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FINAL
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, 1991

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1.0 INTRODUCTION

The following constitutes the final 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
Surface Water	E-06	January	Lake frozen; sample not collected.

NOTE: Page 3 is intentionally left out.

AIRBORNE IODINE-131^a AND GROSS BETA

IN AIR PARTICULATE FILTERS

E-01 Meteorological Tower

Date Collected	Volume (m ³)	Gross Beta (pCi/m ³)	I-131 (pCi/m ³)	Date Collected	Volume (m ³)	Gross Beta (pCi/m ³)	I-131 (pCi/m ³)
01-07-91	268	0.030±0.004	<0.020	07-08-91	303	0.020±0.003	<0.015
01-14-91	416	0.038±0.003	<0.014	07-15-91	301	0.018±0.003	<0.008
01-21-91	303	0.046±0.004	<0.018	07-22-91	305	0.038±0.004	<0.017
01-28-91	360	0.027±0.003	<0.017	07-30-91	347	0.021±0.002	<0.015
02-04-91	376	0.034±0.003	<0.019	08-05-91	265	0.015±0.003	<0.021
02-11-91	371	0.029±0.003	<0.014	08-12-91	313	0.021±0.003	<0.015
02-18-91	377	0.017±0.003	<0.012	08-19-91	309	0.027±0.004	<0.017
02-25-91	372	0.022±0.003	<0.015	08-26-91	311	0.019±0.002	<0.010
03-04-91	364	0.025±0.003	<0.012	09-03-91	369	0.027±0.003	<0.015
03-11-91	345	0.030±0.003	<0.020	09-09-91	269	0.029±0.004	<0.028
03-18-91	350	0.012±0.002	<0.015	09-16-91	326	0.017±0.003	<0.016
03-25-91	333	0.020±0.003	<0.017	09-23-91	321	0.012±0.002	<0.020
04-02-91	387	0.018±0.003	<0.013	09-30-91	337	0.017±0.002	<0.011
1st Qtr. mean ± s.d.		0.027±0.009	<0.020	3rd Qtr. mean ± s.d.		0.022±0.007	<0.021
04-09-91	317	0.018±0.002	<0.026	10-07-91	344	0.021±0.003	<0.012
04-16-91	325	0.014±0.003	<0.016	10-14-91	341	0.019±0.003	<0.015
04-22-91	273	0.016±0.003	<0.024	10-21-91	353	0.016±0.003	<0.011
04-29-91	322	0.011±0.003	<0.021	10-28-91	354	0.019±0.002	<0.013
05-06-91	317	0.008±0.002	<0.018	11-04-91	357	0.022±0.003	<0.012
05-13-91	320	0.013±0.003	<0.013	11-11-91	358	0.024±0.003	<0.016
05-20-91	323	0.021±0.003	<0.016	11-18-91	365	0.040±0.003	<0.015
05-28-91	365	0.012±0.002	<0.015	11-25-91	353	0.021±0.003	<0.027
06-03-91	277	0.013±0.003	<0.026	12-03-91	379	0.029±0.003	<0.016
06-10-91	313	0.012±0.002	<0.020	12-09-91	275	0.033±0.004	<0.020
06-17-91	299	0.021±0.003	<0.018	12-16-91	353	0.035±0.004	<0.015
06-24-91	304	0.024±0.003	<0.015	12-23-91	354	0.035±0.004	<0.022
07-01-91	306	0.027±0.003	<0.017	12-30-91	353	0.040±0.004	<0.014
2nd Qtr. mean ± s.d.		0.016±0.006	<0.026	4th Qtr. mean ± s.d.		0.027±0.008	<0.027

AIRBORNE IODINE-131^a AND GROSS BETA
IN AIR PARTICULATE FILTERS

E-02 Site Boundary Control Center

Date Collected	Volume (m ³)	Gross Beta (pCi/m ³)	I-131 (pCi/m ³)	Date Collected	Volume (m ³)	Gross Beta (pCi/m ³)	I-131 (pCi/m ³)
01-07-91	219	0.026±0.004	<0.028	07-08-91	260	0.022±0.004	<0.014
01-14-91	348	0.027±0.003	<0.020	07-15-91	258	0.021±0.004	<0.021
01-21-91	252	0.034±0.004	<0.029	07-22-91	262	0.036±0.004	<0.017
01-28-91	291	0.024±0.004	<0.016	07-30-91	280	0.013±0.003	<0.018
02-04-91	296	0.028±0.004	<0.017	08-05-91	219	0.022±0.004	<0.021
02-11-91	290	0.023±0.003	<0.026	08-12-91	260	0.021±0.004	<0.016
02-18-91	296	0.016±0.003	<0.026	08-19-91	252	0.026±0.004	<0.028
02-25-91	292	0.019±0.003	<0.024	08-26-91	250	0.014±0.002	<0.021
03-04-91	294	0.023±0.003	<0.017	09-03-91	291	0.028±0.004	<0.017
03-11-91	291	0.027±0.004	<0.023	09-09-91	210	0.024±0.004	<0.028
03-18-91	305	0.011±0.003	<0.026	09-16-91	253	0.018±0.004	<0.022
03-25-91	290	0.017±0.004	<0.024	09-23-91	250	0.012±0.002	<0.022
04-02-91	337	0.016±0.003	<0.028	09-30-91	250	0.011±0.002	<0.018
1st Qtr. mean ± s.d.		0.022±0.006	<0.028	3rd Qtr. mean ± s.d.		0.021±0.007	<0.028
04-10-91	322	0.022±0.002	<0.021	10-07-91	252	0.018±0.003	<0.022
04-16-91	246	0.016±0.003	<0.026	10-14-91	291	0.018±0.003	<0.017
04-22-91	248	0.012±0.003	<0.022	10-21-91	290	0.021±0.003	<0.016
04-29-91	295	0.014±0.003	<0.026	10-28-91	294	0.022±0.002	<0.018
05-06-91	291	0.010±0.003	<0.019	11-04-91	296	0.019±0.003	<0.017
05-13-91	293	0.012±0.003	<0.018	11-11-91	289	0.023±0.003	<0.017
05-20-91	263	0.014±0.003	<0.018	11-18-91	281	0.046±0.004	<0.028
05-28-91	346	0.012±0.003	<0.016	11-25-91	281	0.018±0.003	<0.025
06-03-91	254	0.013±0.004	<0.018	12-03-91	314	0.032±0.004	<0.014
06-10-91	256	0.014±0.002	<0.020	12-09-91	218	0.037±0.005	<0.023
06-17-91	252	0.026±0.004	<0.021	12-16-91	268	0.040±0.004	<0.025
06-24-91	277	0.026±0.004	<0.017	12-23-91	269	0.041±0.005	<0.025
07-01-91	268	0.029±0.004	<0.020	12-30-91	268	0.040±0.004	<0.020
2nd Qtr. mean ± s.d.		0.017±0.006	<0.026	4th Qtr. mean ± s.d.		0.029±0.011	<0.028

AIRBORNE IODINE-131^a AND GROSS BETA
IN AIR PARTICULATE FILTERS

E-03 West Boundary

Date Collected	Volume (m ³)	Gross Beta (pCi/m ³)	I-131 (pCi/m ³)	Date Collected	Volume (m ³)	Gross Beta (pCi/m ³)	I-131 (pCi/m ³)
01-07-91	205	0.025±0.004	<0.029	07-08-91	258	0.024±0.004	<0.018
01-14-91	322	0.028±0.003	<0.026	07-15-91	264	0.020±0.004	<0.018
01-21-91	236	0.037±0.005	<0.028	07-22-91	263	0.039±0.004	<0.016
01-28-91	286	0.025±0.004	<0.018	07-30-91	302	0.012±0.003	<0.019
02-04-91	272	0.021±0.004	<0.023	08-05-91	222	0.022±0.004	<0.026
02-11-91	270	0.026±0.004	<0.023	08-12-91	264	0.021±0.004	<0.026
02-18-91	281	0.013±0.003	<0.018	08-19-91	264	0.030±0.004	<0.016
02-25-91	264	0.021±0.003	<0.014	08-26-91	262	0.016±0.002	<0.018
03-04-91	273	0.020±0.003	<0.017	09-03-91	305	0.031±0.004	<0.019
03-11-91	270	0.023±0.004	<0.026	09-09-91	220	0.028±0.004	<0.030
03-18-91	274	0.013±0.003	<0.018	09-16-91	265	0.017±0.004	<0.025
03-25-91	270	0.014±0.004	<0.018	09-23-91	263	0.012±0.002	<0.026
04-02-91	312	0.017±0.003	<0.023	09-30-91	262	0.011±0.002	<0.017
1st Qtr. mean ± s.d.		0.022±0.007	<0.029	3rd Qtr. mean ± s.d.		0.022±0.008	<0.030
04-10-91	306	0.019±0.002	<0.024	10-07-91	264	0.020±0.003	<0.018
04-16-91	239	0.016±0.004	<0.024	10-14-91	261	0.024±0.004	<0.018
04-22-91	232	0.014±0.004	<0.025	10-21-91	263	0.019±0.003	<0.017
04-29-91	273	0.012±0.003	<0.025	10-28-91	264	0.022±0.003	<0.021
05-06-91	270	0.010±0.003	<0.022	11-04-91	266	0.018±0.003	<0.018
05-13-91	272	0.014±0.003	<0.017	11-11-91	260	0.022±0.004	<0.025
05-20-91	273	0.017±0.003	<0.014	11-18-91	264	0.037±0.004	<0.021
05-28-91	300	0.014±0.003	<0.014	11-25-91	264	0.030±0.004	<0.018
06-03-91	229	0.012±0.004	<0.025	12-03-91	304	0.033±0.004	<0.021
06-10-91	267	0.013±0.002	<0.021	12-09-91	221	0.037±0.005	<0.020
06-17-91	259	0.025±0.004	<0.021	12-16-91	264	0.042±0.004	<0.025
06-24-91	262	0.019±0.004	<0.016	12-23-91	264	0.046±0.005	<0.020
07-01-91	260	0.028±0.004	<0.021	12-30-91	263	0.046±0.005	<0.016
2nd Qtr. mean ± s.d.		0.016±0.005	<0.025	4th Qtr. mean ± s.d.		0.030±0.010	<0.025

AIRBORNE IODINE-131^a AND GROSS BETA
IN AIR PARTICULATE FILTERS

E-04 North Boundary

Date Collected	Volume (m ³)	Gross Beta (pCi/m ³)	I-131 (pCi/m ³)	Date Collected	Volume (m ³)	Gross Beta (pCi/m ³)	I-131 (pCi/m ³)
01-07-91	208	0.031±0.005	<0.023	07-08-91	289	0.020±0.003	<0.013
01-14-91	336	0.032±0.003	<0.019	07-15-91	287	0.020±0.004	<0.013
01-21-91	251	0.040±0.004	<0.022	07-22-91	288	0.036±0.004	<0.019
01-28-91	293	0.027±0.004	<0.017	07-30-91	330	0.011±0.002	<0.015
02-04-91	294	0.027±0.004	<0.024	08-05-91	251	0.021±0.004	<0.017
02-11-91	290	0.025±0.003	<0.017	08-12-91	297	0.018±0.003	<0.020
02-18-91	302	0.017±0.003	<0.025	08-19-91	288	0.028±0.004	<0.025
02-25-91	286	0.024±0.003	<0.028	08-26-91	286	0.018±0.002	<0.016
03-04-91	294	0.026±0.003	<0.016	09-03-91	334	0.029±0.003	<0.015
03-11-91	291	0.027±0.004	<0.017	09-09-91	240	0.027±0.004	<0.029
03-18-91	296	0.012±0.003	<0.027	09-16-91	300	0.017±0.003	<0.013
03-25-91	290	0.014±0.003	<0.024	09-23-91	306	0.011±0.002	<0.017
04-02-91	338	0.017±0.003	<0.026	09-30-91	295	0.018±0.002	<0.013
1st Qtr. mean ± s.d.		0.024±0.008	<0.028	3rd Qtr. mean ± s.d.		0.021±0.007	<0.029
04-10-91	313	0.017±0.002	<0.018	10-07-91	289	0.021±0.003	<0.015
04-16-91	258	0.014±0.003	<0.030	10-14-91	285	0.023±0.003	<0.018
04-22-91	250	0.011±0.003	<0.018	10-21-91	293	0.024±0.003	<0.016
04-29-91	284	0.016±0.003	<0.026	10-28-91	241	0.020±0.003	<0.028
05-06-91	292	0.007±0.002	<0.019	11-04-91	296	0.020±0.003	<0.016
05-13-91	292	0.010±0.003	<0.022	11-11-91	289	0.023±0.003	<0.019
05-20-91	294	0.013±0.003	<0.018	11-18-91	295	0.037±0.004	<0.028
05-28-91	317	0.010±0.003	<0.015	11-25-91	293	0.030±0.004	<0.019
06-03-91	234	0.008±0.004	<0.024	12-03-91	339	0.031±0.004	<0.019
06-10-91	254	0.012±0.002	<0.022	12-09-91	246	0.034±0.004	<0.021
06-17-91	255	0.024±0.004	<0.019	12-16-91	292	0.041±0.004	<0.021
06-24-91	285	0.018±0.003	<0.018	12-23-91	294	0.040±0.004	<0.020
07-01-91	286	0.027±0.004	<0.018	12-30-91	293	0.041±0.004	<0.018
2nd Qtr. mean ± s.d.		0.014±0.006	<0.030	4th Qtr. mean ± s.d.		0.030±0.008	<0.028

