4,12,14,15 E-5,6,7,8,9,16,17,18, 20,22,23,24,25,26,27	Quarterly	Ambient gamma
Lake Water	5	E-1,5,6,9,12	Monthly	GB, GS, I-131 on MC H-3, Sr-89-90 on QC
Well Water	1	E-10	Quarterly	GB, GS, H-3, Sr-89-90, I-131
Vegetation	8	E-1,2,3,4,6,8,9,20	3x/year as available	GB,GS
Shoreline Silt	5	E-1,5,6,9,12	2x/year	GB,GS
Soil	8	E-1,2,3,4,6,8,9,20	2x/year	GB,GS
Milk	3	E-11,19,21	Monthly	GS,I-131,Sr-89-90
Algae	2	E-5,12	3x/year as available	GB,GS
Fish	1	E-13	3x/year as available	GB,GS (in edible portions)

Table C-1. Continued.

Sample Type	Locations		Collection Type (and Frequency) <sup>b</sup>	Analysis (and Frequency) <sup>b</sup>
	No.	Codes (and Type) <sup>a</sup>		
<hr/>				
<hr/>				
SPECIAL COLLECTIONS AND ANALYSES				
Airborne Filters			4 per month 1 per quarter	Sr-89, Sr-90 Sr-89, Sr-90 (comp.)
Liquid			1 per month	GA, Sr-89, Sr-90
Subsoil Water			4 per quarter	GA, GB, H-3, GS
Miscellaneous Water Samples			4-5 per year	Sr-89, Sr-90

<sup>a</sup> Locations codes are defined in Table 2. Control Stations are indicated by (C) all other stations are indicators.

<sup>b</sup> Analysis type is coded as follows: GB = gross beta, GA = gross alpha, GS = gamma spectroscopy, H-3 = tritium, Sr-89 = strontium-89, Sr-90 = strontium-90, I-131 = iodine-131. Analysis frequency is coded as follows: MC = monthly composite, QC = quarterly composite.



## 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, 1991



## 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 January 1986 through December, 1990. 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 1985-1986 through participation in the Second, Third, Fourth, Fifth, Seventh, and Eighth International Intercomparison of Environmental Dosimeters under the sponsorships listed in Table A-2. 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, 1986 through 1990.<sup>a</sup>

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L <sup>b</sup>		
				TIML Result $\pm 2\sigma^c$	EPA Result <sup>d</sup>	
					1s, N=1	Control Limits
STF-447	Food	Jan 1986	Sr-89	24.3 $\pm$ 2.5	25.0 $\pm$ 5.0	16.3-33.7
			Sr-90	17.3 $\pm$ 0.6	10.0 $\pm$ 1.5	7.4-12.6
			I-131	22.7 $\pm$ 2.3	20.0 $\pm$ 0.6	9.6-30.4
			Cs-137	16.3 $\pm$ 0.6	15.0 $\pm$ 5.0	6.3-23.7
			K	927 $\pm$ 46	950 $\pm$ 144	701-1199
STW-448	Water	Feb 1986	Cr-51	46.0 $\pm$ 3.6	36.0 $\pm$ 5.0	29.3-46.7
			Co-60	19.7 $\pm$ 1.5	18.0 $\pm$ 5.0	9.3-26.7
			Zn-65	44.0 $\pm$ 3.5	40.0 $\pm$ 5.0	31.3-48.7
			Ru-106	<9.0	0.0 $\pm$ 5.0	0.0-8.7
			Cs-134	28.3 $\pm$ 2.3	30.0 $\pm$ 5.0	21.3-38.7
			Cs-137	23.7 $\pm$ 0.6	22.0 $\pm$ 5.0	13.3-30.7
STW-449	Water	Feb 1986	H-3	5176 $\pm$ 48	5227 $\pm$ 525	4317-6137
STW-450	Water	Feb 1986	U total	8.0 $\pm$ 0.0	9.0 $\pm$ 6.0	0.0-19.4
STM-451	Milk	Feb 1986	I-131	7.0 $\pm$ 0.0	9.0 $\pm$ 6.0	0.0-19.4
STW-452	Water	Mar 1986	Ra-226	3.8 $\pm$ 0.1	4.1 $\pm$ 0.6	3.0-5.2
			Ra-228	11.0 $\pm$ 0.5	12.4 $\pm$ 1.8	9.2-15.5
STW-453	Water	Mar 1986	Gr. alpha	6.7 $\pm$ 0.6	15.0 $\pm$ 5.0	6.3-23.7
			Gr. beta	7.3 $\pm$ 0.6	8.0 $\pm$ 5.0	0.0-16.7
STW-454	Water	Apr 1986	I-131	7.0 $\pm$ 0.0	9.0 $\pm$ 6.0	0.0-19.4
STW-455 456	Water (Blind)	Apr 1986				
	Sample A		Gr. alpha	15.0 $\pm$ 1.0	17.0 $\pm$ 5.0	8.3-25.7
			Ra-226	3.1 $\pm$ 0.1	2.9 $\pm$ 0.4	2.1-3.7
			Ra-228	1.5 $\pm$ 0.2	2.0 $\pm$ 0.3	1.5-2.5
			Uranium	4.7 $\pm$ 0.6	5.0 $\pm$ 6.0	0.0-15.4
	Sample B		Gr. beta	28.7 $\pm$ 1.2	35.0 $\pm$ 5.0	26.3-43.7
			Sr-89	5.7 $\pm$ 0.6	7.0 $\pm$ 5.0	0.0-15.7
			Sr-90	7.0 $\pm$ 0.0	7.0 $\pm$ 1.5	4.4-9.6
			Co-60	10.7 $\pm$ 1.5	10.0 $\pm$ 5.0	1.3-18.7
			Cs-134	4.0 $\pm$ 1.7	5.0 $\pm$ 5.0	0.0-13.7
			Cs-137	5.3 $\pm$ 0.6	5.0 $\pm$ 5.0	0.0-13.7

