Commonwealth Edison
Braidwood Nuclear Power Station
Route #1, Box 84
Braceville, Illinois 60407
Telephone 815/458-2801

April 24, 1992
BW/92-0249

Mr. A. Bert Davis
Administrator
Nuclear Regulatory Commission Region III
799 Roosevelt Road
Glen Ellyn, IL 60137

Dear Mr. Davis:

Subject: Part 3, Braidwood Station Operating Report
Docket Nos. STN 50-456 and STN 50-457

Enclosed is Part 3 of the 1991 Braidwood Station Operating Report, Docket Numbers STN 50-456 and STN 50-457. This report contains the results of the Radiological Environmental and Meteorogical Monitoring Programs. Part 1, facility operating experience was submitted under separate cover in February 1992, and Part 2, radioactive effluents in August 1991, and February 1992.

Two copies of the report are provided for your use. Two copies will be forwarded to the Document Control Desk and one copy to the Resident Inspector.

K. L. Kofron
Station Manager
Braidwood Nuclear Station

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BRAIDWOOD STATION

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

1991

MARCH 1992

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INTRODUCTION

Braidwood Station, a two-unit PWR plant, is located in Will County, Illinois, fifteen (15) miles south-southwest of Joliet, Illinois. Each reactor is designed to have a capacity of 1120 MW net. Unit No. 1 went critical on May 29, 1987, and Unit No. 2 went critical on March 8, 1988. The plant has been designed to keep releases to the environment at levels below those specified in the regulations.

Liquid effluents from Braidwood Station are released into the Kankakee River in controlled batches after radioassay of each batch. Gaseous effluents are released to the atmosphere and are calculated on the basis of analyses of daily grab samples and batch release analyses of noble gases and continuously collected composite samples of iodine, particulate and other matter. The results of effluent analyses are summarized on a monthly basis. Airborne concentrations of noble gases, I-131 and particulate radioactivity in offsite areas are calculated using isotopic composition of effluents and meteorological data.

Environmental monitoring is conducted by sampling at indicator and reference (control) locations in the vicinity of the Braidwood Station to measure changes in radiation or radioactivity levels that may be attributable to plant operations. If significant changes attributable to Braidwood Station are measured, these changes are correlated with effluent releases. External gamma radiation exposure from noble gases and I-131 in milk are the most critical pathways at this site; however, an environmental monitoring program is conducted which includes other pathways.

SUMMARY

Gaseous and liquid effluents for the period remained at a fraction of the Technical Specification limits. Calculations of environmental concentrations based on effluent, Kankakee River flow, and meteorological data for the period indicate that consumption by the public of radionuclides attributable to the plant are well below the regulatory limits. Radiation exposure from radionuclides released to the atmosphere represented the critical pathway for the period with a maximum individual dose estimated to be 2.82E-02 mrem for the year, when a shielding and occupancy factor of 0.7 is assumed. The assessment of radiation doses are performed in accordance with the Offsite Dose Calculation Manual (ODCM). The results of analysis confirm that the station is operating in compliance with 10CFR50 and 40CFR190.

The results of the current Radiological Environmental Monitoring Program are approximately those found during the preoperational studies conducted at the Braidwood Station.

1.0 EFFLUENTS

1.1 Gaseous Effluents to the Atmosphere

Measured concentrations and isotopic composition of noble gases, radioiodine, and particulate radioactivity released to the atmosphere during the year, are listed in Table 1.1-1. A total of 1.05E+04 curies of fission and activation gases was released from the station with a monthly average release rate of 1.63E+02 µCi/sec for each unit.

A total of 1.09E-02 curies of I-131 and I-133 were released during the year.

A total of 3.22E-04 curies of beta-gamma emitters and 1.45E-04 curies alpha emitters were released as airborne particulate matter.

A total of 97.39 curies of tritium was released.

1.2 Liquids Released to the Kankakee River

A total of 7.89E+07 liters of radioactive liquid waste (prior to dilution) containing 5.83 curies (excluding tritium, gases, and alpha) were discharged after dilution with a total of 4.49E+10 liters of water. These wastes were released at a monthly average concentration of 1.20E-07 µCi/ml, discharged on an unidentified nuclide basis. An undetectable amount of alpha radioactivity and 9.23E+02 curies of tritium were released from the station. Monthly release estimates and principal radionuclides in liquid effluents are given in Table 1.2-1.

2.0 SOLID RADIOACTIVE WASTE

Solid radioactive wastes were shipped to U.S Ecology, Richland, Washington and SEG and Quadrex, Oak Ridge, Tennessee. The record of shipments is summarized in Table 2.0-1.

3.0 DOSE TO MAN

3.1 Gaseous Effluent Pathways

Gamma Dose Rates

Gamma air and total body dose rates offsite were calculated based on measured release rates, isotopic composition of the noble gases, and meterological data for the period (Table 3.1-1). Isodose contours of gamma dose are shown in Figure 3.1-1 for the year Based on measured effluents and meteorological data, the maximum dose to an individual would be 2.82E-02 mrem for the year, with an

occupancy or shielding factor of 0.7 included. The maximum gamma air dose was 1.09E-01 mrad.

Beta Air and Skin Rates

The range of beta particles in air is relatively small (on the order of a few meters or less); consequently, plumes of gaseous effluents may be considered "infinite" for purpose of calculating the dose from beta radiation incident on the skin. However, the actual dose to sensitive skin tissues is difficult to calculate because this depends on the beta particle energies, thickness of inert skin, and clothing covering sensitive tissues. For purposes of this report the skin is taken to have a thickness of 7 mg/cm^2 and an occupancy factor of 1.0 is used. The skin dose from beta and gamma radiation for the year was 2.70E-01 mrem. The maximum offsite beta air dose for the year was 5.83E-01 mrad.

The air concentrations of radioactive noble gases at the offsite receptor locations are given in Figure 3.1-2.

Radioactive Iodine

The human thyroid concentrates ingested or inhaled iodine and the radionuclide I-131. Minimal levels of radioiodine released during routine operation of the plant may be made available to man, thus resulting in a dose to the thyroid. The pathway of interest for this radionuclide is ingestion of radioiodine in milk by an infant. Calculations are performed annually but the levels released from the station in previous years indicate that contributions to doses from inhalation of I-131 and I-133, and I-131 in milk are negligible.

Iodine-131 Concentrations in Air

The calculated concentration contours for I-131 in air are shown in Figure 3.1-3. Included in these calculations is an iodine cloud depletion factor which accounts for the phenomenon of elemental iodine deposition on the ground. The maximum offsite concentration is estimated to be 4.57E-03 pCi/m^3 for the year.

Dose to Infant's Thyroid

The hypothetical thyroid dose to an infant living near the plant via ingestion of milk was calculated. The radionuclide considered was I-131 and the source of milk was taken to be the nearest dairy farm with the cows pastured from May to October. The maximum infant's thyroid dose was 9.12E-02 mrem during the year (Table 3.1-1).