AIRBORNE IODINE-131^a AND GROSS BETA
IN AIR PARTICULATE FILTERS

E-08 G. J. Francar Residence

Date Collected	Volume (m ³)	Gross Beta (pCi/m ³)	I-131 (pCi/m ³)	Date Collected	Volume (m ³)	Gross Beta (pCi/m ³)	I-131 (pCi/m ³)
01-07-91	209	0.032±0.005	<0.028	07-08-91	283	0.021±0.003	<0.015
01-14-91	336	0.035±0.004	<0.017	07-15-91	278	0.018±0.004	<0.016
01-21-91	251	0.042±0.005	<0.028	07-22-91	284	0.034±0.004	<0.018
01-28-91	291	0.030±0.004	<0.022	07-30-91	323	0.011±0.002	<0.014
02-04-91	297	0.031±0.004	<0.018	08-05-91	237	0.022±0.004	<0.018
02-11-91	289	0.028±0.004	<0.020	08-12-91	243	0.019±0.004	<0.017
02-18-91	300	0.017±0.003	<0.018	08-19-91	280	0.027±0.004	<0.022
02-25-91	288	0.026±0.003	<0.021	08-26-91	280	0.016±0.002	<0.022
03-04-91	294	0.024±0.003	<0.016	09-03-91	327	0.032±0.004	<0.020
03-11-91	290	0.025±0.004	<0.025	09-09-91	239	0.025±0.004	<0.026
03-18-91	296	0.013±0.003	<0.017	09-16-91	335	0.012±0.003	<0.018
03-25-91	291	0.015±0.003	<0.018	09-24-91	265	0.013±0.002	<0.020
04-02-91	338	0.017±0.003	<0.024	09-30-91	240	0.018±0.003	<0.015
1st Qtr. mean ± s.d.		0.026±0.008	<0.028	3rd Qtr. mean ± s.d.		0.021±0.007	<0.026
04-10-91	318	0.020±0.002	<0.016	10-07-91	284	0.020±0.003	<0.017
04-16-91	249	0.014±0.003	<0.018	10-14-91	280	0.019±0.003	<0.020
04-22-91	242	0.014±0.004	<0.022	10-21-91	279	0.019±0.003	<0.012
04-29-91	294	0.015±0.003	<0.027	10-28-91	283	0.020±0.002	<0.017
05-06-91	291	0.008±0.002	<0.018	11-04-91	285	0.018±0.003	<0.016
05-13-91	291	0.012±0.003	<0.023	11-11-91	278	0.021±0.003	<0.020
05-20-91	299	0.016±0.003	<0.012	11-18-91	282	0.031±0.004	<0.026
05-28-91	318	0.010±0.003	<0.015	11-25-91	281	0.028±0.004	<0.015
06-03-91	248	0.010±0.004	<0.028	12-03-91	327	0.029±0.004	<0.018
06-10-91	286	0.012±0.002	<0.020	12-09-91	239	0.029±0.004	<0.023
06-17-91	283	0.022±0.003	<0.017	12-16-91	282	0.034±0.004	<0.025
06-24-91	278	0.025±0.004	<0.018	12-23-91	284	0.037±0.004	<0.024
07-01-91	280	0.032±0.004	<0.018	12-30-91	275	0.041±0.004	<0.019
2nd Qtr. mean ± s.d.		0.016±0.007	<0.028	4th Qtr. mean ± s.d.		0.027±0.008	<0.026

AIRBORNE IODINE-131^a AND GROSS BETA
IN AIR PARTICULATE FILTERS

E-20 Silver Lake

Date Collected	Volume (m ³)	Gross Beta (pCi/m ³)	I-131 (pCi/m ³)	Date Collected	Volume (m ³)	Gross Beta (pCi/m ³)	I-131 (pCi/m ³)		
01-07-91	229	0.035±0.004	<0.028	07-08-91	289	0.020±0.003	<0.013		
01-14-91	359	0.040±0.004	<0.013	07-15-91	292	0.020±0.004	<0.013		
01-21-91	266	0.043±0.004	<0.021	07-22-91	298	0.032±0.004	<0.014		
01-28-91	320	0.035±0.004	<0.020	07-30-91	333	0.012±0.002	<0.017		
02-04-91	314	0.035±0.004	<0.019	08-05-91	248	0.022±0.004	<0.015		
02-11-91	301	0.032±0.004	<0.026	08-12-91	296	0.017±0.003	<0.017		
02-18-91	304	0.021±0.003	<0.022	08-19-91	291	0.027±0.004	<0.014		
02-25-91	299	0.028±0.003	<0.020	08-26-91	293	0.019±0.002	<0.021		
03-04-91	364	0.025±0.003	<0.018	09-03-91	340	0.028±0.003	<0.019		
03-11-91	298	0.027±0.004	<0.022	09-09-91	265	0.029±0.004	<0.022		
03-18-91	306	0.013±0.003	<0.016	09-16-91	346	0.016±0.003	<0.014		
03-25-91	300	0.014±0.003	<0.025	09-23-91	346	0.012±0.002	<0.015		
04-02-91	347	0.016±0.003	<0.025	09-30-91	337	0.012±0.002	<0.011		
1st Qtr. mean ± s.d.				0.028±0.010	<0.028	3rd Qtr. mean ± s.d.		0.020±0.007	<0.022
04-09-91	288	0.014±0.002	<0.020	10-07-91	344	0.015±0.003	<0.017		
04-16-91	286	0.016±0.003	<0.025	10-14-91	343	0.020±0.003	<0.016		
04-22-91	251	0.014±0.003	<0.029	10-21-91	341	0.026±0.003	<0.015		
04-29-91	302	0.018±0.003	<0.026	10-28-91	342	0.020±0.002	<0.013		
05-06-91	302	0.008±0.002	<0.014	11-04-91	346	0.020±0.003	<0.017		
05-13-91	299	0.017±0.003	<0.013	11-11-91	338	0.026±0.003	<0.017		
05-20-91	302	0.019±0.003	<0.010	11-18-91	343	0.034±0.003	<0.024		
05-28-91	345	0.012±0.003	<0.012	11-25-91	345	0.024±0.003	<0.020		
06-03-91	264	0.014±0.004	<0.021	12-03-91	383	0.032±0.003	<0.012		
06-10-91	289	0.011±0.002	<0.021	12-09-91	266	0.036±0.004	<0.024		
06-17-91	292	0.025±0.003	<0.016	12-16-91	324	0.040±0.004	<0.018		
06-24-91	289	0.030±0.004	<0.020	12-23-91	324	0.042±0.004	<0.023		
07-01-91	289	0.028±0.004	<0.017	12-30-91	322	0.046±0.004	<0.015		
2nd Qtr. mean ± s.d.				0.017±0.007	<0.029	4th Qtr. mean ± s.d.		0.029±0.010	<0.024

GAMMA EMITTERS IN QUARTERLY COMPOSITES OF
AIR PARTICULATE FILTERS

Location	Lab Code	Concentration (pCi/m ³)			
		Be-7	Cs-134	Cs-137	Other ^a
<u>1st Quarter, 1991</u>					
E-01	EAP-2563	0.059±0.008	<0.0006	<0.0007	<0.0007
E-02	EAP-2564	0.056±0.008	<0.0006	<0.0007	<0.0009
E-03	EAP-2565	0.051±0.010	<0.0004	<0.0009	<0.0006
E-04	EAP-2566	0.061±0.011	<0.0009	<0.0011	<0.0013
E-08	EAP-2567	0.072±0.010	<0.0014	<0.0014	<0.0010
E-20	EAP-2568	0.065±0.012	<0.0007	<0.0007	<0.0011
<u>2nd Quarter, 1991</u>					
E-01	EAP-2655	0.058±0.014	<0.0009	<0.0011	<0.0011
E-02	EAP-2656	0.063±0.018	<0.0009	<0.0010	<0.0013
E-03	EAP-2657	0.068±0.019	<0.0010	<0.0010	<0.0015
E-04	EAP-2658	0.069±0.018	<0.0009	<0.0011	<0.0014
E-08	EAP-2659	0.064±0.013	<0.0006	<0.0005	<0.0004
E-20	EAP-2660	0.065±0.015	<0.0010	<0.0013	<0.0010
<u>3rd Quarter, 1991</u>					
E-01	EAP-2778	0.052±0.008	<0.0010	<0.0011	<0.0010
E-02	EAP-2779	0.055±0.011	<0.0013	<0.0015	<0.0013
E-03	EAP-2780	0.071±0.015	<0.0010	<0.0015	<0.0007
E-04	EAP-2781	0.053±0.010	<0.0010	<0.0012	<0.0011
E-08	EAP-2782	0.057±0.009	<0.0006	<0.0006	<0.0008
E-20	EAP-2783	0.060±0.011	<0.0007	<0.0011	<0.0009
<u>4th Quarter, 1991</u>					
E-01	EAP-2878	0.039±0.012	<0.0009	<0.0014	<0.0012
E-02	EAP-2879	0.038±0.014	<0.0012	<0.0013	<0.0015
E-03	EAP-2880	0.038±0.009	<0.0008	<0.0010	<0.0008
E-04	EAP-2881	0.053±0.013	<0.0009	<0.0015	<0.0015
E-08	EAP-2882	0.042±0.008	<0.0008	<0.0010	<0.0008
E-20	EAP-2883	0.051±0.014	<0.0007	<0.0012	<0.0018

^a See Introduction.

RADIOACTIVITY IN MILK SAMPLES

(Monthly Collection)

Sample Description and Concentration (pCi/L)						
<u>E-11 Funk Dairy Farm</u>						
Collection Date	01-09-91	02-13-91	03-06-91	04-03-91	05-08-91	06-05-91
Lab Code	EMI-5791	EMI-5895	EMI-5950	EMI-6001	EMI-6129	EMI-6273
Sr-89	<0.4	<0.4	<0.4	<0.5	<0.5	<0.5
Sr-90	0.9±0.3	1.7±0.4	1.8±0.4	1.9±0.5	1.2±0.3	0.8±0.3
I-131	<0.2	<0.3	<0.4	<0.3	<0.4	<0.2
K-40	1260±40	1260±100	1420±60	1340±100	1300±130	1500±110
Cs-134	<1.0	<4.4	<2.2	<4.0	<4.3	<4.1
Cs-137	<1.2	<4.4	<2.5	<4.6	<5.0	<4.6
Ba-La-140	<1.1	<4.0	<2.0	<4.3	<3.9	<3.8
Other ^a	<1.2	<4.1	<2.6	<5.8	<4.4	<4.8
Collection Date	07-03-91	08-07-91	09-11-91	10-09-91	11-06-91	12-04-91
Lab Code	EMI-6456	EMI-6664	EMI-6859	EMI-7027	EMI-7175	EMI-7242
Sr-89	<0.6	<0.6	<0.6	<0.7	<0.5	<0.6
Sr-90	1.5±0.4	0.9±0.3	1.2±0.4	3.0±0.5	1.7±0.4	2.1±0.5
I-131	<0.4	<0.2	<0.2	<0.4	<0.5	<0.3
K-40	1440±40	1180±60	1420±120	1320±80	1280±60	1300±100
Cs-134	<1.4	<1.7	<4.2	<2.9	<1.6	<3.7
Cs-137	<1.6	<1.9	<4.5	<3.0	<2.0	<4.0
Ba-La-140	<4.8	<5.0	<3.8	<3.1	<2.0	<4.6
Other ^a	<1.5	<2.0	<4.2	<3.2	<2.0	<3.8

^a See Introduction.

RADIOACTIVITY IN MILK SAMPLES (continued)

Sample Description and Concentration (pCi/L)

E-19 Engelbrecht Dairy^a

Collection Date	01-09-91	02-13-91	03-06-91	04-03-91	05-08-91	06-05-91
Lab Code	EMI-5792	EMI-5896	EMI-5951	EMI-6002	EMI-6130	EMI-6274
Sr-89	<0.4	<0.4	<0.4	<0.4	<0.6	<0.5
Sr-90	2.0±0.5	1.2±0.3	1.7±0.4	1.7±0.4	1.2±0.4	1.7±0.4
I-131	<0.2	<0.3	<0.5	<0.3	<0.4	<0.2
K-40	1360±60	1390±110	1240±60	1650±120	1260±70	1340±140
Cs-134	<2.0	<4.1	<2.5	<4.4	<2.2	<3.6
Cs-137	<2.2	<4.2	<2.6	<4.8	<2.7	<4.8
Ba-La-140	<2.8	<3.5	<2.5	<4.1	<4.1	<4.4
Other ^b	<2.8	<4.1	<2.4	<5.6	<3.1	<4.9

Collection Date	07-03-91	08-07-91	09-11-91	10-09-91	11-06-91	12-04-91
Lab Code	EMI-6457	EMI-6665	EMI-6860	EMI-7028	EMI-7176	EMI-7243
Sr-89	<0.6	<0.6	<0.5	<0.8	<0.6	<0.6
Sr-90	1.4±0.4	1.6±0.4	1.4±0.4	1.2±0.4	1.8±0.5	1.1±0.4
I-131	<0.5	<0.2	<0.2	<0.4	<0.4	<0.4
K-40	1410±50	1200±60	1260±120	1250±70	1380±50	1370±100
Cs-134	<1.2	<1.9	<3.7	<2.2	<1.6	<3.4
Cs-137	<1.3	<2.0	<4.9	<2.7	<1.9	<4.3
Ba-La-140	<5.2	<4.9	<4.7	<2.2	<2.7	<4.4
Other ^b	<1.4	<2.0	<5.3	<2.7	<1.8	<4.3

^a New sampling site, 2.1 mi NNW of station.
^b See Introduction.