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L <sup>b</sup>		
				TIML Result $\pm 2\sigma^c$	EPA Result <sup>d</sup>	
					1s, N=1	Control Limits
STAF-457	Air Filter	Apr 1986	Gr. alpha	13.7 $\pm$ 0.6	15.0 $\pm$ 5.0	6.3-23.7
			Gr. beta	46.3 $\pm$ 0.6	47.0 $\pm$ 5.0	38.3-55.7
			Sr-90	14.7 $\pm$ 0.6	18.0 $\pm$ 1.5	15.4-20.6
			Cs-137	10.7 $\pm$ 0.6	10.0 $\pm$ 5.0	1.3-18.7
STU-458	Urine	Apr 1986	Tritium	4313 $\pm$ 70	4423 $\pm$ 189	4096-4750
STW-459	Water	May 1986	Sr-89	4.3 $\pm$ 0.5	5.0 $\pm$ 5.0	0.0-13.7
			Sr-90	5.0 $\pm$ 0.0	5.0 $\pm$ 1.5	2.4-7.6
STW-460	Water	May 1986	Gr. alpha	5.3 $\pm$ 0.6	8.0 $\pm$ 5.0	0.0-16.7
			Gr. beta	11.3 $\pm$ 1.2	15.0 $\pm$ 5.0	6.3-23.7
STW-461	Water	Jun 1986	Cr-51	<9.0	0.0 $\pm$ 5.0	0.0-8.7
			Co-60	66.0 $\pm$ 1.0	66.0 $\pm$ 5.0	57.3-74.7
			Zn-65	87.3 $\pm$ 1.5	86.0 $\pm$ 5.0	77.3-94.7
			Ru-106	39.7 $\pm$ 2.5	50.0 $\pm$ 5.0	41.3-58.7
			Cs-134	49.3 $\pm$ 2.5	49.0 $\pm$ 5.0	40.3-57.7
			Cs-137	10.3 $\pm$ 1.5	10.0 $\pm$ 5.0	1.3-18.7
STW-462	Water	Jun 1986	Tritium	3427 $\pm$ 25	3125 $\pm$ 361	2499-3751
STM-464	Milk	Jun 1986	Sr-89	<1.0	0.0 $\pm$ 5.0	0.0-8.7
			Sr-90	15.3 $\pm$ 0.6	16.0 $\pm$ 1.5	13.4-18.6
			I-131	48.3 $\pm$ 2.3	41.0 $\pm$ 6.0	30.6-51.4
			Cs-137	43.7 $\pm$ 1.5	31.0 $\pm$ 5.0	22.3-39.7
			K	1567 $\pm$ 114	1600 $\pm$ 80	1461-1739
STW-465	Water	Jul 1986	Gr. alpha	4.7 $\pm$ 0.6	6.0 $\pm$ 5.0	0.0-14.7
			Gr. beta	18.7 $\pm$ 1.2	18.0 $\pm$ 5.0	9.3-26.7
STW-467	Water	Aug 1986	I-131	30.3 $\pm$ 0.6	45.0 $\pm$ 6.0	34.4-55.4
STW-468	Water	Aug 1986	Pu-239	11.3 $\pm$ 0.6	10.1 $\pm$ 1.0	8.3-11.9
STW-469	Water	Aug 1986	Uranium	4.0 $\pm$ 0.0	4.0 $\pm$ 6.0	0.0-14.4
STAF-470 471 472	Air Filter	Sep 1986	Gr. alpha	19.3 $\pm$ 1.5	22.0 $\pm$ 5.0	13.3-30.7
			Gr. beta	64.0 $\pm$ 2.6	66.0 $\pm$ 5.0	57.3-74.7
			Sr-90	22.0 $\pm$ 1.0	22.0 $\pm$ 5.0	19.4-24.6
			Cs-137	25.7 $\pm$ 1.5	22.0 $\pm$ 5.0	13.3-30.7
STW-473	Water	Sep 1986	Ra-226	6.0 $\pm$ 0.1	6.1 $\pm$ 0.9	4.5-7.7
			Ra-228	8.7 $\pm$ 1.1	9.1 $\pm$ 1.4	6.7-11.5