Concentrations of Particulates in Air

Concentration contours of radioactive airborne particulates are shown in Figure 3.1-4. The maximum offsite level is estimated to be 1.12E-04 pCi/m^3.

Summary of Doses

Table 3.1-1 summarizes the doses resulting from releases of airborne radioactivity via the different exposure pathways.

3.2 Liquid Effluent Pathways

The three principal pathways through the aquatic environment for potential doses to man from liquid waste are ingestion of potable water, eating aquatic foods, and exposure while walking on the shoreline. Not all of these pathways are applicable at a given time or station but a reasonable approximation of the dose can be made by adjusting the dose formula for season of the year or type and degree of use of the aquatic environment. NRC* developed equations were used to calculate the doses to the whole body, lower GI tract, thyroid, bone and skin; specific parameters for use in the equations are given in the Commonwealth Edison Offsite Dose Calculation Manual. The maximum whole body (total dose) dose for the year was 5.84E-02 mrem and no organ dose exceeded 5.26E-01 mrem.

3.3 Assessment of Dose to Member of Public

In section 3/4.11 of the Braidwood Technical Specifications, 40CFR190 calculations of total dose due to the Uranium fuel Cycle are required only when calculated doses from liquid or gaseous releases of radioactivity exceed certain levels. These levels are twice the following limits:

- The RETS limits on dose or dose commitment to a Member of the Public due to radioactive materials in liquid effluents from each reactor unit (1.5 mrem to the whole body or 5 mrem to any organ during any calendar quarter; 3 mrem to the whole body or 10 mrem to any organ during any calendar year).

- The RETS limits on air dose in noble gases released in gaseous effluents to a Member of the Public from each reactor unit (5 mrad for gamma radiation or

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* Nuclear Regulatory Commission, Regulatory Guide 1.109 (Rev. 1).

5 mrad for beta radiation during any calendar quarter; 10 mrad for gamma radiation or 20 mrad for beta radiation during any calendar year).

- The RETS limits on dose to a Member of the Public due to I-131, I-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released from each reactor unit (7.5 mrem to any organ during any calendar quarter; 15 mrem to any organ during any calendar year).

During the period January to December, 1991, Braidwood Station did not exceed these criteria offsite and members of the public did not exceed these criteria within the restricted area, as indicated by TLD measurements in Appendix III (assuming 100% occupancy).

4.0 SITE METEOROLOGY

A summary of the site meteorological measurements taken during each quarter of the year is given in Appendix II. The data are presented as cumulative joint frequency distributions of 203' level wind direction and wind speed class by atmospheric stability class determined from the temperature difference between the 199' and 30' levels. Data recovery for these measurements was about 99.3%.

5.0 ENVIRONMENTAL MONITORING

Table 5.0-1 provides an outline of the Radiological Environmental Monitoring Program as required in the Technical Specifications. Table 5.0-2 lists sample locations, sample collection frequencies and analyses performed. Sampling locations are shown in Figures 5.0-1 through 5.0-4. Concentrations of radioactivity in various media are summarized in Tables 5.0-3 through 5.0-6. Tables listing all data are presented in Appendix III.

Specific findings for various environmental media are discussed below.

5.1 Gamma Radiation

External radiation dose was measured at eight indicator and one reference (background) locations using $CaSO_4$:Tm thermoluminescent dosimeters (TLD). Additional TLDs have been installed such that each sector is covered at both five miles and the site boundary where possible.

Quarterly external radiation dose at nine air sampling locations averaged 14.2±1.4 mR and was similar to that measured in 1985 (12.0 mR), 1986 (12.6 mR), 1987 (14.4 mR), 1988 (13.6 mR), 1989 (13.5 mR),and 1990 (14.6 mR). The differences are not statistically significant.

5.2 Airborne I-131 and Particulate Radioactivity

Airborne I-131 concentration remained below the LLD of 0.07 pCi/m^3 throughout the year in all samples collected at the locations shown in Figure 5.0-1.

Gross beta concentrations ranged from 0.007 to 0.042 pCi/m^3, and averaged 0.022 pCi/m^3, slightly lower than the average concentration in 1985 (0.028 pCi/m^3), 1986 (0.034 pCi/m^3, except for the period from May 16 through June 7 when it was influenced by the reactor accident at Chernobyl), 1987 (0.027 pCi/m^3), 1988 (0.031 pCi/m^3), 1989 (0.028 pCi/m^3), and 1990 (0.024 pCi/m^3). The differences are not statistically significant.

All gamma-emitting isotopes activities were below their respective LLD levels. No radioactivity attributable to plant operation was detected in any of the samples.

5.3 Terrestrial Radioactivity

Vegetables were collected in August and analyzed for gamma-emitting isotopes. In addition, green leafy vegetables were analyzed for I-131. I-131 and gamma-emitting isotopes were below the limits of detection indicating that there was no measurable amount of radioactivity attributable to the station releases.

Well water was collected monthly from one offsite well and analyzed for gross beta, and gamma-emittinng isotopes. Quarterly composites were analyzed for tritium. The annual mean gross beta concentration was 28.3±3.0 and was similar to levels observed in 1985 (22.8 pCi/L), 1986 (25.2 pCi/L), 1987 (24.8 pCi/L), 1988 (27.4 pCi/L), 1989 (28.0 pCi/L), and 1990 (17.5 pCi/L). The differences are not statistically significant. All other results were below the lower limits of detection.

5.4 Aquatic Radioactivity

Monthly composites from the Kankakee River (upstream and downstream) were analyzed for gamma-emitting isotopes, and quarterly composites were analyzed for tritium.

Cesium-134 and -137 concentrations were below the LLD level of 10 pCi/L in all samples.

Tritium concentrations were below the LLD level of 200 pCi/L in most samples except those collected at the downstream Wilmington public water supply (571 pCi/L average), and in one quarterly composite (third quarter) from downstream samples (1518 pCi/L). In addition, tritium was detected in one quarterly composite intake water sample

(201 pCi/L). The presence of tritium in environmental samples is attributable to station operation.

Sediment samples were collected twice a year, from one indicator location, and analyzed for gamma-emitters. Cs-134 was detected in one sample (0.16 pCi/g dry weight). Cs-137 was detected in both samples and averaged 0.22 pCi/g dry weight. Also, Mn-54, Co-58 and Co-60 were detected in one sample (0.34, 4.4), and 1.59 pCi/g dry weight, respectively).

Levels of gamma radioactivity in fish were measured and found in all cases but two to be below the lower limits of detection for the program. Level of Cs-137 in one upstream and one downstream smallmouth bass was similar (0.20 and 0.23 pCi/g wet weight, respectively).

5.5 Milk

Milk samples were collected monthly from November through April and biweekly from May through October and analyzed for iodine-131 and gamma-emitting isotopes.

Iodine-131 concentration was below the LLD level of 0.5 pCi/L in all samples.