RADIOACTIVITY IN MILK SAMPLES (continued)

Sample Description and Concentration (pCi/L)						
<u>E-21 Strutz Dairy Farm</u>						
Collection Date	01-09-91	02-13-91	03-06-91	04-03-91	05-08-91	06-05-91
Lab Code	EMI-5793	EMI-5897	EMI-5952	EMI-6003	EMI-6131	EMI-6275
Sr-89	<0.4	<0.4	<0.4	<0.4	<0.6	<0.6
Sr-90	1.3±0.4	1.0±0.3	1.6±0.4	1.7±0.4	1.4±0.5	1.9±0.5
I-131	<0.2	<0.2	<0.4	<0.3	<0.4	<0.2
K-40	1240±50	1520±120	1330±80	1310±130	1390±120	1500±100
Cs-134	<2.3	<4.1	<2.3	<4.3	<4.1	<3.5
Cs-137	<2.4	<4.8	<2.7	<4.9	<4.6	<4.8
Ba-La-140	<2.2	<3.7	<2.2	<4.7	<4.3	<2.5
Other ^a	<2.4	<5.0	<3.4	<4.5	<3.9	<3.8
Collection Date	07-03-91	08-07-91	09-11-91	10-09-91	11-06-91	12-04-91
Lab Code	EMI-6458	EMI-6666,7	EMI-5861	EMI-7029	EMI-7177	EMI-7244
Sr-89	<0.8	<0.6	<0.7	<0.8	<0.6	<0.6
Sr-90	1.8±0.5	1.3±0.3	1.1±0.4	1.4±0.4	1.9±0.5	1.4±0.4
I-131	<0.3	<0.4	<0.2	<0.3	<0.4	<0.2
K-40	1340±40	1360±60	1620±120	1390±60	1440±60	1440±100
Cs-134	<1.1	<2.1	<4.0	<2.3	<2.1	<3.4
Cs-137	<1.3	<2.3	<5.0	<2.5	<2.3	<4.5
Ba-La-140	<4.2	<4.8	<4.1	<2.1	<2.0	<3.8
Other ^a	<1.4	<2.2	<5.0	<2.5	<2.5	<4.2

^a See Introduction.

RADIOACTIVITY IN WELL WATER SAMPLE E-10

(Quarterly Collections)

(pCi/L)

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Collection Date	01-14-91	04-03-91	07-03-91	10-07-91
Lab Code	EW-9344	EW-272	EW-1475	EW-2860
Gross Beta	1.8±1.1	3.9±1.3	3.7±1.2	2.7±1.3
H-3	<179	<169	<175	<174
Sr-89	<0.6	<1.2	<0.9	<1.0
Sr-90	<0.5	<0.7	<0.4	<0.4
I-131	<0.5	<0.3	<0.2	<0.3
Mn-54	<4.1	<5.1	<3.1	<4.2
Fe-59	<13.7	<9.5	<8.4	<9.4
Co-58	<4.1	<5.0	<3.5	<4.5
Co-60	<4.8	<3.6	<2.8	<3.4
Zn-65	<9.5	<9.9	<6.4	<8.7
Zr-Nb-95	<8.3	<9.6	<6.6	<8.0
Cs-134	<3.6	<4.7	<3.0	<4.4
Cs-137	<5.0	<5.2	<3.1	<4.3
Ba-La-140	<6.6	<5.4	<13.1	<11.0
Other Gammas ^a	<6.2	<5.9	<4.3	<4.9

^a Ru-103.

RADIOACTIVITY IN LAKE WATER SAMPLES

(Monthly Collections)

(pCi/L)

1991 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 ^a
Gross Beta					
January	1.9±0.2	1.7±0.2	NS ^b	2.0±0.2	2.6±0.5
February	2.2±0.6	1.9±0.6	0.9±0.2	2.0±0.6	2.2±0.5
March	3.5±0.3	2.6±0.3	2.5±0.3	3.2±0.3	2.9±0.6
April	4.3±0.6	3.0±0.5	3.2±0.4	2.4±0.5	2.3±0.5
May	2.6±0.5	2.4±0.5	3.1±0.5	2.2±0.5	2.6±0.5
June	2.7±0.7	2.6±0.7	2.4±0.6	3.1±0.7	2.2±0.5
July	2.2±0.7	2.2±0.7	2.4±0.7	2.3±0.7	2.0±0.3
August	2.8±0.5	2.8±0.5	2.0±0.5	3.5±0.6	2.9±0.6
September	2.5±0.5	2.5±0.8	2.6±0.8	2.5±0.8	1.8±0.8
October	2.4±0.5	3.3±0.4	3.3±0.4	2.9±0.4	2.5±0.4
November	3.0±0.6	2.9±0.5	4.0±0.8	3.1±0.7	2.1±0.5
December	3.7±0.6	3.7±0.4	3.8±0.6	3.6±0.6	2.4±0.4
Iodine-131					
January	<0.3	<0.4	NS ^b	<0.2	<0.3
February	<0.4	<0.3	<0.4	<0.3	<0.4
March	<0.3	<0.3	<0.2	<0.3	<0.2
April	<0.3	<0.3	<0.3	<0.4	<0.4
May	<0.2	<0.3	<0.3	<0.3	<0.3
June	<0.2	<0.2	<0.2	<0.2	<0.4
July	<0.2	<0.2	<0.2	<0.2	<0.3
August	<0.2	<0.3	<0.3	<0.3	<0.2
September	<0.3	<0.4	<0.4	<0.4	<0.2
October	<0.3	<0.3	<0.4	<0.4	<0.4
November	<0.4	<0.4	<0.3	<0.3	<0.2
December	<0.2	<0.2	<0.2	<0.2	<0.5

^a E-12 Unit 1 Discharge Flume is a monthly composite of weekly grab samples.

^b NS = No sample; sample not collected.

RADIOACTIVITY IN LAKE WATER SAMPLES (continued)

(Monthly Collections)

(pCi/L)

1991 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 ^a
Mn-54					
January	<3.2	<4.0	NS ^b	<4.9	<5.8
February	<9.3	<5.2	<6.5	<5.8	<6.8
March	<4.5	<4.1	<4.0	<4.3	<3.0
April	<3.3	<5.5	<6.2	<3.8	<3.9
May	<5.1	<5.6	<5.1	<2.1	<4.2
June	<3.6	<4.4	<4.6	<4.6	<3.2
July	<3.6	<1.6	<1.5	<1.6	<4.9
August	<1.7	<4.5	<3.9	<5.2	<4.7
September	<1.8	<3.4	<2.7	<3.4	<3.9
October	<4.4	<4.7	<2.4	<7.1	<4.6
November	<3.6	<1.7	<1.8	<3.0	<3.8
December	<3.4	<5.2	<5.1	<4.4	<1.8
Fe-59					
January	<8.4	<10.2	NS ^b	<11.2	<15.5
February	<14.4	<10.2	<12.5	<16.7	<14.6
March	<8.9	<10.5	<7.7	<11.0	<6.7
April	<8.0	<11.7	<12.0	<9.9	<9.5
May	<9.6	<10.8	<10.6	<4.7	<11.4
June	<9.9	<9.7	<11.7	<12.9	<10.7
July	<10.1	<6.7	<5.3	<5.2	<11.7
August	<6.0	<15.1	<14.3	<13.2	<10.0
September	<5.7	<9.9	<8.1	<9.9	<11.4
October	<10.6	<10.6	<6.4	<18.9	<9.0
November	<9.7	<6.3	<6.9	<9.7	<11.4
December	<12.2	<17.6	<13.7	<12.2	<5.7

^a E-12 Unit 1 Discharge Flume is a monthly composite of weekly grab samples.

^b NS = No sample; sample not collected.

RADIOACTIVITY IN LAKE WATER SAMPLES (continued)

(Monthly Collections)

(pCi/L)

1991 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 ^a
Co-58					
January	<3.9	<4.5	NS ^b	<5.6	<6.4
February	<8.8	<5.9	<6.8	<6.5	<7.2
March	<4.2	<4.5	<4.2	<4.5	<3.0
April	<4.3	<5.3	<6.1	<4.8	<4.6
May	<5.5	<5.6	<5.5	<2.3	<6.2
June	<4.2	<4.7	<4.2	<4.6	<3.9
July	<3.9	<2.3	<2.0	<2.1	<5.5
August	<1.8	<4.4	<5.8	<5.8	<5.4
September	<2.2	<4.5	<3.4	<4.5	<4.1
October	<4.8	<5.2	<2.4	<6.2	<4.7
November	<4.1	<2.4	<2.1	<3.2	<5.1
December	<4.6	<3.9	<6.0	<5.8	<1.9
Co-60					
January	<6.0	<4.0	NS ^b	<5.7	<5.4
February	<5.9	<5.5	<7.4	<6.2	<6.2
March	<4.7	<5.4	<3.0	<4.6	<2.8
April	<4.8	<5.7	<7.1	<4.7	<3.1
May	<5.6	<5.5	<4.8	<1.9	<5.4
June	<3.8	<3.7	<3.8	<4.0	<3.0
July	<3.1	<1.7	<1.4	<1.5	<4.3
August	<1.7	<3.3	<3.6	<5.3	<3.8
September	<1.9	<3.9	<2.4	<3.9	<3.9
October	<4.0	<4.0	<2.6	<7.8	<5.4
November	<3.3	<1.5	<1.6	<2.6	<3.0
December	<3.5	<4.8	<4.7	<5.0	<1.8

^a E-12 Unit 1 Discharge Flume is a monthly composite of weekly grab samples.

^b NS = No sample; sample not collected.

RADIOACTIVITY IN LAKE WATER SAMPLES (continued)

(Monthly Collections)

(pCi/L)

1991 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 ^a
Zn-65					
January	<8.9	<9.5	NS ^b	<12.4	<15.6
February	<15.2	<12.7	<12.2	<16.2	<13.0
March	<9.9	<10.1	<7.4	<12.6	<5.6
April	<7.5	<11.1	<12.2	<8.0	<7.2
May	<9.4	<11.4	<11.2	<4.6	<12.6
June	<8.6	<8.7	<8.2	<9.1	<6.0
July	<8.3	<3.5	<3.3	<3.4	<9.4
August	<3.3	<10.6	<8.7	<11.2	<9.8
September	<4.6	<9.3	<5.9	<9.3	<8.7
October	<8.9	<11.1	<5.9	<17.6	<11.6
November	<7.4	<3.6	<3.6	<5.3	<8.8
December	<7.3	<8.6	<8.6	<9.4	<3.5
Zr-Nb-95					
January	<6.0	<8.3	NS ^b	<9.9	<10.1
February	<14.4	<9.6	<11.3	<12.5	<12.8
March	<8.0	<8.4	<7.2	<8.2	<5.2
April	<6.9	<9.0	<9.9	<8.6	<8.8
May	<10.5	<10.0	<10.7	<4.2	<9.3
June	<7.9	<8.7	<9.7	<9.2	<7.6
July	<8.4	<4.2	<3.7	<4.0	<9.4
August	<3.9	<9.9	<11.0	<11.1	<10.8
September	<4.2	<7.4	<6.8	<7.4	<7.0
October	<9.7	<7.6	<4.5	<13.4	<8.4
November	<8.0	<4.4	<4.2	<6.7	<8.7
December	<8.7	<9.9	<11.0	<9.8	<3.4

^a E-12 Unit 1 Discharge Flume is a monthly composite of weekly grab samples.

^b NS = No sample; sample not collected.

RADIOACTIVITY IN LAKE WATER SAMPLES (continued)

(Monthly Collections)

(pCi/L)

1991 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 ^a
Cs-134					
January	<4.5	<4.7	NS ^b	<5.4	<5.7
February	<7.6	<5.3	<5.7	<6.0	<6.9
March	<4.3	<4.0	<3.6	<4.8	<2.5
April	<3.5	<5.0	<5.1	<4.7	<3.5
May	<5.5	<4.9	<5.1	<2.0	<5.0
June	<3.6	<4.0	<3.6	<3.9	<3.0
July	<3.3	<1.5	<1.4	<1.5	<4.4
August	<1.4	<3.9	<3.7	<5.4	<4.0
September	<1.6	<3.9	<2.6	<3.9	<3.4
October	<3.9	<4.3	<2.3	<6.5	<4.2
November	<3.5	<1.6	<1.4	<2.5	<3.5
December	<3.3	<3.4	<4.2	<3.8	<1.6
Cs-137					
January	<4.0	<4.4	NS ^b	<5.7	<5.3
February	<8.4	<5.4	<6.2	<6.8	<6.8
March	<4.5	<4.8	<3.9	<4.4	<3.1
April	<3.9	<4.7	<6.0	<5.0	<3.9
May	<5.2	<5.5	<6.3	<2.3	<4.9
June	<3.9	<4.4	<3.8	<4.4	<2.9
July	<4.1	<1.8	<1.5	<1.6	<4.8
August	<1.6	<4.3	<3.8	<5.4	<4.8
September	<1.7	<3.8	<2.9	<3.8	<3.8
October	<4.7	<4.2	<2.3	<7.5	<4.4
November	<3.8	<1.9	<1.9	<2.8	<4.1
December	<4.1	<4.2	<4.5	<4.6	<2.3

^a E-12 Unit 1 Discharge Flume is a monthly composite of weekly grab samples.

^b NS = No sample; sample not collected.