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	TIML Result $\pm 2\sigma^c$	Concentration in pCi/Lb	
					EPA Result <sup>d</sup>	
					1s, N=1	Control Limits
STW-474	Water	Sep 1986	Gr. alpha	16.3 $\pm$ 3.2	15.0 $\pm$ 5.0	6.3-23.7
			Gr. beta	9.0 $\pm$ 1.0	8.0 $\pm$ 5.0	0.0-16.7
STW-475	Water	Oct 1986	Cr-51	63.3 $\pm$ 5.5	59.0 $\pm$ 5.0	50.3-67.7
			Co-60	31.0 $\pm$ 2.0	31.0 $\pm$ 5.0	22.3-39.7
			Zn-657	87.3 $\pm$ 5.9	85.0 $\pm$ 5.0	76.3-93.7
			Ru-106	74.7 $\pm$ 7.4	74.0 $\pm$ 5.0	65.3-82.7
			Cs-134	25.7 $\pm$ 0.6	28.0 $\pm$ 5.0	19.3-36.7
			Cs-137	46.3 $\pm$ 1.5	44.0 $\pm$ 5.0	35.3-52.7
STW-476	Water	Oct 1986	H-3	5918 $\pm$ 60	5973 $\pm$ 597	4938-7008
SPW-477	Water (Blind)	Oct 1986				
	Sample A		Gr. alpha	34.0 $\pm$ 6.0	40.0 $\pm$ 5.0	31.3-48.7
			Ra-226	5.8 $\pm$ 0.2	6.0 $\pm$ 0.9	4.4-7.6
			Ra-228	2.7 $\pm$ 1.0	5.0 $\pm$ 0.8	3.7-6.3
			Uranium	11.0 $\pm$ 0.0	10.0 $\pm$ 6.0	0.0-20.4
	Sample B		Gr. beta	38.7 $\pm$ 1.2	51.0 $\pm$ 5.0	42.3-59.7
			Sr-89	5.0 $\pm$ 0.0	10.0 $\pm$ 5.0	1.3-18.7
			Sr-90	3.0 $\pm$ 0.0	4.0 $\pm$ 1.5	1.4-6.6
			Co-60	24.7 $\pm$ 1.2	24.0 $\pm$ 5.0	15.3-32.7
			Cs-134	11.0 $\pm$ 2.0	12.0 $\pm$ 5.0	3.3-20.7
			Cs-137	9.3 $\pm$ 1.2	8.0 $\pm$ 5.0	0.0-20.4
STM-479	Milk	Nov 1986	Sr-89	7.7 $\pm$ 1.2	9.0 $\pm$ 5.0	0.3-17.7
			Sr-90	1.0 $\pm$ 0.0	0.0 $\pm$ 1.5	0.0-2.6
			I-131	52.3 $\pm$ 3.1	49.0 $\pm$ 6.0	38.6-59.4
			Cs-137	45.7 $\pm$ 3.1	39.0 $\pm$ 5.0	30.3-47.7
			K	1489 $\pm$ 104	1565 $\pm$ 78	1430-1700
STU-480	Urine	Nov 1986	H-3	5540 $\pm$ 26	5257 $\pm$ 912	4345-6169
STW-481	Water	Nov 1986	Gr. alpha	12.0 $\pm$ 4.0	20.0 $\pm$ 5.0	11.3-28.7
			Gr. beta	20.0 $\pm$ 3.5	20.0 $\pm$ 5.0	11.3-28.7
STW-482	Water	Dec 1986	Ra-226	6.7 $\pm$ 0.2	6.8 $\pm$ 1.0	5.0-8.6
			Ra-228	5.2 $\pm$ 0.2	11.1 $\pm$ 1.7	8.2-14.0
STW-483	Water	Jan 1987	Sr-89	19.7 $\pm$ 5.0	25.0 $\pm$ 5.0	16.3-33.7
			Sr-90	21.0 $\pm$ 2.0	25.0 $\pm$ 1.5	22.4-27.6

Table A-1. (continued)