Cs-134 and Cs-137 were below the LLD level of 5 pCi/L. All other gamma-emitting isotopes, except naturally-occurring K-40, were below their respective LLDs. There was no indication of the effect on the environment due to station operation.

5.6 Sample Collections

All samples were collected as scheduled except those listed in Listing of Missed Samples, Appendix III.

5.7 Program Modifications

In October of 1991, the milk farm at Location BD-23 (Klausing farm, 4.3 miles at 83°) went out of business and was replaced by Gaddis Farm (BD-26), 11.1 miles at 122°.

In January 1991, one surface water Location BD-25 (Kankakee River upstream) was added to the program. The samples were collected monthly and analyzed for gamma-emitting isotopes. Quarterly composites were analyzed for tritium.

6.0 ANALYTICAL PROCEDURES

Procedures used for analyzing radioactivity in environmental samples are presented in Appendix V.

7.0 MILCH ANIMALS AND NEAREST CATTLE CENSUSES

Censuses of milch animals and nearest cattle was conducted within five miles of the Station. The survey was conducted by a "door-to-door" canvas and by information from Illinois Agricultural Agents. The censuses were conducted by A. Lewis on August 20, 1991.

Results of milch animal and nearest cattle censuses are presented in Appendix III.

8.0 NEAREST RESIDENCES CENSUS

A census of the nearest residences within a five (5) mile radius was conducted by A. Lewis on August 20, 1991.

Results of nearest residence census are presented in Appendix III.

9.0 INTERLABORATORY COMPARISON PROGRAM RESULTS

Teledyne's Interlaboratory Comparison Program results are presented in Appendix IV.

Commonwealth Edison's Thermoluminescent Dosimeter (TLD) Program is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) which requires biennual review and evaluation. In addition to the biennual ANSI testing requiremen Commonwealth Edison also tests to the ANSI standard during the n LAP visitation year. Commonwealth Edison additionally has an int nal irradiation program that tests each of the six nuclear station TLD processors once per quart r. The results of all TLD performance tests are retained by Commonwealth Edison's Corporate Radiation Protection Department.

APPENDIX 1

DATA TABLES AND FIGURES

TABLE 1.1-1

BRAIDWOOD NUCLEAR POWER STATION
SEMIANNUAL EFFLUENT REPORT FOR JANUARY THROUGH JUNE (99)
GASEOUS EFFLUENTS - MIXED MODE RELEASES
UNIT 1 (Docket Number 50-456)
SUMMATION OF ALL RELEASES

	UNITS	JAN	FEB	MAR	1st QUARTER	APR	MAY	JUN	2nd QUARTER
A. Fission and Activation Gas Releases									
1. Total Release Activity	Ci	8.42E+2	2.79E+2	3.66E+2	1.31E+3	1.60E+3	2.25E+2	7.25E+2	2.63E+3
2. Average Release Rate	uCi/sec	3.16E+2	1.07E+2	1.38E+2	1.78E+2	5.42E+2	1.08E+2	2.52E+2	3.01E+2
B. Iodine Releases									
1. Total I-131 Activity	Ci	1.12E-4	2.45E-5	6.42E-6	1.43E-4	< LLD	2.89E-3	2.45E-3	5.34E-3
2. Average Release Rate	uCi/sec	4.63E-5	1.35E-5	1.77E-6	2.05E-5	0.00	1.22E-3	8.23E-4	6.81E-4
C. Particulate (> 8 day half-life) Releases									
1. Gross Activity	Ci	< LLD	< LLD	6.95E-6	6.95E-6	1.19E-6	1.41E-5	2.08E-4	2.23E-4
2. Average Release Rate	uCi/sec	0.00	0.00	1.92E-6	6.40E-7	4.92E-7	5.96E-6	6.99E-5	2.55E-5
3. Gross Alpha Activity	Ci	1.98E-6	9.15E-7	3.15E-6	6.05E-6	6.67E-6	1.74E-5	1.33E-5	3.74E-5
D. Tritium Releases									
1. Total Release Activity	Ci	5.81E+0	3.56E+0	4.15E+0	1.35E+1	1.52E+0	4.93E-1	4.77E-1	2.49E+0
2. Average Release Rate	uCi/sec	2.69E+0	1.87E+0	2.49E-1	1.77E+0	4.90E-1	2.36E-1	1.66E-1	2.97E-1
E. Sum of Iodine, Particulate (> 8 day half-life), and Tritium Releases									
1. Total Activity	Ci	5.81E+0	7.56E+0	4.15E+0	1.35E+1	1.52E+0	4.96E-1	4.79E-1	2.49E+0

Note: LLD Values are included in Appendix A of this report.
Note: 5 % Limit Values are included in Appendix B of this report.

TABLE 1.1-1 (continued)

BRAIDWOOD NUCLEAR POWER STATION
SEMIANNUAL EFFLUENT REPORT FOR JULY THROUGH DECEMBER 1991
GASEOUS EFFLUENTS - MIXED MODE RELEASES
UNIT 1 (Docket Number 50-456)
SUMMATION OF ALL RELEASES

	UNITS	JUL	AUG	SEP	3rd QUARTER	OCT	NOV	DEC	4th QUARTER
A. Fission and Activation Gas Releases									
1. Total Release Activity	Ci	8.05E2	1.82E2	2.81E2	1.19E3	8.48E1	1.54E1	1.01E1	1.10E2
2. Average Release Rate	uCi/sec	2.58E2	5.44E1	1.06E2	1.53E2	1.93E1	6.05E0	3.77E0	9.71E0
B. Iodine Releases									
1. Total I-131 Activity	Ci	7.52E-5	5.92E-7	4.95E-5	1.23E-4	1.71E-4	8.94E-6	<LLD	1.77E-4
2. Average Release Rate	uCi/sec	2.41E-5	4.90E-7	2.05E-5	1.58E-5	3.92E-5	2.53E-6	0.00	1.39E-5
C. Particulate (> 8 day half-life) Releases									
1. Gross Activity	Ci	7.11E-5	7.64E-8	<LLD	7.12E-5	2.14E-6	2.87E-6	<LLD	5.01E-6
2. Average Release Rate	uCi/sec	2.28E-5	6.32E-8	0.00	7.62E-6	4.90E-7	1.13E-6	0.00	5.40E-7
3. Gross Alpha Activity	Ci	4.35E-6	7.41E-7	2.36E-6	7.41E-6	3.71E-5	2.86E-6	1.24E-6	4.10E-5
D. Tritium Releases									
1. Total Release Activity	Ci	7.29E-1	3.60E-2	2.20E0	3.04E0	2.46E1	2.81E1	2.81E1	7.28E1
2. Average Release Rate	uCi/sec	2.36E-1	2.98E-2	9.09E-1	3.98E-1	5.64E0	1.10E1	7.51E0	8.05E0
E. Sum of Iodine, Particulate (> 8 day half-life), and Tritium Releases									
1. Total Activity	Ci	7.29E-1	3.60E-2	2.20E0	3.04E0	2.46E1	2.81E1	2.81E1	7.28E1

Note: LLD Values are included in Apendix A of this report.
Note: % Limit Values are included in Appendix B of this report.