RADIOACTIVITY IN LAKE WATER SAMPLES (continued)

(Monthly Collections)

(pCi/L)

1991 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 ^a
Ba-La-140					
January	<7.1	<10.9	NS ^b	<8.8	<10.9
February	<8.2	<9.0	<11.0	<10.4	<14.6
March	<8.9	<10.3	<3.8	<11.6	<3.9
April	<7.2	<11.2	<12.8	<8.6	<13.4
May	<9.8	<9.9	<8.2	<2.6	<9.1
June	<15.0	<7.5	<14.7	<13.8	<11.9
July	<9.6	<14.6	<14.8	<13.7	<11.9
August	<6.2	<14.8	<13.1	<13.0	<7.2
September	<13.2	<14.3	<14.9	<14.3	<8.8
October	<6.8	<11.1	<7.7	<7.6	<7.4
November	<3.9	<10.6	<12.4	<14.8	<11.1
December	<10.6	<11.5	<10.0	<14.8	<3.3
Other Gammas ^c					
January	<5.0	<6.2	NS ^b	<5.8	<5.2
February	<9.1	<5.4	<5.7	<5.7	<8.4
March	<5.2	<4.3	<4.5	<6.0	<3.8
April	<3.8	<4.7	<6.6	<6.1	<6.1
May	<6.1	<6.4	<6.2	<2.7	<4.6
June	<5.1	<5.7	<6.6	<7.3	<5.0
July	<5.5	<3.2	<2.9	<2.9	<5.9
August	<2.5	<8.8	<7.5	<7.3	<6.4
September	<2.7	<4.7	<5.2	<4.7	<3.8
October	<5.9	<5.8	<2.6	<6.6	<3.9
November	<4.7	<3.3	<3.2	<4.9	<6.3
December	<5.4	<6.5	<6.5	<6.9	<2.3

^a E-12 Unit 1 Discharge Flume is a monthly composite of weekly grab samples.

^b NS = No sample; sample not collected.

^c Ru-103.

RADIOACTIVITY IN LAKE WATER SAMPLES
(Quarterly Analyses of Composites of Monthly Collections)
(pCi/L)

1991 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 ^a
Sr-89					
1st Quarter	<0.6	<0.6	<0.8	<0.4	<0.6
2nd Quarter	<0.7	<0.7	<0.8	<0.6	<0.9
3rd Quarter	<0.8	<1.0	<1.9	<1.4	<1.0
4th Quarter	<0.8	<0.7	<0.6	<0.7	<0.5
Sr-90					
1st Quarter	<0.5	<0.5	<0.7	<0.5	0.6±0.3
2nd Quarter	<0.7	<0.7	<0.9	<0.7	<0.8
3rd Quarter	<0.4	<0.5	<0.8	0.8±0.4	0.7±0.4
4th Quarter	<0.4	<0.4	<0.3	0.7±0.3	0.5±0.2
H-3					
1st Quarter	<179	241±69	227±93	118±93	251±94
2nd Quarter	228±96	250±97	234±96	147±93	134±92
3rd Quarter	182±86	<159	320±92	187±87	282±90
4th Quarter	182±103	426±111 ^b	<182	600±116 ^c	201±103

^a E-12 Unit 1 Discharge Flume is a monthly composite of weekly grab samples.

^b Analysis was repeated; result of reanalysis 361±103 pCi/L.

^c Analysis was repeated; result of reanalysis 758±117 pCi/L.

RADIOACTIVITY IN FISH SAMPLES
EDIBLE PORTIONS ONLY - COLLECTED AT E-13
(Collected 3x/year)

Sample Description and Activity (pCi/g wet)			
Collection Date	03-21-91	03-21-91	03-21-91
Lab Code	EF-1394	EF-1395	EF-1396
Type	Brook Trout	Coho Salmon	Sucker
Ratio (wet wt./dry wt.)	5.38	5.74	5.19
Gross Beta	2.5±0.1	2.2±0.1	2.1±0.1
K-40	2.19±0.29	1.93±0.65	1.73±0.45
Mn-54	<0.017	<0.047	<0.033
Fe-59	<0.035	<0.099	<0.069
Co-58	<0.014	<0.044	<0.032
Co-60	<0.012	<0.047	<0.033
Zn-65	<0.039	<0.10	<0.079
Cs-134	<0.014	<0.038	<0.035
Cs-137	0.074±0.015	0.097±0.041	<0.036
Other gamma emitters ^a	<0.013	<0.051	<0.036
Collection Date	03-21-91		
Lab Code	EF-1397,8		
Type	Lake Trout		
Ratio (wet wt./dry wt.)	2.86		
Gross Beta	2.8±0.1		
K-40	1.92±0.20		
Mn-54	<0.012		
Fe-59	<0.025		
Co-58	<0.012		
Co-60	<0.012		
Zn-65	<0.030		
Cs-134	<0.010		
Cs-137	0.070±0.013		
Other gamma emitters ^a	<0.013		

^a Ru-103.

RADIOACTIVITY IN FISH SAMPLES (continued)
EDIBLE PORTIONS ONLY - COLLECTED AT E-13
(Collected 3x/year)

Sample Description and Activity (pCi/g wet)		
Collection Date	08-13-91	08-13-91
Lab Code	EF-1513	EF-1514
Type	Brown Trout	Rainbow Trout
Ratio (wet wt./dry wt.)	2.64	6.15
Gross Beta	2.71±0.06	1.59±0.05
K-40	2.66±0.44	1.63±0.26
Mn-54	<0.021	<0.016
Fe-59	<0.10	<0.067
Co-58	<0.036	<0.023
Co-60	<0.026	<0.015
Zn-65	<0.044	<0.033
Cs-134	<0.017	<0.012
Cs-137	0.11±0.025	0.040±0.016
Other gamma emitters ^a	<0.039	<0.029
Collection Date	08-13-91	08-13-91
Lab Code	EF-1515	EF-1516
Type	Rainbow Trout	Rainbow Trout
Ratio (wet wt./dry wt.)	3.67	3.20
Gross Beta	2.69±0.08	2.82±0.08
K-40	2.60±0.40	2.59±0.26
Mn-54	<0.019	<0.015
Fe-59	<0.11	<0.055
Co-58	<0.027	<0.019
Co-60	<0.023	<0.012
Zn-65	<0.057	<0.031
Cs-134	<0.017	<0.012
Cs-137	0.098±0.017	0.12±0.016
Other gamma emitters ^a	<0.037	<0.025

^a Ru-103.

RADIOACTIVITY IN FISH SAMPLES (continued)

EDIBLE PORTIONS ONLY - COLLECTED AT E-13

(Collected 3x/year)

Sample Description and Activity (pCi/g wet)		
Collection Date	12-26-91	12-26-91
Lab Code	EF-1635	EF-1636
Type	Brown Trout	Brown Trout
Ratio (wet wt./dry wt.)	5.13	3.84
Gross Beta	2.44±0.08	2.27±0.07
K-40	2.04±0.58	1.84±0.32
Mn-54	<0.036	<0.016
Fe-59	<0.099	<0.043
Co-58	<0.033	<0.015
Co-60	<0.031	<0.015
Zn-65	<0.080	<0.042
Cs-134	<0.034	<0.016
Cs-137	0.11±0.040	0.040±0.017
Other gamma emitters ^a	<0.038	<0.013
Collection Date	12-26-91	
Lab Code	EF-1637	
Type	Brown Trout	
Ratio (wet wt./dry wt.)	4.76	
Gross Beta	2.23±0.07	
K-40	2.21±0.47	
Mn-54	<0.026	
Fe-59	<0.065	
Co-58	<0.025	
Co-60	<0.026	
Zn-65	<0.048	
Cs-134	<0.022	
Cs-137	0.085±0.021	
Other gamma emitters ^a	<0.020	

^a Ru-103.

RADIOACTIVITY IN SHORELINE SEDIMENT SAMPLES

(Semiannual Collections)

Sample Description and Concentration (pCi/g dry)

Lab Code	ESS-910	ESS-911	ESS-912	ESS-913,4	ESS-915
Location	E-01	E-05	E-06	E-09	E-12
Date Collected	04-03-91	04-03-91	04-03-91	04-03-91	04-03-91
Gross Beta	5.6±1.6	7.7±1.6	9.8±1.8	5.5±1.1	7.4±1.6
Be-7	<0.16	<0.19	<0.17	<0.13	<0.14
K-40	5.54±0.41	9.00±0.61	7.22±0.47	3.89±0.27	6.05±0.37
Cs-137	0.054±0.023	<0.031	0.038±0.022	0.40±0.020	0.004±0.012
Tl-208	0.16±0.055	0.18±0.060	0.20±0.061	0.19±0.045	0.13±0.033
Pb-212	0.16±0.031	0.17±0.043	0.13±0.025	0.20±0.021	0.22±0.028
Bi-214	<0.063	<0.077	<0.058	<0.062	<0.030
Ra-226	0.52±0.28	0.56±0.39	0.40±0.29	0.42±0.20	<0.44
Ac-228	0.11±0.055	<0.12	<0.097	0.25±0.053	<0.052
Lab Code	ESS-1000	ESS-994	ESS-995	ESS-1001	ESS-996
Location	E-09	E-05	E-06	E-09	E-12
Date Collected	09-23-91	09-17-91	09-17-91	09-24-91	09-17-91
Gross Beta	5.3±1.3	8.0±1.4	9.1±1.4	4.4±1.1	8.8±1.4
Be-7	<0.34	<0.20	<0.29	<0.32	<0.25
K-40	7.27±0.59	7.17±0.54	13.16±0.82	4.85±0.45	8.77±0.71
Cs-137	0.10±0.024	0.040±0.022	0.073±0.027	0.049±0.025	0.063±0.030
Tl-208	0.22±0.083	0.19±0.078	0.24±0.092	0.31±0.074	0.25±0.10
Pb-212	0.17±0.044	0.14±0.038	0.19±0.044	0.24±0.040	0.17±0.054
Bi-214	<0.078	<0.057	<0.091	<0.079	<0.085
Ra-226	0.51±0.46	<0.39	<0.52	0.66±0.38	<0.49
Ac-228	<0.13	<0.098	<0.15	0.25±0.086	0.14±0.072

RADIOACTIVITY IN SOIL SAMPLES

(Semiannual Collections)

Sample Description and Concentration (pCi/g dry)

Lab Code	ESO-541	ESO-542	ESO-543	ESO-544
Location	E-01	E-02	E-03	E-04
Date Collected	05-07-91	05-07-91	05-07-91	05-07-91
Gross Beta	24.0±2.8	25.7±2.9	28.3±2.9	27.3±2.0
Be-7	<0.42	<0.57	<0.50	<0.36
K-40	17.56±1.03	20.13±1.22	19.58±0.93	23.41±1.23
Cs-137	0.37±0.061	0.26±0.064	0.41±0.058	0.51±0.063
Tl-208	0.64±0.15	0.85±0.17	1.01±0.14	0.81±0.19
Pb-212	0.64±0.089	0.80±0.072	1.01±0.058	0.78±0.075
Bi-214	<0.15	<0.18	0.63±0.072	<0.16
Ra-226	0.47±0.10	0.67±0.10	0.66±0.086	0.58±0.10
Ac-228	0.60±0.17	0.67±0.20	0.79±0.16	0.95±0.17

Lab Code	ESO-545	ESO-546	ESO-547	ESO-548
Location	E-06	E-08	E-09	E-20
Date Collected	05-07-91	05-07-91	05-07-91	05-07-91
Gross Beta	13.3±1.6	17.4±1.7	23.6±7.0	28.9±2.9
Be-7	<0.20	<0.28	<0.33	<0.53
K-40	12.25±0.70	15.16±0.99	21.78±1.20	16.80±0.81
Cs-137	0.13±0.032	0.31±0.056	0.28±0.056	0.70±0.047
Tl-208	0.23±0.083	0.36±0.12	0.73±0.15	0.58±0.088
Pb-212	0.24±0.035	0.50±0.056	0.62±0.10	0.77±0.064
Bi-214	<0.072	<0.12	<0.16	0.47±0.068
Ra-226	0.17±0.046	0.35±0.087	0.59±0.10	0.52±0.099
Ac-228	<0.14	<0.21	0.62±0.19	<0.15

RADIOACTIVITY IN SOIL SAMPLES (continued)

Sample Description and Concentration (pCi/g dry)				
Lab Code	ESO-570	ESO-571,2	ESO-573	ESO-574
Location	E-01	E-02	E-03	E-04
Date Collected	09-23-91	09-23-91	09-23-91	09-23-91
Gross Beta	22.3±2.7	21.4±1.9	25.9±2.8	23.3±2.8
Be-7	<0.44	<0.63	<0.53	<0.37
K-40	12.13±0.73	18.04±0.79	14.20±0.55	12.99±0.59
Cs-137	0.24±0.036	0.64±0.047	0.44±0.030	0.60±0.035
Tl-208	0.50±0.088	0.61±0.10	0.48±0.081	0.38±0.090
Pb-212	0.52±0.061	0.62±0.060	0.72±0.047	0.52±0.038
Bi-214	0.35±0.067	0.45±0.088	<0.063	0.31±0.050
Ra-226	0.95±0.59	1.48±1.01	1.63±0.44	0.77±0.43
Ac-228	0.37±0.14	0.55±0.12	<0.12	0.56±0.094
Lab Code	ESO-575	ESO-576	ESO-577	ESO-578
Location	E-06	E-08	E-09	E-20
Date Collected	09-23-91	09-24-91	09-24-91	09-23-91
Gross Beta	11.2±1.9	17.3±1.7	24.7±2.8	22.4±2.7
Be-7	<0.19	<0.74	<0.60	<0.32
K-40	7.81±0.32	10.38±1.67	20.08±0.98	9.12±0.39
Cs-137	0.28±0.017	0.58±0.10	0.33±0.044	0.33±0.021
Tl-208	0.22±0.028	0.42±0.22	0.70±0.12	0.22±0.083
Pb-212	0.29±0.020	0.20±0.15	0.79±0.065	0.39±0.044
Bi-214	<0.21	<0.19	<0.13	0.23±0.042
Ra-226	<0.24	<1.43	1.31±0.59	0.50±0.49
Ac-228	<0.40	<0.36	0.74±0.16	0.34±0.089