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



Table A-1. (continued)

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

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L <sup>b</sup>			
				TIML Result ±2σ <sup>c</sup>	EPA Result <sup>d</sup>		
					1s, N=1	Control Limits	
STW-508	Water	Aug 1987	Pu-239	5.8±0.2	5.3±0.5	4.4-6.2	
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	Sep 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	Sep 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	Sep 1987	H-3	4473±100	4492±449	3714-5270	
STW-514	Water (Blind)	Oct 1987					
	Sample A	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		
	Sample B	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
Sample A		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-518	Water	Nov 1987	Gr. alpha	3.0±2.0	7.0±5.0	0.0-15.7	
			Gr. beta	15.7±2.3	19.0±5.0	10.3-27.7	
STW-519	Water	Dec 1987	I-131	26.0±3.0	25.0±6.0	15.6-36.4	



Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/Lb		
				TIML Result $\pm 2\sigma^c$	EPA Result <sup>d</sup>	
					1s, N=1	Control Limits
STW-520	Water	Dec 1987	Ra-226	5.1 $\pm$ 0.8	4.8 $\pm$ 0.7	3.6-6.0
			Ra-228	3.4 $\pm$ 0.1	5.3 $\pm$ 0.8	3.9-6.7
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	2.0 $\pm$ 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
			Zn-65	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 <sup>e</sup>	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
			Cs-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	TIML Result $\pm 2\sigma^c$	Concentration in pCi/L <sup>b</sup>	
					EPA Result <sup>d</sup>	Control Limits
					1s, N=1	
STW-533 534	Water (Blind)	Apr 1988				
	Sample A		Gr. alpha	ND <sup>f</sup>	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 $\pm$ 0.0	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	K-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	51.0 $\pm$ 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 <sup>f</sup>	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 <sup>b</sup>		
				TIML Result $\pm 2\sigma^c$	EPA Result <sup>d</sup>	
					1s, N=1	Control Limits
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	Cr. 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	16.3-33.7
			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 <sup>b</sup>		
				TIML Result $\pm 2\sigma^c$	EPA Result <sup>d</sup>	
					1s, N=1	Control Limits
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	24.4-27.6
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	146.8-209.2
			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
STW-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 <sup>b</sup>		
				TIML Result $\pm 2\sigma^c$	EPA Result <sup>d</sup>	
					1s, 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	11.3-28.7
			Cs-137	23.0 $\pm$ 2.0	20.0 $\pm$ 5.0	11.3-28.7
STW-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-5719	Water	May 1989	Sr-89	<0.7	6.0 $\pm$ 5.0	0.0-14.7
			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	30.6-51.4
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	6.0 $\pm$ 5.0	0.0-14.7
			Cs-137	10.3 $\pm$ 2.3	10.0 $\pm$ 5.0	1.3-18.7



Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/Lb		
				TIML Result $\pm 2\sigma^c$	EPA Result <sup>d</sup>	
					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	50.3-67.7
STW-584	Water	Oct 1989	H-3	3407 $\pm$ 150	3496 $\pm$ 364	2866-4126
STW-585 586	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 $\pm$ 6.0	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 $\pm$ 0.09	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 <sup>b</sup>		
				TIML Result $\pm 2\sigma^c$	EPA Result <sup>d</sup>	
					1s, N=1	Control Limits
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
STW-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 $\pm$ 0.8	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	11.6-32.4
			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 <sup>b</sup>		
				TIML Result $\pm 2\sigma^c$	EPA Result <sup>d</sup> 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	28.6-49.4
STW-607	Water	Aug 1990	Pu-239	10.0 $\pm$ 1.7	9.1 $\pm$ 0.9	7.5-10.7
STW-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
STM-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 $\pm$ 3.1	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	90.9-129.1
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	TIML Result $\pm 2\sigma^c$	Concentration in pCi/Lb	
					EPA Result <sup>d</sup>	Control Limits
					1s, N=1	
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-6179	Water	Nov 1990	U	35.0 $\pm$ 0.4	35.5 $\pm$ 3.6	29.3-41.7

<sup>a</sup> 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.

<sup>b</sup> All results are in the 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.

<sup>c</sup> Unless otherwise indicated, the TIML results are given as the mean  $\pm$  2 standard deviations for three determinations.

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

<sup>e</sup> NA = Not analyzed.

<sup>f</sup> ND = No data; not analyzed due to relocation of the lab.