TABLE 1.1-1 (continued)

BRAIDWOOD NUCLEAR POWER STATION
SEMIANNUAL EFFLUENT REPORT FOR JANUARY THROUGH JUNE 1991
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES
UNIT 2 (Docket Number 50-457)
SUMMATION OF ALL RELEASES

	UNITS	JAN	FEB	MAR	1st QUARTER	APR	MAY	JUN	2nd QUARTER
A. Fission and Activation Gas Releases									
1. Total Release Activity	Ci	7.87E+1	6.81E+1	8.11E+2	9.58E+2	2.28E+2	6.98E+2	3.63E+2	1.29E+3
2. Average Release Rate	uCi/sec	1.69E+1	3.63E+1	1.89E+2	8.79E+1	1.82E+2	3.26E+2	1.24E+2	1.84E+2
B. Iodine Releases									
1. Total I-131 Activity	Ci	9.61E-6	1.34E-5	1.82E-4	2.07E-4	2.19E-5	4.35E-3	2.18E-4	4.59E-3
2. Average Release Rate	uCi/sec	1.97E-6	8.49E-6	5.87E-5	2.09E-5	6.85E-6	1.83E-3	7.25E-5	6.37E-4
C. Particulate (> 8 day half-life) Releases									
1. Gross Activity	Ci	< LLD	< LLD	5.24E-8	5.24E-8	< LLD	1.25E-5	2.95E-6	1.55E-5
2. Average Release Rate	uCi/sec	0.00	0.00	1.44E-8	4.67E-9	0.00	5.27E-6	9.91E-7	2.09E-6
3. Gross Alpha Activity	Ci	5.57E-7	1.89E-7	1.05E-6	1.72E-6	1.13E-6	3.61E-5	1.99E-6	4.12E-5
D. Tritium Releases									
1. Total Release Activity	Ci	6.25E-1	1.56E-1	7.81E-1	1.48E+0	1.29E-1	3.75E-1	8.69E-2	5.90E-1
2. Average Release Rate	uCi/sec	2.89E-1	8.21E-2	1.64E-1	1.78E-1	5.76E-2	1.75E-1	2.96E-2	8.74E-2
E. Sum of Iodine, Particulate (> 8 day half-life), and Tritium Releases									
1. Total Activity	Ci	6.25E-1	1.56E-1	7.81E-1	1.48E+0	1.29E-1	3.79E-1	8.69E-2	5.95E-1

Note: LLD Values are included in Appendix A of this report.
Note: % Limit Values are included in Appendix B of this report.

TABLE 1.1-1 (continued)

BRAIDWOOD NUCLEAR POWER STATION
SEMIANNUAL EFFLUENT REPORT FOR JULY THROUGH DECEMBER 1991
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES
UNIT 2 (Docket Number 50-457)
SUMMATION OF ALL RELEASES

	UNITS	JUL	AUG	SEP	3rd QUARTER	OCT	NOV	DEC	4th QUARTER
A. Fission and Activation Gas Releases									
1. Total Release Activity	Ci	2.42E3	3.72E2	2.15E2	3.01E3	2.98E1	2.61E0	8.67E-1	3.33E1
2. Average Release Rate	uCi/sec	7.75E2	3.98E2	8.09E1	3.91E2	3.83E0	1.82E0	3.24E-1	2.72E0
B. Iodine Releases									
1. Total Iodine Activity	Ci	1.08E-4	9.26E-5	1.22E-5	2.13E-4	1.40E-4	7.08E-8	8.59E-7	1.41E-4
2. Average Release Rate	uCi/sec	3.46E-5	7.66E-5	5.04E-6	3.87E-5	1.21E-5	2.78E-8	3.21E-7	1.08E-5
C. Particulate (> 8 day half-life) Releases									
1. Gross Activity	Ci	< LLD	< LLD	< LLD	< LLD	8.35E-7	< LLD	< LLD	8.35E-7
2. Average Release Rate	uCi/sec	0.00	0.00	0.00	0.00	1.45E-7	0.00	0.00	4.83E-8
3. Gross Alpha Activity	Ci	2.87E-6	1.71E-6	9.21E-7	5.51E-6	2.46E-6	1.54E-6	5.83E-7	4.58E-6
D. Tritium Releases									
1. Total Release Activity	Ci	4.[illegible]E-1	3.63E-1	2.83E-1	1.09E0	9.66E-1	4.39E-1	9.99E-1	2.40E0
2. Average Release Rate	uCi/sec	1.[illegible]E-1	1.00E-1	1.17E-1	1.06E-1	2.21E-1	1.72E-1	3.73E-1	2.55E-1
E. Sum of Iodine, Particulate (> 8 day half-life), and Tritium Releases									
1. Total Activity	Ci	4.42E-1	3.63E-1	2.83E-1	1.09E0	9.66E-1	4.39E-1	9.99E-1	2.40E0

Note: LLD Values are included in Appendix A of this report.
Note: % Limit Values are included in Appendix B of this report.

TABLE 1.2-1

BRAIDWOOD NUCLEAR POWER STATION
SEMIANNUAL EFFLUENT REPORT FOR JANUARY THROUGH JUNE 1991
LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES
UNIT 1 (Docket Number 50-456)
SUMMATION OF ALL RELEASES

	UNITS	JAN	FEB	MAR	1st QUARTER	APR	MAY	JUN	2nd QUARTER
A. Fission and Activation Products									
1. Total Activity Released	Ci	1.28E-2	1.08E-1	8.64E-2	2.05E-1	2.46E-1	6.89E-1	1.24E+0	2.09E+0
2. Average Concentration Released	uCi/ml	6.78E-9	5.59E-8	4.53E-8	3.59E-8	1.01E-7	3.22E-7	5.34E-7	3.15E-7
3. % of 10CFR50 Limits									
a. Quarterly Whole Body (1.5 mrem)	%	0.09	0.10	0.08	0.27	0.03	0.12	0.54	0.69
b. Quarterly Any Organ (5.0 mrem)	%	0.02	0.17	0.18	0.38	0.51	1.04	1.72	3.27
c. Annual Whole Body (3.0 mrem)	%	0.04	0.07	0.05	0.14	0.15	0.06	0.45	0.66
d. Annual Any Organ (10.0 mrem)	%	0.02	0.04	0.09	0.19	0.44	0.53	0.79	1.76
B. Tritium									
1. Total Activity Released	Ci	3.54E+1	5.20E+1	3.72E+1	1.25E+2	3.95E+1	2.50E+1	3.42E+1	9.87E+1
2. Average Concentration Released	uCi/ml	1.95E-5	2.69E-5	2.00E-5	2.19E-5	1.63E-5	1.32E-5	1.47E-5	1.49E-5
3. % of Limit (3E-3 uCi/ml)	%	6.16E-1	8.96E-1	6.66E-1	7.30E-1	5.41E-1	4.40E-1	4.90E-1	4.95E-1
C. Dissolved Noble Gases									
1. Total Activity Released	Ci	9.11E-3	2.69E-2	9.86E-3	4.96E-2	1.49E-2	1.21E-1	3.17E-2	1.68E-1
2. Average Concentration Released	uCi/ml	4.76E-9	1.36E-8	4.87E-9	7.82E-9	6.13E-9	6.40E-8	1.30E-8	2.53E-8
3. % of Limit (2E-4 uCi/ml)	%	2.38E-3	6.80E-3	2.44E-3	3.91E-3	3.07E-3	3.20E-2	6.50E-3	1.27E-2
D. Gross Alpha									
1. Total Activity Released	Ci	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD
2. Average Concentration Released	uCi/ml	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD
E. Volume of Liquid Waste to Discharge	liters	8.42E+5	2.91E+6	1.52E+6	7.27E+6	3.37E+6	4.20E+6	4.81E+6	1.17E+7
F. Volume of Dilution Water	liters	1.91E+9	1.93E+9	1.86E+9	5.70E+9	2.43E+9	1.89E+9	2.32E+9	6.64E+9