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
E-01	05-07-91	EG-1713	3.62	5.6±0.2	1.99±0.16	<0.08	<0.06	<0.06	6.06±0.16
E-02	05-07-91	1714	4.88	5.4±0.2	0.89±0.23	<0.08	<0.06	<0.06	7.51±0.61
E-03	05-07-91	1715 ^a	4.95	5.8±0.1	0.91±0.05	<0.08	<0.06	<0.06	7.14±0.21
E-04	05-07-91	1717	5.69	5.6±0.2	0.67±0.10	<0.08	<0.06	<0.06	8.21±0.42
E-06	05-07-91	1718	3.98	4.1±0.2	1.15±0.20	0.26±0.03 ^b	<0.06	<0.06	6.03±0.39
E-08	05-07-91	1719	3.67	5.5±0.2	1.51±0.08	<0.08	<0.06	<0.06	5.62±0.22
E-09	05-07-91	1720	4.55	3.8±0.2	2.15±0.20	<0.08	<0.06	<0.06	8.11±0.56
E-20	05-07-91	1721	5.14	5.6±0.2	1.07±0.12	<0.08	<0.06	<0.06	6.01±0.28
E-01	07-03-91	EG-1764	2.86	5.1±0.2	0.76±0.19	<0.08	<0.06	<0.06	3.90±0.47
E-02	07-03-91	1765	2.77	4.6±0.2	0.51±0.20	<0.08	<0.06	<0.06	3.37±0.52
E-03	07-03-91	1766	2.67	7.2±0.3	0.72±0.20	<0.08	<0.06	<0.06	5.02±0.67
E-04	07-03-91	1767	3.46	6.4±0.2	0.93±0.31	<0.08	<0.06	<0.06	6.41±0.53
E-06	07-03-91	1768	3.44	4.3±0.1	1.03±0.32	<0.08	<0.06	<0.06	3.47±0.57
E-08	07-03-91	1769	3.09	6.9±0.2	1.38±0.27	<0.08	<0.06	<0.06	6.33±0.58
E-09	07-03-91	1770 ^a	2.91	5.7±0.1	1.48±0.26	<0.08	<0.06	<0.06	5.23±0.48
E-20	07-03-91	1772	4.03	5.2±0.1	0.72±0.22	<0.08	<0.06	<0.06	4.94±0.67
E-01	09-23-91	EG-1819	3.43	7.4±0.2	2.34±0.17	<0.08	<0.06	<0.06	8.06±0.45
E-02	09-17-91	1809	4.18	3.2±0.1	1.78±0.11	<0.08	<0.06	<0.06	4.06±0.27
E-03	09-17-91	1810	3.92	4.3±0.2	1.37±0.11	<0.08	<0.06	<0.06	4.08±0.22
E-04	09-17-91	1811	3.04	4.6±0.2	1.84±0.12	<0.08	<0.06	<0.06	4.90±0.25
E-06	09-17-91	1812	2.04	2.8±0.2	2.67±0.14	<0.08	<0.06	<0.06	3.06±0.24
E-08	09-24-91	1820	3.32	4.7±0.2	1.55±0.14	<0.08	<0.06	<0.06	3.75±0.28
E-09	09-24-91	1821	2.72	10.8±0.3	2.17±0.19	<0.08	<0.06	<0.06	4.28±0.39
E-20	09-23-91	1822	8.69	6.4±0.1	1.60±0.01	<0.08	<0.06	<0.06	11.69±0.25

^a See Introduction.

^b Analysis was repeated; result of reanalysis, 0.23±0.03 pCi/g wet.

RADIOACTIVITY IN AQUATIC VEGETATION SAMPLES
(Triennial Collections)

Sample Description and Concentration (pCi/g wet)			
Lab Code	ESL-269	ESL-287	ESL-297
Location	E-5	E-5	E-5
Date Collected	06-03-91	08-12-91	10-09-91
Ratio (wet wt./dry wt.)	8.55	10.03	2.02
Gross Beta	1.2±0.1	4.2±0.2	2.4±0.4
Be-7	<0.21	0.39±0.16	0.32±0.22
K-40	0.90±0.33	3.34±0.44	1.79±0.53
Co-58	<0.020	<0.023	<0.032
Co-60	<0.018	<0.022	<0.029
Cs-134	<0.015	<0.018	<0.025
Cs-137	<0.019	0.032±0.018	0.052±0.026
Lab Code	ESL-270	ESL-288	ESL-298
Location	E-12	E-12	E-12
Date Collected	06-03-91	08-13-91	10-09-91
Ratio (wet wt./dry wt.)	6.30	10.56	3.43
Gross Beta	1.6±0.1	4.0±1.8	1.8±0.3
Be-7	0.90±0.18	0.27±0.09	<0.14
K-40	0.98±0.33	4.00±0.36	1.53±0.27
Co-58	<0.024	<0.017	<0.014
Co-60	<0.016	<0.017	<0.017
Cs-134	<0.015	<0.012	<0.012
Cs-137	0.050±0.017	<0.017	<0.018

AMBIENT GAMMA RADIATION (TLD)

1st Quarter, 1991

Date Annealed:	12-24-90	Days in the Field:	89
Date Placed:	01-03-91	Days from Annealing	
Date Removed:	04-02-91	to Readout:	106
Date Read:	04-09-91		

Location	Days in the Field	Total mR	Net mR	Net mR per 7 days
<u>Indicator</u>				
E-1	89	14.5±0.8	10.6±0.8	0.83±0.06
E-2	89	16.4±0.4	12.5±0.4	0.98±0.03
E-3	89	17.4±0.8	13.5±0.8	1.06±0.06
E-4	89	15.8±0.7	11.9±0.7	0.94±0.06
E-5	89	15.6±0.3	11.7±0.4	0.92±0.03
E-6	89	14.8±0.5	10.9±0.5	0.86±0.04
E-7	89	15.0±0.2	11.1±0.3	0.87±0.02
E-8	89	13.7±0.3	9.8±0.4	0.77±0.03
E-9	89	17.0±0.9	13.1±0.4	1.03±0.07
E-12	89	14.8±0.4	10.9±0.4	0.86±0.03
E-14	89	30.6±0.3	26.7±0.4 ^a	2.10±0.03
E-15	89	30.1±0.4	26.2±0.4 ^a	2.06±0.03
E-16	89	30.1±0.3	26.2±0.4 ^a	2.06±0.03
E-17	89	15.6±0.6	11.7±0.6	0.92±0.05
E-18	89	30.2±1.3	26.3±0.4 ^b	2.07±0.03
E-22	89	16.5±0.6	12.6±0.6	0.92±0.05
E-23	89	15.4±0.2	11.5±0.3 ^c	0.90±0.02
E-24	89	15.9±0.6	12.0±0.6	0.94±0.05
E-25	89	15.5±0.4	11.6±0.4 ^d	0.91±0.03
E-26	89	14.2±0.3	10.3±0.4	0.81±0.03
E-27	89	15.4±0.3	11.5±0.4 ^e	0.90±0.03
<u>Control</u>				
E-20	89	15.4±0.3	11.5±0.4	0.90±0.03
Mean ± s.d.		18.2±5.9	14.3±5.9	1.12±0.46

In-Transit Exposure

Date Annealed	12-24-90	03-25-91
Date Read	01-12-91	04-09-91

Total mR

ITC-1	4.2±0.2	3.9±0.2
ITC-2	3.6±0.2	4.0±0.2

^a Chips were dry and looked normal.

^b Chips were wet but looked normal after drying.

^c Chips were wet; three chips turned white after drying and read high. Result of one chip reported.

^d Chips were dry; two were white and two looked normal. Results of white chips, which read high, not included.

^e Chips were wet. Two turned white after drying. Results of white chips, which read high, not included.

AMBIENT GAMMA RADIATION (TLD)

2nd Quarter, 1991

Date Annealed:	03-25-91
Date Placed:	04-02-91
Date Removed:	07-02-91
Date Read:	07-06-91
Days in the Field:	91
Days from Annealing to Readout:	103

Location	Days in the Field	Total mR	Net mR	Net mR per 7 days
<u>Indicator</u>				
E-1	91	15.1±0.9	10.8±1.1	0.83±0.08
E-2	91	16.9±0.5	12.6±0.8	0.97±0.06
E-3	91	17.4±0.5	13.1±0.8	1.01±0.06
E-4	91	17.5±0.7	13.2±0.9	1.02±0.07
E-5	91	17.7±0.8	13.4±1.0	1.03±0.08
E-6	91	16.3±0.4	12.0±0.7	0.92±0.06
E-7	91	16.2±1.1	11.9±1.2	0.92±0.09
E-8	91	15.0±0.2	10.7±0.7	0.82±0.06
E-9	91	16.5±1.0	12.2±1.2	0.94±0.09
E-12	91	14.0±0.7	9.7±0.9	0.75±0.07
E-14	91	18.0±0.7	13.7±0.9	1.05±0.07
E-15	91	21.2±0.8	16.9±1.0	1.30±0.08
E-16	91	19.9±0.5	15.6±0.8	1.20±0.06
E-17	91	17.8±0	13.5±0.8	1.04±0.06
E-18	91	21.3±0	17.0±0.8	1.31±0.06
E-22	91	18.3±0.4	14.0±0.7	1.08±0.06
E-23	91	22.6±1.1	18.3±1.2	1.41±0.09
E-24	91	20.3±0.6	16.0±0.8	1.23±0.06
E-25	91	20.6±0.6	16.3±0.8	1.25±0.06
E-26	91	15.9±0.6	11.6±0.8	0.89±0.06
E-27	91	18.3±0.4	14.0±0.7	1.08±0.06
<u>Control</u>				
E-20	91	17.2±0.4	12.9±0.7	0.99±0.06
Mean ± s.d.		17.9±2.2	13.6±2.2	1.05±0.17

In-Transit Exposure

Date Annealed	03-25-91	06-25-91
Date Read	04-09-91	07-06-91

Total mR

ITC-1	3.9±0.2	5.2±0.3
ITC-2	4.0±0.2	4.2±0.2

AMBIENT GAMMA RADIATION (TLD)

3rd Quarter, 1991

Date Annealed:	06-25-91
Date Placed:	07-02-91
Date Removed:	10-01-91
Date Read:	10-07-91
Days in the Field:	91
Days from Annealing to Readout:	104

Location	Days in the Field	Total mR	Net mR	Net mR per 7 days
<u>Indicator</u>				
E-1	91	15.3±0.2	11.3±1.0	0.87±0.08
E-2	91	16.9±0.4	12.9±1.1	0.99±0.08
E-3	91	17.8±0.4	13.8±1.1	1.06±0.08
E-4	91	18.1±0.3	14.1±1.0	1.08±0.08
E-5	91	17.7±0.6	13.7±1.2	1.05±0.09
E-6	91	13.8±0.5	9.8±1.1	0.75±0.08
E-7	91	12.9±0.4	8.9±1.1	0.68±0.08
E-8	91	14.5±0.7	10.5±1.2	0.81±0.09
E-9	91	17.9±0.5	13.9±1.1	1.07±0.08
E-12	91	12.8±0.2	8.8±1.0	0.68±0.08
E-14	91	17.3±0.5	13.3±1.1	1.02±0.08
E-15	91	17.5±0.3	13.5±1.0	1.04±0.08
E-16	91	16.5±0.3	16.5±1.0	1.27±0.08
E-17	91	13.6±0.3	9.6±1.2	0.74±0.09
E-18	91	18.7±0.6	14.7±1.2	1.13±0.09
E-22	91	17.1±0.3	13.1±1.0	1.01±0.08
E-23	91	19.5±0.6	15.5±1.2	1.19±0.09
E-24	91	16.4±0.6	12.4±1.2	0.95±0.09
E-25	91	16.6±0.6	12.6±1.2	0.97±0.09
E-26	91	13.6±0.3	9.6±1.0	0.74±0.08
E-27	91	14.5±0.4	10.5±1.1	0.81±0.08
<u>Control</u>				
E-20	91	16.3±0.4	12.3±1.1	0.95±0.08
Mean ± s.d.		16.2±2.0	12.3±2.2	0.95±0.17

In-Transit Exposure

Date Annealed	06-25-91	09-23-91
Date Read	07-06-91	10-07-91

Total mR

ITC-1	5.2±0.3	3.2±0.2
ITC-2	4.2±0.2	3.2±0.1

AMBIENT GAMMA RADIATION (TLD)

4th Quarter, 1991

Date Annealed:	09-23-91
Date Placed:	10-01-91
Date Removed:	01-08-92
Date Read:	01-11-92
Days in the Field:	99
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	99	16.1±0.8	13.1±0.8	0.93±0.06
E-2	99	NA ^a		
E-3	99	19.5±0.6	16.5±0.6	1.17±0.04
E-4	99	19.3±0.4	16.3±0.4	1.15±0.03
E-5	99	18.6±0.6	15.6±0.6	1.10±0.04
E-6	99	16.2±0.1	13.2±0.2	0.93±0.01
E-7	99	15.1±0.2	12.1±0.3	0.86±0.02
E-8	99	16.2±0.5	13.2±0.5	0.93±0.04
E-9	99	19.5±0.4	16.5±0.4	1.17±0.03
E-12	99	13.2±0.5	10.2±0.5	0.72±0.04
E-14	99	18.7±0.5	15.7±0.5	1.11±0.04
E-15	99	21.4±0.3	18.4±0.4	1.30±0.03
E-16	99	17.6±0.9	14.6±0.9	1.03±0.06
E-17	99	17.3±0.4	14.3±0.4	1.01±0.03
E-18	99	20.4±0.7	17.4±0.7	1.23±0.05
E-22	99	18.0±1.0	15.0±1.0	1.06±0.07
E-23	99	20.6±0.5	17.6±0.5	1.24±0.04
E-24	99	18.3±0.5	15.3±0.5	1.08±0.04
E-25	99	18.4±0.6	15.4±0.6	1.09±0.04
E-26	99	15.9±0.2	12.9±0.3	0.91±0.02
E-27	99	17.3±0.5	14.3±0.5	1.01±0.04
<u>Control</u>				
E-20	99	18.1±0.1	15.1±0.2	1.07±0.01
Mean ± s.d.		17.9±2.0	14.9±2.0	1.05±0.14

In-Transit Exposure

Date Annealed	09-23-91	12-27-91
Date Read	10-07-91	01-11-92

Total mR

ITC-1	3.2±0.2	3.0±0.2
ITC-2	3.2±0.1	2.8±0.2

^a NA = no data. TLD was misplaced.