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

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

Lab Code	TLD Type	Measurement	mR		
			Teledyne Result $\pm 2\sigma^a$	Known Value <sup>c</sup>	Average $\pm 2\sigma^d$ (All Participants)
<u>2nd International Intercomparison<sup>b</sup></u>					
115-2	CaF <sub>2</sub> :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<sup>e</sup></u>					
115-3	CaF <sub>2</sub> :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<sup>f</sup></u>					
115-4	CaF <sub>2</sub> :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 $\pm$ 13.2
<u>5th International Intercomparison<sup>g</sup></u>					
115-5A	CaF <sub>2</sub> :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
		Lab 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 Intercomparison<sup>h</sup></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 $\pm$ 22.2

Table A-2. (continued)

Lab Code	TLD Type	Measurement	mR		
			Teledyne Result $\pm 2\sigma^a$	Known Value <sup>c</sup>	Average $\pm 2\sigma^d$ (All Participants)
115-7B	CaF <sub>2</sub> :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 <sub>4</sub> :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 Intercomparison<sup>1</sup></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 <sub>2</sub> :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 <sub>4</sub> :Dy Cards	Field Site 1	32.3 $\pm$ 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<sup>j</sup></u>					
89-1	LiF-100 Chips	Lab	21.0 $\pm$ 0.4	22.4	--
89-2	Teledyne CaSO <sub>4</sub> :Dy Cards	Lab	20.9 $\pm$ 1.0	20.3	--

Table A-2. (continued)

Lab Code	TLD Type	Measurement	mR		
			Teledyne Result $\pm 2\sigma^a$	Known Value <sup>c</sup>	Average $\pm 2\sigma^d$ (All Participants)
<u>Teledyne Testing<sup>j</sup></u>					
90-1 <sup>k</sup>	Teledyne CaSO <sub>4</sub> :Dy Cards	Lab	20.6 $\pm$ 1.4	19.6	--
90-1 <sup>l</sup>	Teledyne CaSO <sub>4</sub> :Dy Cards	Lab	100.8 $\pm$ 4.3	100.0	--

<sup>a</sup> Lab result given is the mean  $\pm 2$  standard deviations of three determinations.

<sup>b</sup> 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.

<sup>c</sup> Value determined by sponsor of the intercomparison using continuously operated pressurized ion chamber.

<sup>d</sup> Mean  $\pm 2$  standard deviations of results obtained by all laboratories participating in the program.

<sup>e</sup> 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.

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

<sup>g</sup> 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.

<sup>h</sup> 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.

<sup>i</sup> 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.

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

<sup>k</sup> Cards were irradiated by Teledyne Isotopes, Inc., Westwood, NJ on June 19, 1990.

<sup>l</sup> Cards were irradiated by Dosimetry Associates, Inc., Northville, MI on October 30, 1990.

Table A-3. In-house spiked samples.

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L)		
				TIML Result n=3	Known Activity	Expected Precision 1s, n=38
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 <sup>b</sup>
			Cs-134	30.2±2.4	25.8±8.0	7.1 <sup>b</sup>
			Cs-137	21.9±1.9	19.9±5.0	7.1 <sup>b</sup>
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	Gr. alpha	15.8±1.8	18.0±5.0	5 <sup>c</sup>
QC-W-16	Water	Jun 1986	Gr. alpha	16.2±0.7	16.9±2.5	8.7
			Gr. beta	38.4±3.5	30.2±5.0	8.7
QC-MI-9	Milk	Jun 1986	Sr-89	<1.0	0.0	7.1 <sup>b</sup>
			Sr-90	12.6±1.8	13.3±3.0	4.2 <sup>b</sup>
			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	Jun 1986	Gr. alpha	16.8±1.8	18.0±5.0	5 <sup>c</sup>
SPW-3	Water	Jun 1986	Gr. alpha	17.7±0.8	18.0±5.0	5 <sup>c</sup>
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 <sup>b</sup>
			Sr-90	6.4±1.6	6.2±2.0	4.2 <sup>b</sup>



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

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L)		
				TIML Result n=3	Known Activity	Expected Precision 1s, n=3 <sup>a</sup>
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 <sup>b</sup>
QC-W-22	Water	Dec 1986	Gr. alpha	9.8±1.4	11.2±4.0	8.7
			Gr. 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
QC-MI-13	Milk	Jan 1987	Sr-89	10.4±2.1	12.2±4.0	8.7
			Sr-90	14.6±1.6	12.6±2.7	5.2
			I-131	49.5±1.2	54.9±5.0	10.4
			Cs-134	<1.6	0.0	8.7
			Cs-137	33.3±0.6	27.4±8.0	8.7
QC-W-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
QC-W-25	Water	Apr 1987	I-131	28.0±1.9	29.3±5.0	10.6
QC-MI-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
QC-W-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	1.0	0.0	8.7
			Cs-137	21.2±0.5	21.6±7.0	8.7
QC-W-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
QC-W-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 (pCi/L)		
				TIML Result n=3	Known Activity	Expected Precision 1s, n=3 <sup>a</sup>
QC-W-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
QC-MI-15	Milk	Jul 1987	Sr-90	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
QC-W-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
QC-W-31	Water	Oct 1987	H-3	2053±939	2059±306	520
QC-W-32	Water	Dec 1987	Gr. alpha	9.6±1.0	10.1±5.0	8.7
			Gr. beta	15.2±0.1	13.1±3.0	8.7
QC-W-33	Water	Dec 1987	Gr. alpha	7.7±1.4	10.1±5.0	8.7
			Gr. beta	10.9±1.0	7.9±3.0	8.7
QC-W-34	Water	Dec 1987	Gr. alpha	4.0±0.9	5.1±3.0	8.7
			Gr. beta	9.4±0.9	7.9±3.0	8.7
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	Feb 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