Note: LLD Values are included in Appendix A of this report.

TABLE 1.2-1 (continued)

BRAIDWOOD NUCLEAR POWER STATION
SEMI-ANNUAL EFFLUENT REPORT FOR JULY THROUGH DECEMBER 1991
LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES
UNIT 1 (Docket Number 50-456)
SUMMATION OF ALL RELEASES

	UNITS	JUL	AUG	SEP	3rd QUARTER	OCT	NOV	DEC	4th QUARTER
A. Fission and Activation Products									
1. Total Activity Released	Ci	2.85E-1	3.44E-2	4.58E-2	3.65E-1	2.13E-2	2.11E-1	2.36E-2	2.56E-1
2. Average Concentration Released	uCi/ml	1.59E-7	3.17E-8	2.29E-8	7.48E-8	1.24E-8	1.32E-7	1.20E-8	4.90E-8
3. % of 10CFR50 Limits									
a. Quarterly Whole Body (1.5 mrem)	%	0.20	0.08	0.07	0.35	0.05	0.86	0.05	0.96
b. Quarterly Any Organ (5.0 mrem)	%	0.61	0.08	0.08	0.77	0.07	0.37	0.06	0.50
c. Annual Whole Body (3.0 mrem)	%	0.10	0.04	0.03	0.17	0.03	0.43	0.02	0.46
d. Annual Any Organ (10.0 mrem)	%	0.31	0.04	0.04	0.39	0.03	0.18	0.04	0.45
B. Tritium									
1. Total Activity Released	Ci	6.07E+1	3.83E+1	2.38E+1	1.23E+2	2.46E+1	4.33E+1	4.70E+1	1.15E+2
2. Average Concentration Released	uCi/ml	3.29E-3	4.35E-3	1.19E-3	2.52E-3	1.43E-3	2.81E-3	2.40E-3	2.20E-3
3. % of Limit (1E-3 uCi/ml)	%	1.13E+0	1.19E+0	3.97E-1	2.71E+0	4.77E-1	9.37E-1	8.00E-1	2.21E+0
C. Dissolved Noble Gases									
1. Total Activity Released	Ci	1.54E-2	2.02E-2	2.05E-2	5.61E-2	1.16E-2	8.85E-3	2.67E-3	2.11E-2
2. Average Concentration Released	uCi/ml	8.60E-9	1.87E-8	1.03E-8	1.15E-8	6.74E-9	4.65E-9	1.36E-9	4.04E-9
3. % of Limit (2E-4 uCi/ml)	%	4.30E-3	9.35E-3	5.13E-3	1.80E-2	3.37E-3	2.22E-3	6.81E-4	6.27E-3
D. Gross Alpha									
1. Total Activity Released	Ci	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD
2. Average Concentration Released	uCi/ml	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD
E. Volume of Liquid Waste to Discharge	liters	4.59E+6	3.58E+6	3.25E+6	1.14E+7	2.97E+6	3.66E+6	2.45E+6	9.08E+6
F. Volume of Dilution Water	liters	1.79E+9	1.08E+9	2.00E+9	4.87E+9	1.72E+9	1.54E+9	1.96E+9	5.22E+9

Note: LLD Values are included in Appendix A of this report.

TABLE 1.2-1 (continued)

BRAIDWOOD NUCLEAR POWER STATION
SEMIANNUAL EFFLUENT REPORT FOR JANUARY THROUGH JUNE 1991
LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES
UNIT 2 (Docket Number 50-457)
SUMMATION OF ALL RELEASES

	UNITS	JAN	FEB	MAR	1st QUARTER	APR	MAY	JUN	2nd QUARTER
A. Fission and Activation Products									
1. Total Activity Released	Ci	1.28E-2	1.04E-1	8.64E-2	2.05E-1	2.96E-1	6.89E-1	1.24E+0	2.09E+0
2. Average Concentration Released	uCi/ml	6.79E-9	5.59E-8	4.53E-8	3.59E-8	1.01E-7	3.22E-7	5.34E-7	3.15E-7
3. % of 10CFR50 Limits									
a. Quarterly Whole Body (1.5 mrem)	%	8.89	6.10	8.08	8.27	8.03	8.12	8.54	8.69
b. Quarterly Any Organ (5.0 mrem)	%	6.83	6.17	8.18	8.38	8.51	1.84	1.72	3.27
c. Annual Whole Body (3.0 mrem) (*)	%	8.04	8.05	8.05	8.14	8.15	8.06	8.45	8.66
d. Annual Any Organ (10.0 mrem)	%	8.02	8.08	8.09	8.19	8.44	8.53	8.79	1.76
B. Tritium									
1. Total Activity Released	Ci	3.54E+1	5.20E+1	3.72E+1	1.25E+2	3.95E+1	2.56E+1	3.42E+1	9.87E+1
2. Average Concentration Released	uCi/ml	1.85E-5	2.69E-5	2.80E-5	2.19E-5	1.63E-5	1.32E-5	1.47E-5	1.49E-5
3. % of Limit (3E-3 uCi/ml)	%	6.16E-1	8.96E-1	6.66E-1	7.30E-1	5.41E-1	4.40E-1	4.90E-1	4.95E-1
C. Dissolved Noble Gases									
1. Total Activity Released	Ci	9.11E-3	2.64E-2	9.96E-3	4.86E-2	1.49E-2	1.21E-1	3.17E-2	1.84E-1
2. Average Concentration Released	uCi/ml	4.76E-9	1.36E-8	4.87E-9	7.82E-9	6.13E-9	6.40E-8	1.36E-8	2.53E-8
3. % of Limit (2E-4 uCi/ml)	%	2.38E-3	6.80E-3	2.44E-3	3.91E-3	3.07E-3	1.28E-2	6.80E-3	1.27E-2
D. Gross Alpha									
1. Total Activity Released	Ci	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD
2. Average Concentration Released	uCi/ml	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD
E. Volume of Liquid Waste to Discharge	Liters	8.42E+5	2.91E+6	3.52E+6	7.27E+6	3.37E+6	4.28E+6	4.61E+6	1.17E+7
F. Volume of Dilution Water	Liters	1.91E+9	1.93E+9	1.86E+9	5.70E+9	2.43E+9	1.89E+9	2.32E+9	6.64E+9

Note: LLD Values are included in Appendix A of this report.