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.

July, 1991

APPENDIX A

INTERLABORATORY COMPARISON PROGRAM RESULTS

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

January, 1992

Appendix A

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

The results in Table A-1 were obtained through participation in the environmental sample crosscheck program for milk, water, air filters, and food samples during the period January 1988 through November 1991. This program has been conducted by the U.S. Environmental Protection Agency Intercomparison and Calibration Section, Quality Assurance Branch, Environmental Monitoring and Support Laboratory, Las Vegas, Nevada.

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

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

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

Attachment B lists acceptance criteria for "spiked" samples.

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

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

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^b		
				EPA Result ^d		Control Limits
				TIML Result $\pm 2\sigma^c$	1s, N=1	
STW-521	Water	Jan 1988	Sr-89	27.3 \pm 5.0	30.0 \pm 5.0	21.3-38.7
			Sr-90	15.3 \pm 1.2	12.4-17.6	
STW-523	Water	Jan 1988	Gr. alpha	2.3 \pm 1.2	4.0 \pm 5.0	0.0-12.7
			Gr. beta	7.7 \pm 1.2	8.0 \pm 5.0	
STW-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	86.8-127
			Cs-134	61.7 \pm 8.0	64.0 \pm 5.0	55.3-72.
			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
STW-528	Milk	Feb 1988	I-131	4.7 \pm 1.2	4.0 \pm 0.4	3.3-4.7
STW-529	Water	Mar 1988	Ra-226	7.1 \pm 0.6	7.6 \pm 1.1	5.6-9.6
			Ra-228	NA ^e	7.7 \pm 1.2	5.7-9.7
STW-530	Water	Mar 1988	Gr. alpha	4.3 \pm 1.2	6.0 \pm 5.0	0.0-14.7
			Gr. beta	13.3 \pm 1.3	13.0 \pm 5.0	4.3-21.7
STAF-531	Air Filter	Mar 1988	Gr. alpha	21.0 \pm 2.0	20.0 \pm 5.0	11.3-28.7
			Gr. beta	48.0 \pm 0.0	50.0 \pm 5.0	41.3-58.7
			Sr-90	16.7 \pm 1.2	17.0 \pm 1.5	14.4-19.6
			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	Concentration in pCi/L ^b		
				EPA Result ^d		Control Limits
				TIML Result $\pm 2\sigma^c$	1s, N=1	
STW-533 534	Water (Blind)	Apr 1988				
	Sample A		Gr. alpha	ND ^f	46.0 \pm 11.0	27.0-65.0
			Ra-226	ND	6.4 \pm 1.0	4.7-8.1
			Ra-228	ND	5.6 \pm 0.8	4.2-7.0
			Uranium	6.0 \pm 6.0	6.0 \pm 6.0	0.0-16.4
	Sample B		Gr. beta	ND	57.0 \pm 5.0	48.3-65.7
			Sr-89	3.3 \pm 1.2	5.0 \pm 5.0	0.0-13.7
			Sr-90	5.3 \pm 1.2	5.0 \pm 1.5	2.4-7.6
			Co-60	63.3 \pm 1.3	50.0 \pm 5.0	41.3-58.7
			Cs-134	7.7 \pm 1.2	7.0 \pm 5.0	0.0-15.7
			Cs-137	8.3 \pm 1.2	7.0 \pm 5.0	0.0-15.7
STU-535	Urine	Apr 1988	H-3	6483 \pm 155	6202 \pm 620	5128-7276
STW-536	Water	Apr 1988	Sr-89	14.7 \pm 1.3	20.0 \pm 5.0	11.3-28.7
			Sr-90	20.0 \pm 2.0	20.0 \pm 1.5	17.4-22.6
STW-538	Water	Jun 1988	Cr-51	331.7 \pm 13.0	302.0 \pm 30.0	250.0-354.0
			Co-60	16.0 \pm 2.0	15.0 \pm 5.0	6.3-23.7
			Zn-65	107.7 \pm 11.4	101.0 \pm 10.0	83.7-118.3
			Ru-106	191.3 \pm 11.0	195.0 \pm 20.0	160.4-229.6
			Cs-134	18.3 \pm 4.6	20.0 \pm 5.0	11.3-28.7
			Cs-137	26.3 \pm 1.2	25.0 \pm 5.0	16.3-33.7
STW-539	Water	Jun 1988	H-3	5586 \pm 92	5565 \pm 557	4600-6530
STW-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	54.6-65.2
			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 ^f	33.0 \pm 5.0	24.3-41.7
			Sr-90	ND	34.0 \pm 2.0	30.5-37.5
			I-131	115.0 \pm 5.3	107.0 \pm 11.0	88.0-126.0
			Cs-137	52.7 \pm 6.4	49.0 \pm 5.0	40.3-57.7
			K	1190 \pm 66	1240 \pm 62	1133-1347

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^b		
				TIML Result $\pm 2\sigma^c$	EPA Result ^d	
					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	Gr. alpha	7.0 \pm 2.0	8.0 \pm 5.0	0.0-16.7
			Gr. beta	11.3 \pm 1.2	10.0 \pm 5.0	1.3-18.7
STW-550	Water	Oct 1988	Cr-51	252.0 \pm 14.0	251.0 \pm 25.0	207.7-294
			Co-60	26.0 \pm 2.0	25.0 \pm 5.0	16.3-33
			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	25.7-58.3
			Ra-226	4.5 \pm 0.5	5.0 \pm 0.8	3.6-6.4
			Ra-228	4.4 \pm 0.6	5.2 \pm 0.8	3.6-6.4
			Uranium	4.7 \pm 1.2	5.0 \pm 6.0	0.0-15.4
	Sample B		Gr. beta	51.3 \pm 3.0	54.0 \pm 5.0	45.3-62.7
			Sr-89	3.7 \pm 1.2	11.0 \pm 5.0	2.3-19.7
			Sr-90	10.7 \pm 1.2	10.0 \pm 1.5	7.4-12.6
			Cs-134	15.3 \pm 2.3	15.0 \pm 5.0	6.3-23.7
			Cs-137	16.7 \pm 1.2	15.0 \pm 5.0	6.3-23.7

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^b		
				EPA Result ^d		Control Limits
				TIML Result $\pm 2\sigma^c$	1s, N=1	
STM-554	Milk	Oct 1988	Sr-89	40.3 \pm 7.0	40.0 \pm 5.0	31.3-48.7
			Sr-90	51.0 \pm 2.0	60.0 \pm 3.0	54.8-65.2
			I-131	94.0 \pm 3.4	91.0 \pm 9.0	75.4-106.6
			Cs-137	45.0 \pm 4.0	50.0 \pm 5.0	41.3-58.7
			K	1500 \pm 45	1600 \pm 80	1461-1739
STU-555	Urine	Nov 1988	H-3	3030 \pm 209	3025 \pm 359	2403-3647
STW-556	Water	Nov 1988	Gr. alpha	9.0 \pm 3.5	9.0 \pm 5.0	0.3-17.7
			Gr. beta	9.7 \pm 1.2	9.0 \pm 5.0	0.3-17.7
STW-557	Water	Dec 1988	I-131	108.7 \pm 3.0	115.0 \pm 12.0	94.2-135.8
STW-559	Water	Jan 1989	Sr-89	40.0 \pm 8.7	40.0 \pm 5.0	31.3-48.7
			Sr-90	24.3 \pm 3.1	25.0 \pm 1.5	22.4-27.6
STW-560	Water	Jan 1989	Pu-239	5.8 \pm 1.1	4.2 \pm 0.4	3.5-4.9
STW-561	Water	Jan 1989	Gr. alpha	7.3 \pm 1.2	8.0 \pm 5.0	0.0-16.7
			Gr. beta	5.3 \pm 1.2	4.0 \pm 5.0	0.0-12.7
STW-562	Water	Feb 1989	Cr-51	245 \pm 46	235 \pm 24	193.4-276.6
			Co-60	10.0 \pm 2.0	10.0 \pm 5.0	1.3-18.7
			Zn-65	170 \pm 10	159 \pm 16	139.2-186.7
			Ru-106	181 \pm 7.6	178 \pm 18	146.8-209.2
			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 350	2137-3371
STW-565	Water	Mar 1989	Ra-226	4.2 \pm 0.3	4.9 \pm 0.7	3.7-6.1
			Ra-228	1.9 \pm 1.0	1.7 \pm 0.3	1.2-2.2
STW-566	Water	Mar 1989	U	5.0 \pm 0.0	5.0 \pm 6.0	0.0-15.4
STAF-567	Air Filter	Mar 1989	Gr. alpha	21.7 \pm 1.2	21.0 \pm 5.0	12.3-29.7
			Gr. beta	68.3 \pm 4.2	62.0 \pm 5.0	53.3-70.7
			Sr-90	20.0 \pm 2.0	20.0 \pm 1.5	17.4-22.6
			Cs-137	21.3 \pm 1.2	20.0 \pm 5.0	11.3-28.7

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^b		
				EPA Result ^d		Control Limits
				TIML Result $\pm 2\sigma^c$	1s, N=1	
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
STM-570	Milk	Apr 1989	Sr-89	26.0 \pm 10.0	39.0 \pm 5.0	30.3-47.7
			Sr-90	45.7 \pm 4.2	55.0 \pm 3.0	49.8-60.2
			Cs-137	54.0 \pm 6.9	50.0 \pm 5.0	41.3-58.7
			K-40	1521 \pm 208	1600 \pm 80	1461-1739
STW-571B	Water	May 1989	Sr-89	<0.7	6.0 \pm 5.0	0.0-14.
			Sr-90	5.0 \pm 1.0	6.0 \pm 1.5	3.4-8.6
STW-572	Water	May 1989	Gr. alpha	24.0 \pm 2.0	30.0 \pm 8.0	16.1-43.9
			Gr. beta	49.3 \pm 15.6	50.0 \pm 5.0	41.3-58.7
STW-573	Water	Jun 1989	Ba-133	50.7 \pm 1.2	49.0 \pm 5.0	40.3-57.7
			Co-60	31.3 \pm 2.3	31.0 \pm 5.0	22.3-39.7
			Zn-65	167 \pm 10	165 \pm 17	135.6-194.4
			Ru-106	123 \pm 9.2	128 \pm 13	105.5-150.5
			Cs-134	40.3 \pm 1.2	39 \pm 5	30.3-47.7
			Cs-137	22.3 \pm 1.2	20 \pm 5	11.3-28.7
STW-574	Water	Jun 1989	H-3	4513 \pm 136	4503 \pm 450	3724-5282
STW-575	Water	Jul 1989	Ra-226	16.8 \pm 3.1	17.7 \pm 2.7	13.0-22.4
			Ra-228	13.8 \pm 3.7	18.3 \pm 2.7	13.6-23.0
STW-576	Water	Jul 1989	U	40.3 \pm 1.2	41.0 \pm 6.0	30.6 \pm 51.4
STW-577	Water	Aug 1989	I-131	84.7 \pm 5.8	83.0 \pm 8.0	69.1-96.9
STAF-579	Air Filter	Aug 1989	Gr. alpha	6.0 \pm 0.0	6.0 \pm 5.0	0.0-14.7
			Cs-137	10.3 \pm 2.3	10.0 \pm 5.0	1.3-18.