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

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L)		
				TIML Result n=3	Known Activity	Expected Precision 1s, n=38
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±31	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
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

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

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L)		
				TIML Result n=3	Known Activity	Expected Precision 1s, n=3 <sup>a</sup>
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-M1-22	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-M1-23	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-M1-24	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
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-M1-25	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

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

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L)		
				TIML Result n=3	Known Activity	Expected Precision 1s, n=3 <sup>a</sup>
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 <sup>d</sup>	11.1±1.0 <sup>d</sup>	8.7
			Sr-90	10.4±1.0 <sup>d</sup>	10.3±1.0 <sup>d</sup>	5.2
QC-W-59	Water	Nov 1989	Sr-89	101.0±6.0 <sup>d</sup>	104.1±10.5 <sup>d</sup>	17.5
			Sr-90	98.0±3.0 <sup>d</sup>	95.0±10.0 <sup>d</sup>	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
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

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

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L)		
				TIML Result n=3	Known Activity	Expected Precision 1s, n=3 <sup>a</sup>
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

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

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

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



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

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L)	
				Results (4.66 $\sigma$ )	Acceptance Criteria (4.66 $\sigma$ )
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	<2.2	<10
			Cs-137	<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 $\pm$ 0.6 <sup>a</sup>	<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	<300
SPS-4628	Milk	Aug 1987	Sr-89	<0.6	<5
			Sr-90	2.4 $\pm$ 0.6 <sup>a</sup>	<1

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

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L)	
				Results (4.66 $\sigma$ )	Acceptance Criteria (4.66 $\sigma$ )
SPS-4847	Milk	Sep 1987	Cs-134	<4.4	<10
			Cs-137	<5.3	<10
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
SPW-4859	D.I. Water	Oct 1987	Ra-228	<1.0	<2
			Fe-55	<0.5	<1
SPS-5348	Milk	Dec 1987	Cs-134	<2.3	<10
			Cs-137	<2.5	<10
SPW-5384	D.I. 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	D.I. Water	Nov 1987	Gross alpha	<0.4	<1
			Gross 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

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

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L)	
				Results (4.66 $\sigma$ )	Acceptance Criteria (4.66 $\sigma$ )
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 $\sigma$	<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-242	<0.01	<1
			Pu-238	<0.08	<1
SPS-6090	Milk	Jul 1988	Pu-240	<0.02	<1
			Sr-89	<0.5	<1
			Sr-90	1.8 $\pm$ 0.5	<1
			I-131	<0.4	<1
SPW-6209	Water	Jul 1988	Cs-137	<0.4	<10
			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
SPW-6625	Water	Dec 1988	Gross alpha	<0.7	<1
			Gross beta	<1.9	<4