TABLE 1.2-1 (continued)

BRAIDWOOD NUCLEAR POWER STATION
SEMI-ANNUAL EFFLUENT REPORT FOR JULY THROUGH DECEMBER 1991
LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES
UNIT 2 (Docket Number 50-457)
SUMMATION OF ALL RELEASES

	UNITS	JUL	AUG	SEP	3rd QUARTER	OCT	NOV	DEC	4th QUARTER
A. Fission and Activation Products									
1. Total Activity Released	Ci	2.85E-1	2.44E-2	4.58E-2	3.65E-1	2.13E-2	2.11E-1	2.30E-2	2.56E-1
2. Average Concentration Released	uCi/ml	1.59E-7	3.17E-8	2.29E-8	7.48E-8	1.24E-8	1.37E-7	1.20E-8	4.90E-8
3. % of 10CFR50 Limits									
a. Quarterly Whole Body (1.5 mrem)	%	0.20	0.08	0.07	0.35	0.05	0.86	0.05	0.96
b. Quarterly Any Organ (5.0 mrem)	%	0.62	0.08	0.08	0.77	0.07	0.27	0.04	0.50
c. Annual Whole Body (3.0 mrem)	%	0.10	0.04	0.03	0.17	0.03	0.43	0.02	0.48
d. Annual Any Organ (10.0 mrem)	%	0.21	0.04	0.04	0.29	0.03	0.18	0.04	0.25
B. Tritium									
1. Total Activity Released	Ci	6.07E+1	3.83E+1	2.38E+1	1.23E+2	2.46E+1	4.33E+1	4.70E+1	1.15E+2
2. Average Concentration Released	uCi/ml	3.39E-5	3.55E-5	1.19E-5	2.52E-5	1.43E-5	2.81E-5	2.40E-5	2.20E-5
3. % of Limit (3E-3 uCi/ml)	%	1.13E+0	1.18E+0	3.97E-1	2.71E+0	4.77E-1	9.37E-1	8.00E-1	2.21E+0
C. Dissolved Noble Gases									
1. Total Activity Released	Ci	1.54E-2	2.02E-2	2.05E-2	5.61E-2	1.16E-3	6.85E-3	2.67E-3	2.11E-2
2. Average Concentration Released	uCi/ml	8.60E-9	1.87E-8	1.03E-8	1.15E-8	6.74E-9	4.45E-9	1.36E-9	4.04E-9
3. % of Limit (2E-4 uCi/ml)	%	4.30E-3	9.35E-3	5.13E-3	1.88E-2	3.37E-3	2.22E-3	6.81E-4	6.27E-3
D. Gross Alpha									
1. Total Activity Released	Ci	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD
2. Average Concentration Released	uCi/ml	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD
E. Volume of Liquid Waste to Discharge	Liters	4.59E+6	3.58E+6	3.26E+6	1.14E+7	2.97E+6	3.66E+6	2.45E+6	9.08E+6
F. Volume of Dilution Water	Liters	1.79E+9	1.88E+9	2.00E+9	4.87E+9	1.72E+9	1.54E+9	1.96E+9	5.22E+9

Note: LLD Values are included in Appendix A of this report.

TABLE 2.0-1

SOLID RADIOACTIVE WASTE
UNIT 1 AND 2 COMBINED (Docket Number 50-456 and 50-457)

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL

DESCRIPTION	VOLUME (m^3)	CURIES	MAJOR NUCLIDES/CURIES	
Process Waste	6.26E+1	4.90E+1	FE55	CURIES= 2.54E+01 +/- 5.22E+00
		Error=2.81E+0%	CO58	CURIES= 8.36E+00 +/- 1.79E+00
			NI63	CURIES= 4.85E+00 +/- 4.79E+00
			H3	CURIES= 4.20E+00 +/- 4.77E+00
			CO60	CURIES= 3.34E+00 +/- 4.45E+00
			MN54	CURIES= 8.94E-01 +/- 4.49E+00
			CS137	CURIES= 4.20E-01 +/- 1.55E+00
			CS134	CURIES= 3.40E-01 +/- 1.60E+00
			NB95	CURIES= 2.71E-01 +/- 3.33E+00
			CR51	CURIES= 2.11E+01 +/- 1.86E+00
			I131	CURIES= 2.09E-01 +/- 1.28E+00
			ZR95	CURIES= 1.55E-01 +/- 2.95E+00
			FE59	CURIES= 1.44E-01 +/- 4.74E+00
			C14	CURIES= 7.65E-02 +/- 2.97E+00
			SB125	CURIES= 5.46E-03 +/- 1.69E+00
Dry Active Waste	3.25E+2	3.51E+0	FE55	CURIES= 1.30E+00 +/- 2.77E+00
		Error=1.35E-0%	CO58	CURIES= 9.49E-01 +/- 2.78E+00
			NI63	CURIES= 4.62E-01 +/- 2.77E+00
			CO60	CURIES= 2.31E-01 +/- 2.77E+00
			MN54	CURIES= 2.30E-01 +/- 2.77E+00
			CR51	CURIES= 1.30E-01 +/- 2.78E+00
			NB95	CURIES= 1.04E-01 +/- 2.78E+00
			FE59	CURIES= 3.47E-02 +/- 2.78E+00
			ZR95	CURIES= 2.06E-02 +/- 2.78E+00
			PU241	CURIES= 1.88E-02 +/- 2.77E+00
			C14	CURIES= 1.16E-02 +/- 2.17E+00
			ZN65	CURIES= 8.77E-03 +/- 2.77E+00
			CS137	CURIES= 6.09E-03 +/- 2.77E+00
			CO57	CURIES= 4.18E-03 +/- 2.77E+00
			PU239	CURIES= 8.35E-04 +/- 2.77E+00
Irradiated Components		0.00E+0	0.00E+0	
Other:				

Number of Shipments: 16
Mode of Transportation: Exclusive Use Vehicle
Destination: U.S. Ecology, Richland, WA (11)
SEG, Oak Ridge, TN (1)
Quadrex, Oak Ridge, TN (4)

B. IRRADIATED FUEL SHIPMENTS

No irradiated fuel shipments for January through June, 1991

TABLE 2.0-1 (continued)