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^b		
				TIML Result $\pm 2\sigma^c$	EPA Result ^d	
					1s, N=1	Control Limits
STW-580	Water	Sep 1989	Sr-89 Sr-90	14.7 \pm 1.2 9.7 \pm 1.2	14.0 \pm 5.0 10.0 \pm 1.5	5.3-22.7 7.4-12.6
STW-581	Water	Sep 1989	Gr. alpha Gr. beta	5.0 \pm 0.0 8.7 \pm 2.3	4.0 \pm 5.0 6.0 \pm 5.0	0.0-12.7 0.0-14.7
STW-583	Water	Oct 1989	Ba-133 Co-60 Zn-65 Ru-106 Cs-134 Cs-137	60.3 \pm 10.0 29.0 \pm 4.0 132.3 \pm 6.0 155.3 \pm 6.1 30.7 \pm 6.1 66.3 \pm 4.6	59.0 \pm 6.0 30.0 \pm 5.0 129.0 \pm 13.0 161.0 \pm 16.0 29.0 \pm 5.0 59.0 \pm 5.0	48.6-69.4 21.1-38.7 104.5-151.5 133.3-188.7 20.3-37.7 50.3 \pm 67.7
STW-584	Water	Oct 1989	H-3	3407 \pm 150	3496 \pm 364	2866 \pm 4126
STW-585 586	Water (Blind)	Oct 1989				
	Sample A		Gr. alpha Ra-226 Ra-228 U	41.7 \pm 9.4 7.9 \pm 0.4 4.4 \pm 0.8 12.0 \pm 0.0	49.0 \pm 12.0 8.4 \pm 1.3 4.1 \pm 0.6 12.0 \pm 6.0	28.2-69.8 6.2-10.6 3.1-5.1 1.6-22.4
	Sample B		Gr. beta Sr-89 Sr-90 Cs-134 Cs-137	31.7 \pm 2.3 13.3 \pm 4.2 7.0 \pm 2.0 5.0 \pm 0.0 7.0 \pm 0.0	32.0 \pm 5.0 15.0 \pm 5.0 7.0 \pm 3.0 5.0 \pm 5.0 5.0 \pm 5.0	23.3-40.7 6.3-23.7 4.4-9.6 0.0-13.7 0.0-13.7
STW-587	Water	Nov 1989 Ra-228	Ra-226 8.9 \pm 1.2	7.9 \pm 0.4 9.3 \pm 1.2	8.7 \pm 1.3 6.9-11.7	6.4-11.0
STW-588	Water	Nov 1989	U	15.0 \pm 0.08	15.0 \pm 6.0	4.6-25.4
STW-589	Water	Jan 1990	Sr-89 Sr-90	22.7 \pm 5.0 17.3 \pm 1.2	25.0 \pm 5.0 20.0 \pm 1.5	16.3-33.7 17.4-22.6
STW-591	Water	Jan 1990	Gr. alpha Gr. beta	10.3 \pm 3.0 12.3 \pm 1.2	12.0 \pm 5.0 12.0 \pm 5.0	3.3-20.7 3.3-20.7

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^b		
				EPA Result ^d		Control Limits
				TIML Result $\pm 2\sigma^c$	1s, N=1	
STW-592	Water	Jan 1990	Co-60	14.7 \pm 2.3	15 \pm 5.0	6.3-23.7
			Zn-65	135.0 \pm 6.9	139.0 \pm 14.0	114.8-163.2
			Ru-106	133.3 \pm 13.4	139.0 \pm 14.0	114.8-163.2
			Cs-134	17.3 \pm 1.2	18.0 \pm 5.0	9.3-26.7
			Cs-137	19.3 \pm 1.2	18.0 \pm 5.0	9.3-26.7
			Ba-133	78.0 \pm 0.0	74.0 \pm 7.0	61.9-86.1
STW-593	Water	Feb 1990	H-3	4827 \pm 83	4976 \pm 498	4113-5839
STW-594	Water	Mar 1990	Ra-226	5.0 \pm 0.2	4.9 \pm 0.7	4.1-5.7
			Ra-228	13.5 \pm 0.7	12.7 \pm 1.9	9.4-16.0
STW-595	Water	Mar 1990	U	4.0 \pm 0.0	4.0 \pm 6.0	0.0-14.4
STAF-596	Air Filter	Mar 1990	Co. alpha	7.3 \pm 1.2	5.0 \pm 5.0	0.0-13.7
			Gr. beta	31.0 \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 3.9	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
			Gr. beta	12.3 \pm 1.2	15.0 \pm 5.0	6.3-23.7

Table A-1. (continued)

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

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^b		
				EPA Result ^d		Control Limits
				TIML Result $\pm 2\sigma^c$	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-617B	Water	Nov 1990	U	35.0 \pm 0.4	35.5 \pm 3.6	29.3 \pm 41.7
STW-618	Water	Jan 1991	Sr-89	4.3 \pm 1.2	5.0 \pm 5.0	0.0-13.7
			Sr-90	4.7 \pm 1.2	5.0 \pm 5.0	0.0-13.7
STW-619	Water	Jan 1991	Pu-239	3.6 \pm 0.2	3.3 \pm 0.3	2.8-3.8
STW-620	Water	Jan 1991	Gr. alpha	6.7 \pm 3.0	5.0 \pm 5.0	0.0-13.7
			Gr. beta	6.3 \pm 1.2	5.0 \pm 5.0	0.0-13.7
STW-621	Water	Feb 1991	Co-60	41.3 \pm 8.4	40.0 \pm 5.0	31.3-48.7
			Zn-65	166.7 \pm 19.7	149.0 \pm 15.0	123.0-175.0
			Ru-106	209.7 \pm 18.6	186.0 \pm 19.0	153.0-219.0
			Cs-134	9.0 \pm 2.0	8.0 \pm 5.0	0.0-16.7
			Cs-137	9.7 \pm 1.2	8.0 \pm 5.0	0.0-16.7
			Ba-133	85.7 \pm 9.2	75.0 \pm 8.0	61.1-88.9
STW-622	Water	Feb 1991	I-131	81.3 \pm 6.1	75.0 \pm 8.0	61.1-88.9
STW-623	Water	Feb 1991	H-3	4310.0 \pm 144.2	4418.0 \pm 442.0	3651.2-5184.8
STW-624	Water	Mar 1991	Ra-226	31.4 \pm 3.2	31.8 \pm 4.8	23.5-40.1
			Ra-228	ND ^h	21.1 \pm 5.3	11.9-30.3
STW-625	Water	Mar 1991	U	6.7 \pm 0.4	7.6 \pm 3.0	2.4-12.8

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^b		
				EPA Result ^d		Control Limits
				TIML Result $\pm 2\sigma^c$	1s, N=1	
STAF-626	Filter	Mar 1991	Gr. alpha	38.7 \pm 1.2	25.0 \pm 6.0	14.6-35.4
			Gr. beta	130.0 \pm 4.0	124.0 \pm 6.0	113.6-134.4
			Sr-90	35.7 \pm 1.2	40.0 \pm 5.0	31.3-48.7
			Cs-137	33.7 \pm 4.2	40.0 \pm 5.0	31.3-48.7
STW-627 628	Water	Apr 1991				
	Sample A		Gr. alpha	51.0 \pm 6.0	54.0 \pm 14.0	29.7-78.3
			Ra-226	7.0 \pm 0.8	8.0 \pm 1.2	5.9-10.1
			Ra-228	9.7 \pm 1.9	15.2 \pm 3.8	8.6-21.8
			U	27.7 \pm 2.4	29.8 \pm 3.0	24.6-35.0
	Sample B		Gr. beta	93.3 \pm 6.4	115.0 \pm 17.0	85.5-144.5
			Sr-89	21.0 \pm 3.5	28.0 \pm 5.0	19.3-36.7
			Sr-90	23.0 \pm 0.0	26.0 \pm 5.0	17.3-34.7
			Cs-134	27.3 \pm 1.2	24.0 \pm 5.0	15.3-32.7
			Cs-137	29.0 \pm 2.0	25.0 \pm 5.0	16.3-33.7
STM-629	Milk	Sr-89	24.0 \pm 8.7	32.0 \pm 5.0	23.3-40.7	
		Sr-90	28.0 \pm 2.0	32.0 \pm 5.0	23.3-40.7	
		I-131	65.3 \pm 14.7	60.0 \pm 6.0	49.6-70.4	
		Cs-137	54.7 \pm 11.0	49.0 \pm 5.0	40.3-57.7	
		K	1591.7 \pm 180.1	1650.0 \pm 83.0	1506.0-1794.0	
STW-630	Water	May 1991	Sr-89	40.7 \pm 2.3	39.0 \pm 5.0	30.3-47.7
			Sr-90	23.7 \pm 1.2	24.0 \pm 5.0	15.3-32.7
STW-631	Water	May 1991	Gr. alpha	27.7 \pm 5.8	24.0 \pm 6.0	13.6-34.4
			Gr. beta	46.0 \pm 0.0	46.0 \pm 5.0	37.3-54.7
STW-632	Water	Jun 1991	Co-60	11.3 \pm 1.2	10.0 \pm 5.0	1.3-18.7
			Zn-65	119.3 \pm 16.3	108.0 \pm 11.0	88.9-127.1
			Ru-106	162.3 \pm 19.0	149.0 \pm 15.0	123.0-175.0
			Cs-134	15.3 \pm 1.2	15.0 \pm 5.0	6.3-23.7
			Cs-137	16.3 \pm 1.2	14.0 \pm 5.0	5.3-22.7
			Ba-133	74.0 \pm 6.9	62.0 \pm 6.0	51.6-72.4
STW-633	Water	Jun 1991	H-3	13470.0 \pm 385.6	12480.0 \pm 1248.0	10314.8-14645.2
STW-634	Water	Jul 1991	Ra-226	14.9 \pm 0.4	15.9 \pm 2.4	11.7-20.1
			Ra-228	17.6 \pm 1.8	16.7 \pm 4.2	9.4-24.0

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L ^b		
				EPA Result ^d		Control Limits
				TIML Result $\pm 2\sigma^c$	1s, N=1	
STW-635	Water	Jul 1991	U	12.8 \pm 0.1	14.2 \pm 3.0	9.0-19.4
STW-636	Water	Aug 1991	I-131	19.3 \pm 1.2	20.0 \pm 6.0	9.6-30.4
STW-637	Water	Aug 1991	Pu-239	21.4 \pm 0.5	19.4 \pm 1.9	16.1-22.7
STW-638	Filter	Aug 1991	Gr. alpha	33.0 \pm 2.0	25.0 \pm 6.0	14.6-35.4
			Gr. beta	88.7 \pm 1.2	92.0 \pm 10.0	80.4-103.6
			Sr-90	27.0 \pm 4.0	30.0 \pm 5.0	21.3-38.7
			Cs-137	26.3 \pm 1.2	30.0 \pm 5.0	21.3-38.7
STW-639	Water	Sep 1991	Sr-89	47.0 \pm 10.4	49.0 \pm 5.0	40.3-57.7
			Sr-90	24.0 \pm 2.0	25.0 \pm 5.0	16.3-33.7
STW-640	Water	Sep 1991	Gr. alpha	12.0 \pm 4.0	10.0 \pm 5.0	1.3-18.7
			Gr. beta	20.3 \pm 1.2	20.0 \pm 5.0	11.3-28.7
STM-641	Milk	Sep 1991	Sr-89	20.3 \pm 5.0	25.0 \pm 5.0	16.3-33.7
			Sr-90	19.7 \pm 3.1	25.0 \pm 5.0	16.3-33.7
			I-131	130.7 \pm 16.8	108.0 \pm 11.0	88.9-151.1
			Cs-137	33.7 \pm 3.2	30.0 \pm 5.0	21.3-38.7
			K	1743.3 \pm 340.8	1740.0 \pm 87.0	1589.1-1890.9
STW-642	Water	Oct 1991	Co-60	29.7 \pm 1.2	29.0 \pm 5.0	20.3-37.7
			Zn-65	75.7 \pm 8.3	73.0 \pm 7.0	60.9-85.1
			Ru-106	196.3 \pm 15.1	199.0 \pm 20.0	164.3-233.7
			Cs-134	9.7 \pm 1.2	10.0 \pm 5.0	1.3-18.7
			Cs-137	11.0 \pm 2.0	10.0 \pm 5.0	1.3-18.7
			Ba-133	94.7 \pm 3.1	98.0 \pm 10.0	80.7-115.3
STW-643	Water	Oct 1991	H-3	2640.0 \pm 156.2	2454.0 \pm 352.0	1843.3-3064.7
STW-644 645	Water Sample A	Oct 1991	Gr. alpha	73.0 \pm 13.1	82.0 \pm 21.0	45.6-118.4
			Ra-226	20.9 \pm 2.0	22.0 \pm 3.3	16.3-27.7
			Ra-228	19.6 \pm 2.3	22.2 \pm 5.6	12.5-31.9
			U	13.5 \pm 0.6	13.5 \pm 3.0	8.3-18.7
	Sample B		Gr. beta	55.3 \pm 3.1	65.0 \pm 10.0	47.7-82.3
			Sr-89	9.7 \pm 3.1	10.0 \pm 5.0	1.3-18.7
			Sr-90	8.7 \pm 1.2	10.0 \pm 5.0	1.3-18.7
			Co-60	20.3 \pm 1.2	20.0 \pm 5.0	11.3-28.7
			Cs-134	9.0 \pm 5.3	10.0 \pm 5.0	1.3-18.7
			Cs-137	14.7 \pm 5.0	11.0 \pm 5.0	2.3-19.4

Table A-1. (continued)

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

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

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

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

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

^e NA = Not analyzed.