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

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L)	
				Results (4.66 $\sigma$ )	Acceptance Criteria (4.66 $\sigma$ )
SPS-6723	Milk	Jan 1989	Sr-89	<0.6	<5
			Sr-90	1.9 $\pm$ 0.5 <sup>a</sup>	<1
			I-131	<0.2	<1
			Cs-134	<4.3	<10
			Cs-137	<4.4	<10
SPW-6877	Water	Mar 1989	Sr-89	<0.4	<5
			Sr-90	<0.6	<1
SPS-6963	Milk	Apr 1989	I-131	<0.3	<1
			Cs-134	<5.9	<10
			Cs-137	<6.2	<10
SPW-7561	Water	Apr 1989	H-3	<150	<300
SPW-7207	Water	Jun 1989	Ra-226	<0.2	<1
			Ra-228	<0.6	<1
SPS-7208	Milk	Jun 1989	Sr-89	<0.6	<5
			Sr-90	2.1 $\pm$ 0.5 <sup>a</sup>	<1
			I-131	<0.3	<1
			Cs-134	<6.4	<10
			Cs-137	<7.2	<10
SPW-7558	Water	Jun 1989	Gross alpha	<0.2	<1
			Gross beta	<1.0	<4
SPS-7322	Milk	Aug 1989	Sr-89	<1.4	<5
			Sr-90	4.8 $\pm$ 1.0 <sup>a</sup>	<1
			I-131	<0.2	<1
			Cs-134	<6.9	<10
			Cs-137	<8.2	<10
SPW-7559	Water	Sep 1989	Sr-89	<2.0	<5
			Sr-90	<0.7	<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 $\sigma$ )	Acceptance Criteria (4.66 $\sigma$ )
SPS-7605	Milk	Nov 1989	I-131	<0.2	<1
			Cs-134	<8.6	<10
			Cs-137	<10	<10
SPW-7971	Water	Dec 1989	Gross alpha	<0.4	<1
			Gross 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 <sup>a</sup>	<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 <sup>a</sup>	<1
SPW-8312A	Water	Feb 1990	Sr-89	<0.6	<5
			Sr-90	<0.7	<1
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 <sup>a</sup>	<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 $\sigma$ )	Acceptance Criteria (4.66 $\sigma$ )
SPW-8926	Water	Aug 1990	Gross alpha Gross beta	<0.3 <0.7	<1 <4
SPW-8927	Water	Aug 1990	U-234 U-235 U-238	<0.01 <0.02 <0.01	<1 <1 <1
SPW-8928	Water	Aug 1990	Mn-54 Co-58 Co-60 Cs-134 Cs-137	<4.0 <4.1 <2.4 <3.3 <3.7	<5 <5 <5 <5 <5
SPW-8929	Water	Aug 1990	Sr-89 Sr-89	<1.4 <0.6	<5 <1
SPW-69	Water	Sep 1990	Sr-89 Sr-90	<1.8 <0.8	<5 <1
SPW-106	Water	Oct 1990	H-3	<180	<300
SPM-107	Milk	Oct 1990	I-131 Cs-134 Cs-137	<0.4 <3.3 <4.3	<1 <5 <5
SPW-370	Water	Oct 1990	Mn-54 Co-58 Co-60 Cs-134 Cs-137	<1.7 <2.6 <1.6 <1.7 <1.8	<5 <5 <5 <5 <5
SPW-372	Water	Dec 1990	Gross alpha Gross beta	<0.3 <0.8	<1 <4

<sup>a</sup> 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<sup>a</sup>

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
Strontium-89 <sup>b</sup>	5 to 50 pCi/liter or kg >50 pCi/liter or kg	5 pCi/liter 10% of known value
Strontium-90 <sup>b</sup>	2 to 30 pCi/liter or kg >30 pCi/liter of 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) <sup>-0.933</sup> 10% of known value
Radium-226, Radium-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 <sup>b</sup>	<55 pCi/liter >55 pCi/liter	6 pCi/liter 10% of known value
Uranium-238, Nickel-63 <sup>b</sup> , Technetium-99 <sup>b</sup>	<35 pCi/liter >35 pCi/liter	6 pCi/liter 15% of known value
Iron-55 <sup>b</sup>	50 to 100 pCi/liter >100 pCi/liter	10 pCi/liter 10% of known value

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

<sup>b</sup> 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 Comparison Program starting January 1987.

Lab Code	Analysis	TIML Result (pCi/L) <sup>a</sup>	EPA Control Limit (pCi/L) <sup>a</sup>	Explanation
STM-504	Sr-89 Sr-90	57.0±4.3 32.0±1.0	60.3-77.7 32.4-37.6	Milk had high fat content which made analyses difficult. Addition of errors to TIML result would put values within EPA control limits. EPA also had the same problem in analyzing its own sample.
STW-511	Ra-228	8.1±1.4	4.6-8.0	TIML results are usually within EPA control limits. Analysis of the next sample was within EPA control limits. No further action is planned.
STW-516	Cr-51	80.3±17.5	61.3-78.7	Results in the past have been within EPA control limits and TIML will monitor the situation in the future.
STF-524	K	1010.7±158.5 <sup>b</sup>	1123.5-1336.5 <sup>b</sup>	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.
STW-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.

<sup>a</sup> Reported in pCi/L unless otherwise noted.

<sup>b</sup> Concentrations are reported in mg/kg.

ADDENDUM TO APPENDIX A (continued)

Lab Code	Analysis	TIML Result (pCi/L) <sup>a</sup>	EPA Control Limit (pCi/L) <sup>a</sup>	Explanation
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 53.2±3.6 and 50.9±2.4 pCi/L.
STM-554	Sr-90	51.0±2.0	54.8-65.2	The cause of low result was due to very high fat content in the milk. It should be 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 it is suspected that the standard was not properly calibrated by supplier and is under investigation. New Pu-236 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 crosscheck results were within the control limits. No further action is planned.
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.