BRAIDWOOD NUCLEAR POWER STATION
SEMIANNUAL EFFLUENT REPORT FOR JULY THROUGH DECEMBER 1991
SOLID RADIOACTIVE WASTE
UNIT 1 AND 2 COMBINED (Docket Number 50-456 and 50-457)

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL

DESCRIPTION	VOLUME (m^3)	CURIES	MAJOR NUCLIDES/CURIES	
Process Waste	4.71E+2	8.50E+0	CO58	Curies = 5.74E+00 +/- 1.24E+00%
		Error = 9.18E-1%	FE55	Curies = 7.74E-01 +/- 1.19E+00%
			CO60	Curies = 5.82E-01 +/- 1.19E+00%
			NI63	Curies = 5.31E-01 +/- 1.19E+00%
			MN54	Curies = 2.49E-01 +/- 1.24E+00%
			H3	Curies = 1.96E-01 +/- 1.48E+00%
			CR51	Curies = 1.84E-01 +/- 1.49E+00%
			CS137	Curies = 1.56E-01 +/- 1.51E+00%
			CS134	Curies = 1.19E-01 +/- 1.48E+00%
			NB95	Curies = 7.09E-02 +/- 1.28E+00%
			SB125	Curies = 6.92E-02 +/- 1.28E+00%
			ZR95	Curies = 4.20E-02 +/- 1.29E+00%
			FE59	Curies = 3.48E-02 +/- 1.22E+00%
			C14	Curies = 3.48E-02 +/- 1.19E+00%
			I131	Curies = 2.47E-02 +/- 2.00E+00%
Dry Active Waste	4.71E+2	3.81E+0	FE55	Curies = 1.43E+00 +/- 2.27E+00%
		ERROR = 1.12E+0%	CO58	Curies = 1.01E+00 +/- 2.28E+00%
			NI63	Curies = 5.12E-01 +/- 2.27E+00%
			CO60	Curies = 2.56E-01 +/- 2.27E+00%
			MN54	Curies = 2.53E-01 +/- 2.27E+00%
			CR51	Curies = 1.30E-01 +/- 2.30E+00%
			NB95	Curies = 1.08E-01 +/- 2.29E+00%
			FE59	Curies = 3.61E-02 +/- 2.29E+00%
			ZR95	Curies = 2.18E-02 +/- 2.28E+00%
			PU241	Curies = 2.09E-02 +/- 2.27E+00%
			C14	Curies = 1.28E-02 +/- 2.27E+00%
			ZN65	Curies = 9.61E-03 +/- 2.27E+00%
			CS137	Curies = 6.75E-03 +/- 2.27E+00%
			CO57	Curies = 4.58E-03 +/- 2.27E+00%
			PU239	Curies = 7.04E-04 +/- 2.27E+00%
Irradiated Components		0.00E+0		0.00E+0

Other:

Number of Shipments: 15
Mode of Transportation: Exclusive Use Vehicle
Destination: U S. Ecology, Richland, WA (8)
Quadrex, Oak Ridge, TN (7)

B. IRRADIATED FUEL SHIPMENTS

No irradiated fuel shipments for July through December, 1991

NOTE: Actual burial volume of process and dry active waste = 8.50E+1m^3.

TABLE 2.0-1 (continued)

BRAIDWOOD NUCLEAR POWER STATION
SEMI ANNUAL EFFLUENT REPORT FOR JANUARY THROUGH JUNE 1991
SOLID RADIOACTIVE WASTE
UNIT 1 AND 2 COMBINED (Docket Numbers 50-456 and 50-457)

Shipment Number	Waste Class	Type of Container	Solidification Agent or Absorbent
RWS-91-001	A	LSA	NONE
RWS-91-002	A	LSA	NONE
RWS-91-003	A	LSA	NONE
RWS-91-004	A	LSA	NONE
RWS-91-005	A	LSA	NONE
RWS-91-006	A	LSA	NONE
RWS-91-007	B	LSA	NONE
RWS-91-008	A	LSA	NONE
RWS-91-009	A	LSA	NONE
RWS-91-010	A	LSA	NONE
RWS-91-011	A	LSA	NONE
RWS-91-012	A	LSA	NONE
RWS-91-013	A	LSA	NONE
RWS-91-014	A	LSA	NONE
RWS-91-015	A	LSA	NONE
RWS-91-016	A	LSA	NONE

TABLE 2.0-1 (continued)

BRAIDWOOD NUCLEAR POWER STATION
SEMI ANNUAL EFFLUENT REPORT FOR JULY THROUGH DECEMBER 1991
SOLID RADIOACTIVE WASTE
UNIT 1 AND 2 COMBINED (Docket Numbers 50-456 and 50-457)

Shipment Number	Waste Class	Type of Container	Solidification Agent or Absorbent
BWS-91-017	A	LSA	NONE
BWS-91-018	A	LSA	NONE
BWS-91-019	A	LSA	NONE
BWS-91-020	A	LSA	NONE
BWS-91-021	A	LSA	NONE
BWS-91-022	A	LSA	NONE
BWS-91-023	A	LSA	NONE
BWS-91-024	A	LSA	NONE
BWS-91-025	A	LSA	NONE
BWS-91-026	A	LSA	NONE
BWS-91-027	A	LSA	NONE
BWS-91-028	A	LSA	NONE
BWS-91-029	A	LSA	NONE
BWS-91-030	A	LSA	NONE
BWS-91-031	A	LSA	NONE

FIGURE 3.1-1

Estimated Cumulative Gamma Dose (in mrem) from the Braidwood Station for the period January-December 1991

Isopleth Labels
Small figure - multiply by 10^{-4}
Large figure - multiply by 10^{-4}