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

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

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

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

Lab Code	TLD Type	Measurement $\pm 2\sigma^a$	Teledyne Result Value ^c	mR	
				Known Participants)	Average $\pm 2\sigma$ (All
<u>2nd International Intercomparison^b</u>					
115-2	CaF ₂ :Mn Bulb	Field	17.0 \pm 1.9	17.1	16.4 \pm 7.7
		Lab	20.8 \pm 4.1	21.3	18.8 \pm 7.6
<u>3rd International Intercomparison^e</u>					
115-3	CaF ₂ :Mn Bulb	Field	30.7 \pm 3.2	34.9 \pm 4.8	31.5 \pm 3.0
		Lab	89.6 \pm 6.4	91.7 \pm 14.6	86.2 \pm 24.0
<u>4th International Intercomparison^f</u>					
115-4	CaF ₂ :Mn Bulb	Field	14.1 \pm 1.1	14.1 \pm 1.4	16.0 \pm 9.0
		Lab (Low)	9.3 \pm 1.3	12.2 \pm 2.4	12.0 \pm 7.4
		Lab (High)	40.4 \pm 1.4	45.8 \pm 9.2	43.9 \pm 13.2
<u>5th International Intercomparison^g</u>					
115-5A	CaF ₂ :Mn Bulb	Field	31.4 \pm 1.8	30.0 \pm 6.0	30.2 \pm 14.6
		Lab at beginning	77.4 \pm 5.8	75.2 \pm 7.6	75.8 \pm 40.4
		Lab at the end	96.6 \pm 5.8	88.4 \pm 8.8	90.7 \pm 31.2
115-5B	LiF-100 Chips	Field	30.3 \pm 4.8	30.0 \pm 6.0	30.2 \pm 14.6
		Field at beginning	81.1 \pm 7.4	75.2 \pm 7.6	75.8 \pm 40.4
		Lab at the end	85.4 \pm 11.7	88.4 \pm 8.8	90.7 \pm 31.2
<u>7th International Comparison^h</u>					
115-7A	LiF-100 Chips	Field	75.4 \pm 2.6	75.8 \pm 6.0	75.1 \pm 29.8
		Lab (Co-60)	80.0 \pm 3.5	79.9 \pm 4.0	77.9 \pm 27.6
		Lab (Cs-137)	66.6 \pm 2.5	75.0 \pm 3.8	73.0 \pm 22

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

Lab Code	TLD Type	Measurement $\pm 2\sigma^a$	mR		
			Teledyne Result Value ^c	Known Participants)	Average $\pm 2\sigma^d$ (All
115-7B	CaF ₂ :Mn Bulbs	Field	71.5 \pm 2.6	75.8 \pm 4.0	75.1 \pm 29.8
		Lab (Co-60)	84.8 \pm 6.4	79.9 \pm 4.0	77.9 \pm 27.6
		Lab (Cs-137)	78.8 \pm 1.6	75.0 \pm 3.8	73.0 \pm 22.2
115-7C	CaSO ₄ :Dy Cards	Field ^d	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 Intercomparison¹</u>					
115-8A	LiF-100 Chips	Field Site 1	29.5 \pm 1.4	29.7 \pm 1.5	28.9 \pm 12.4
		Field Site 2	11.3 \pm 0.8	10.4 \pm 0.5	10.1 \pm 9.06
		Lab (Cs-137)	13.7 \pm 0.9	17.2 \pm 0.9	16.2 \pm 6.8
115-8B	CaF ₂ :Mn Bulbs	Field Site 1	32.3 \pm 1.2	29.7 \pm 1.5	28.9 \pm 12.4
		Field Site 2	9.0 \pm 1.0	10.4 \pm 0.5	10.1 \pm 9.0
		Lab (Cs-137)	15.8 \pm 0.9	17.2 \pm 0.9	16.2 \pm 6.8
115-8C	CaSO ₄ :Dy Cards	Field Site 1	32.2 \pm 0.7	29.7 \pm 1.5	28.9 \pm 12.4
		Field Site 2	10.6 \pm 0.6	10.4 \pm 0.5	10.1 \pm 9.0
		Lab (Cs-137)	18.1 \pm 0.8	17.2 \pm 0.9	16.2 \pm 6.8
<u>Teledyne Testing¹</u>					
89-1	LiF-100 Chips	Lab	21.0 \pm 0.4	22.4	--
89-2	Teledyne CaSO ₄ :Dy Cards	Lab	20.9 \pm 1.0	20.3	--

Table A-2. (continued)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Table A-3. In-house spiked samples.

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L		Expected Precision 1s, n=1 ^a
				TIML Result n=1	Known Activity	
QC-MI-16	Milk	Feb 1988	Sr-89	31.8±4.7	31.7±6.0	8.7
			Sr-90	25.5±2.7	27.8±3.5	5.2
			I-131	26.4±0.5	23.2±5.0	10.4
			Cs-134	23.8±2.3	24.2±6.0	8.7
			Cs-137	26.5±0.8	25.1±6.0	8.7
QC-MI-17	Milk	Feb 1988	I-131	10.6±1.2	14.3±1.6	10.4
QC-W-35	Water	Feb 1988	I-131	9.7±1.1	11.6±1.1	10.4
QC-W-36	Water	Mar 1988	I-131	10.5±1.3	11.6±1.0	10.4
QC-W-37	Water	Mar 1988	Sr-89	17.1±2.0	19.8±8.0	8.7
			Sr-90	18.7±0.9	17.3±5.0	5.2
QC-MI-18	Milk	Mar 1988	I-131	33.2±2.3	26.7±5.0	10.4
			Cs-134	31.3±2.1	30.2±5.0	8.7
			Cs-137	29.9±1.4	26.2±5.0	8.7
QC-W-38	Water	Apr 1988	I-131	17.1±1.1	14.2±5.0	10.4
QC-W-39	Water	Apr 1988	H-3	4439±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

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

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

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

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

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

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

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

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L		Expected Precision 1s, n=1 ^a
				TIML Result n=1	Known Activity	
QC-W-76	Water	Apr 1991	I-131	56.5±1.7	59.0±5.9	5.9
QC-W-77	Water	Apr 1991	Co-60	16.4±2.2	15.7±5.0	5.0
			Cs-134	23.8±2.5	22.6±5.0	5.0
			Cs-137	25.0±2.4	21.1±5.0	5.0
QC-W-78	Water	Apr 1991	H-3	4027±188	4080±408	408
QC-MI-35	Milk	Apr 1991	I-131	48.0±0.8	49.2±6.0	6.0
			Cs-134	19.2±2.0	22.6±5.0	5.0
			Cs-137	22.8±2.2	22.1±5.0	5.0
QC-W-79	Water	Jun 1991	Gr. alpha	7.4±0.7	7.8±5.0	5.0
			Gr. beta	11.0±0.7	11.0±5.0	5.0
QC-MI-36	Milk	Jul 1991	Sr-89	28.1±2.1	34.0±10.0	10.0
			Sr-90	11.6±0.7	11.5±3.0	3.0
			I-131	14.4±1.9	18.3±5.0	5.0
			Cs-137	34.3±3.0	35.1±5.0	5.0
QC-W-80	Water	Oct 1991	Sr-89	27.4±6.9	24.4±5.0	5.0
			Sr-90	11.7±1.4	14.1±5.0	5.0
QC-W-81	Water	Oct 1991	I-131	19.1±0.7	20.6±4.2	4.2
QC-W-82	Water	Oct 1991	Co-60	22.6±2.7	22.1±5.0	5.0
			Cs-134	15.5±1.8	17.6±5.0	5.0
			Cs-137	17.5±2.1	17.6±5.0	5.0
QC-W-83	Water	Oct 1991	H-3	4639±137	4382±438	438
QC-MI-37	Milk	Oct 1991	I-131	23.6±3.2	25.8±5.0	5.0
			Cs-134	22.7±2.8	22.1±5.0	5.0
			Cs-137	38.3±3.0	35.1±5.0	5.0
QC-W-84	Water	Dec 1991	Gr. alpha	6.2±0.6	7.8±5.0	5.0
			Gr. beta	11.0±0.7	11.0±5.0	5.0

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

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

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

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

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L)	
				Results (4.66 σ)	Acceptance Criteria (4.66 σ)
SPW-6625	Water	Dec 1988	Gr. alpha	<0.7	<1
			Gr. beta	<1.9	<4
SPS-6723	Milk	Jan 1989	Sr-89	<0.6	<5
			Sr-90	1.9 \pm 0.5 ^a	<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 ^a	<1
			I-131	<0.3	<1
			Cs-134	<6.4	<10
			Cs-137	<7.2	<10
SPW-7588	Water	Jun 1989	Gr. alpha	<0.2	<1
			Gr. beta	<1.0	<4
SPS-7322	Milk	Aug 1989	Sr-89	<1.4	<5
			Sr-90	4.8 \pm 1.0 ^a	<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 Cocle	Sample Type	Date Collected	Analysis	Concentration (pCi/L)	
				Results (4.66 σ)	Acceptance Criteria (4.66 σ)
SPS-7605	Milk	Nov 1989	I-131	<0.2	<1
			Cs-134	<8.6	<10
			Cs-137	<10	<10
SPW-7971	Water	Dec 1989	Gr. alpha	<0.4	<1
			Gr. beta	<0.8	<4
SPW-8039	Water	Jan 1990	Ra-226	<0.2	<1
SPS-8040	Milk	Jan 1990	Sr-89	<0.8	<5
			Sr-90	<1.0	<1
SPS-8208	Milk	Jan 1990	Sr-89	<0.8	<5
			Sr-90	1.6 ± 0.5^a	<1
			Cs-134	<3.6	<10
			Cs-137	<4.7	<10
SPS-8312	Milk	Feb 1990	Sr-89	<0.3	<5
			Sr-90	1.2 ± 0.3^a	<1
SPW-8312A	Water	Feb 1990	Sr-89	<0.6	<5
			Sr-90	<0.7	<5
SPS-8314	Milk	Mar 1990	I-131	<0.3	<1
SPS-8510	Milk	May 1990	I-131	<0.2	<1
			Cs-134	<4.6	<10
			Cs-137	<4.8	<10
SPW-8511A	Water	May 1990	H-3	<200	<300
SPS-8600	Milk	Jul 1990	Sr-89	<0.8	<5
			Sr-90	1.7 ± 0.6^a	<1
			I-131	<0.3	<1
			Cs-134	<5.0	<10
			Cs-137	<7.0	<10
SPM-8877	Milk	Aug 1990	I-131	<0.2	<1
SPW-8925	Water	Aug 1990	H-3	<200	<300

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

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

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

Lab Code	Sample Type	Date Collected	Analysis	Concentration (pCi/L)	
				Results (4.66 σ)	Acceptance Criteria (4.66 σ)
SPW-514	Water	Mar 1991	Sr-89	<1.1	<5
			Sr-90	<0.9	<1
SPW-586	Water	Apr 1991	I-131	<0.2	<1
			Co-60	<2.5	<5
			Cs-134	<2.1	<5
			Cs-137	<2.2	<5
SPS-587	Milk	Apr 1991	I-131	<0.2	<1
			Cs-134	<1.7	<5
			Cs-137	<1.9	<5
SPW-837	Water	Jun 1991	Gr. alpha	<0.6	<1
			Gr. beta	<1.1	<4
SPM-953	Milk	Jul 1991	Sr-89	<0.7	<5
			Sr-90	0.4 \pm 0.3 ^a	<1
			I-131	<0.2	<1
			Cs-137	<4.9	<5
SPM-1236	Milk	Oct 1991	I-131	<0.2	<1
			Cs-134	<3.7	<5
			Cs-137	<4.6	<5
SPW-1254	Water	Oct 1991	Sr-89	<2.8	<5
			Sr-90	<0.7	<1
SPW-1256	Water	Oct 1991	I-131	<0.4	<1
			Co-60	<3.6	<5
			Cs-134	<4.0	<5
			Cs-137	<3.6	<5
SPW-1259	Water	Oct 1991	H-3	<160	<300
SPW-1444	Water	Dec 1991	Gr. alpha	<0.4	<1
			Gr. beta	<0.8	<4

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

ATTACHMENT B

ACCEPTANCE CRITERIA FOR "SPIKED" SAMPLES

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

Analysis	Level	One Standard Deviation for Single Determination
Gamma Emitters	5 to 100 pCi/liter or kg >100 pCi/liter or kg	5 pCi/liter 5% of known value
Strontium-89 ^b	5 to 50 pCi/liter or kg >50 pCi/liter or kg	5 pCi/liter 10% of known value
Strontium 90 ^b	2 to 30 pCi/liter or kg >30 pCi/liter or kg	3.0 pCi/liter 10% of known value
Potassium	>0.1 g/liter or kg	5% of known value
Gross alpha	<20 pCi/liter >20 pCi/liter	5 pCi/liter 25% of known value
Gross beta	<100 pCi/liter >100 pCi/liter	5 pCi/liter 5% of known value
Tritium	<4,000 pCi/liter >4,000 pCi/liter	1s = (pCi/liter) = 169.85 x (known) .0933 10% of known value
Radium-226, -228	<0.1 pCi/liter	15% of known value
Plutonium	0.1 pCi/liter, gram, or sample	10% of known value
Iodine-131, Iodine-129 ^b	<55 pCi/liter >55 pCi/liter	6 pCi/liter 10% of known value
Uranium-238, Nickel-64 ^b , Technetium-99 ^b	<35 pCi/liter >35 pCi/liter	6 pCi/liter 15% of known value
Iron-55 ^b	50 to 100 pCi/liter >100 pCi/liter	10 pCi/liter 10% of known value

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

^b TIML limit.

ADDENDUM TO APPENDIX A

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

Lab Code	Analysis	TIML Result (pCi/L) ^a	EPA Control Limit (pCi/L) ^a	Explanation
STF-524	K	1010.7±158.5 ^b	1123.5-1336.5 ^b	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.
STW-534	Co-60	63.3±1.3	41.3-58.7	High level of Co-60 was due to contamination of beaker. Beaker discarded upon discovery of contamination and sample was recounted. Recount results were 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 of 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 though 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 cross check results were within the control limits. No further action is planned.

ADDENDUM TO APPENDIX A (continued)

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

^a Reported in pCi/L unless otherwise noted.

^b Concentrations are reported in mg/kg.

^c Concentrations are reported in mg/L.

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 = 2σ 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 4.66σ 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) ^b	Analysis (and Frequency) ^b
	No.	Codes (and Type) ^a		
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 E-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) ^b	Analysis (and Frequency) ^b
	No.	Codes (and Type) ^a		
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

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

^b 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.