<sup>a</sup> Reported in pCi/L unless otherwise noted.

ADDENDUM TO APPENDIX A (continued)

Lab Code	Analysis	TIML Result (pCi/L) <sup>a</sup>	EPA Control Limit (pCi/L) <sup>a</sup>	Explanation
STW-589	Sr-90	17.3±1.2	17.4-22.6	Sample was reanalyzed in triplicate; results of reanalyses 18.8±1.5 pCi/L. No further action is planned.
STM-599	K	1300.0±69.2 <sup>c</sup>	1414.7-1685.3 <sup>c</sup>	Sample was reanalyzed in triplicate. Results of reanalyses, 1421.7±95.3 mg/L. The cause of low results is unknown.
STW-601	Gross Alpha	11.0±2.0	11.6-32.4	Sample was reanalyzed in triplicate. Results of reanalyses, 13.4±1.0 pCi/L.

<sup>a</sup> Reported in pCi/L unless otherwise noted.

<sup>c</sup> Concentrations are reported in mg/L.

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;

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

In cases where the activity is found to be below the lower limit of detection  $L$  it is reported as

$$<L$$

where  $L$  = is the lower limit of detection based on 4.66 $\sigma$  uncertainty for a background sample.

### 3.0. Duplicate Analyses

3.1. Individual results:  $x_1 \pm s_1$   
 $x_2 \pm s_2$

Reported result:  $x \pm s$

where  $x = (1/2) (x_1 + x_2)$

$$s = (1/2) \sqrt{s_1^2 + s_2^2}$$

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  $x_1, x_2, \dots, x_n$  are defined as follows:

$$\bar{x} = \frac{1}{n} \sum x$$

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

- 4.2 Values below the highest lower limit of detection are not included in the average.
- 4.3 If all of the 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 is 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 greater than 5, the figure is dropped, and the last retained figure is raised by 1. As an example, 11.446 is rounded off to 11.45.
- 4.5.3. If the figure following those to be retained is 5, and if there are no figures other than zeros beyond the five, the figure 5 is dropped, and the last-place figure retained is increased by one if it is an odd number or it is kept unchanged if an even number. As an example, 11.435 is rounded off to 11.44, while 11.425 is rounded off to 11.42.

Appendix C  
Sampling Program and Locations

Table C-1. Sample collection and analysis program

Sample Type	Locations		Collection Type (and Frequency) <sup>b</sup>	Analysis (and Frequency) <sup>b</sup>
	No.	Codes (and Type) <sup>a</sup>		
Airborne Filters	6	E-1-4,8,20	Weekly	GB,GS on QC for each location
Airborne Iodine	6	E-1-4,8,20	Weekly	I-131
Ambient Radiation (TLDs)	22	E-1,2,3,4,12,14,15 E-5,6,7,8,9,16,17,18, 20,22,23,24,25,26,27	Quarterly	Ambient gamma
Lake Water	5	E-1,5,6,9,12	Monthly	GB, GS, I-131 on MC H-3, Sr-89-90 on QC
Well Water	1	E-10	Quarterly	GB, GS, H-3, Sr-89-90, I-131
Vegetation	8	E-1,2,3,4,6,8,9,20	3x/year as available	GB,GS
Shoreline Silt	5	E-1,5,6,9,12	2x/year	GB,GS
Soil	8	E-1,2,3,4,6,8,9,20	2x/year	GB,GS
Milk	3	E-11,19,21	Monthly	GS,I-131,Sr-89-90
Algae	2	E-5,12	3x/year as available	GB,GS
Fish	1	E-13	3x/year as available	GB,GS (In edible portions)

Table C-1. Continued.

Sample Type	Locations		Collection Type (and Frequency) <sup>b</sup>	Analysis (and Frequency) <sup>b</sup>
	No.	Codes (and Type) <sup>a</sup>		
SPECIAL COLLECTIONS AND ANALYSES				
Airborne Filters			4 per month	Sr-89, Sr-90
			1 per quarter	Sr-89, Sr-90 (comp.)
Liquid			1 per month	GA, Sr-89, Sr-90
Subsoil Water			4 per quarter	GA, GB, H-3, GS
Miscellaneous Water Samples			4-5 per year	Sr-89, Sr-90

<sup>a</sup> Locations codes are defined in Table 2. Control Stations are indicated by (C) all other stations are indicators.

<sup>b</sup> Analysis type is coded as follows: CB = gross beta, GA = gross alpha, GS = gamma spectroscopy, H-3 = tritium, Sr-89 = strontium-89, Sr-90 = strontium-90, I-131 = iodine-131. Analysis frequency is coded as follows: MC = monthly composite, QC = quarterly composite.