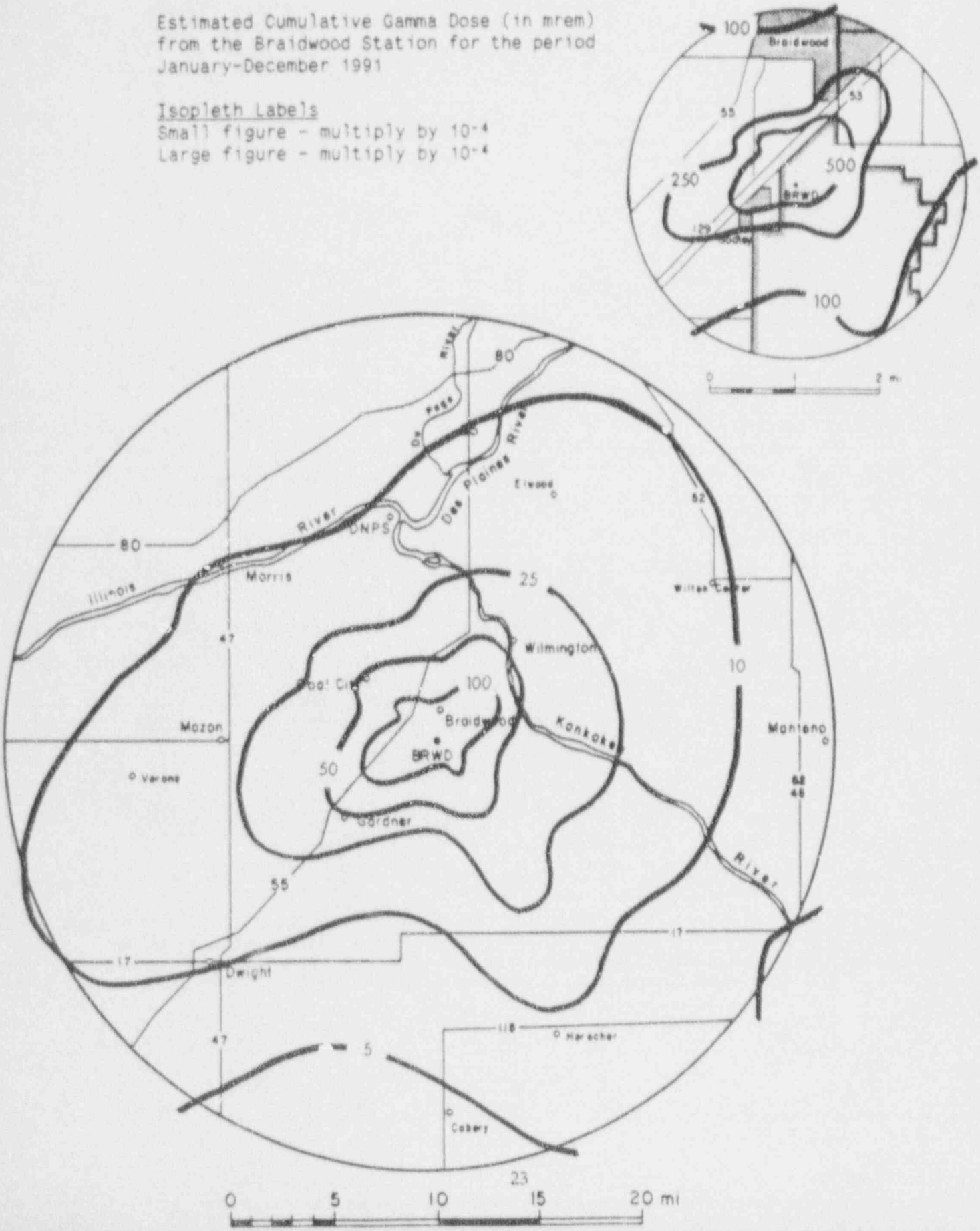


FIGURE 3.1-2

Estimated Total Concentrations (in pCi/m^3) of Noble Gases from the Braidwood Station for the period January-December 1991

Isopleth Labels
Small figure - multiply by 10^{+1}
Large figure - multiply by 10^{+0}

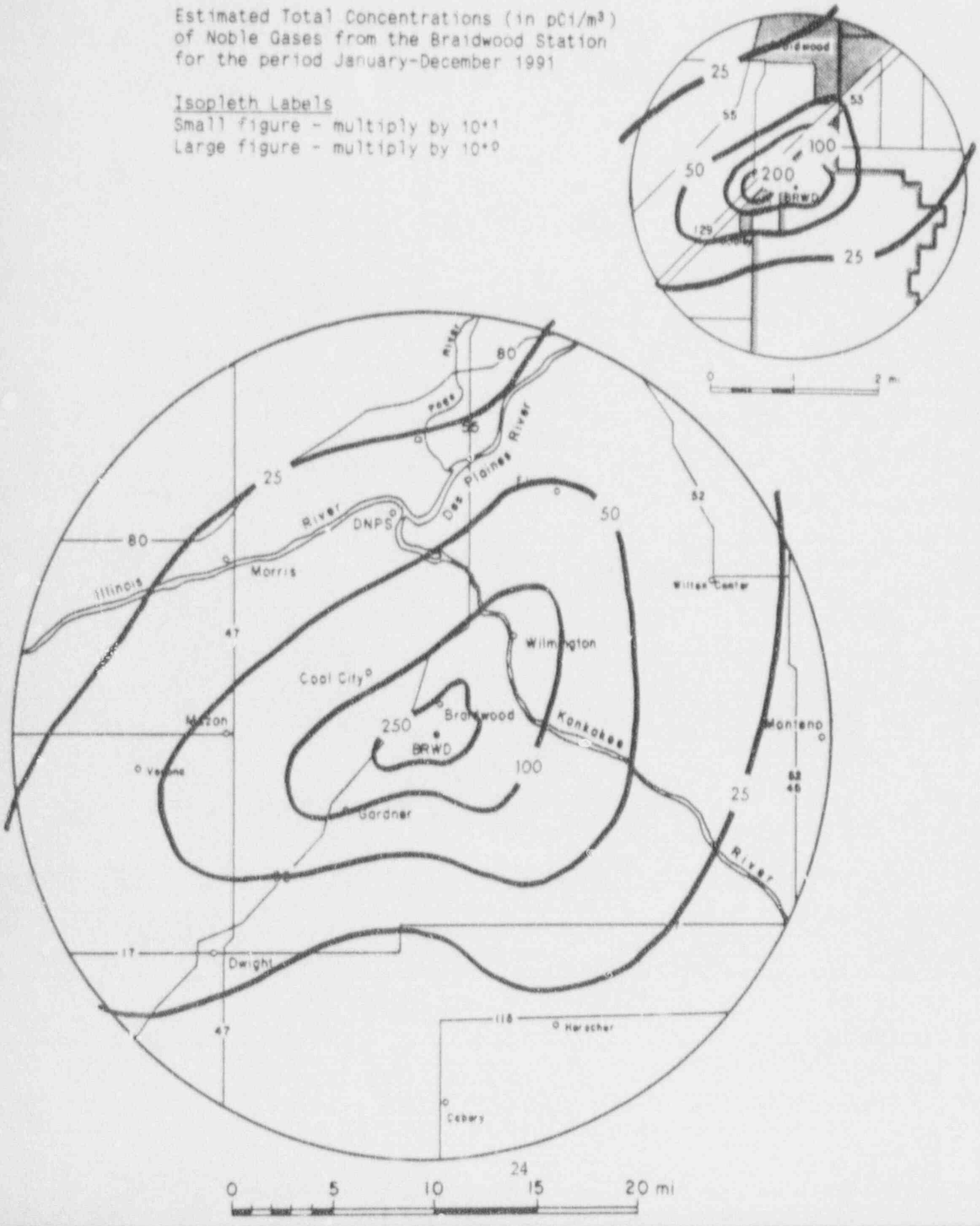


FIGURE 3.1-3

Estimated Total Concentrations (in pCi/m^3) of Iodine from the Braidwood Station for the period January-December 1991

Isopleth Labels
Small figure - multiply by 10^{-5}
Large figure - multiply by 10^{-6}

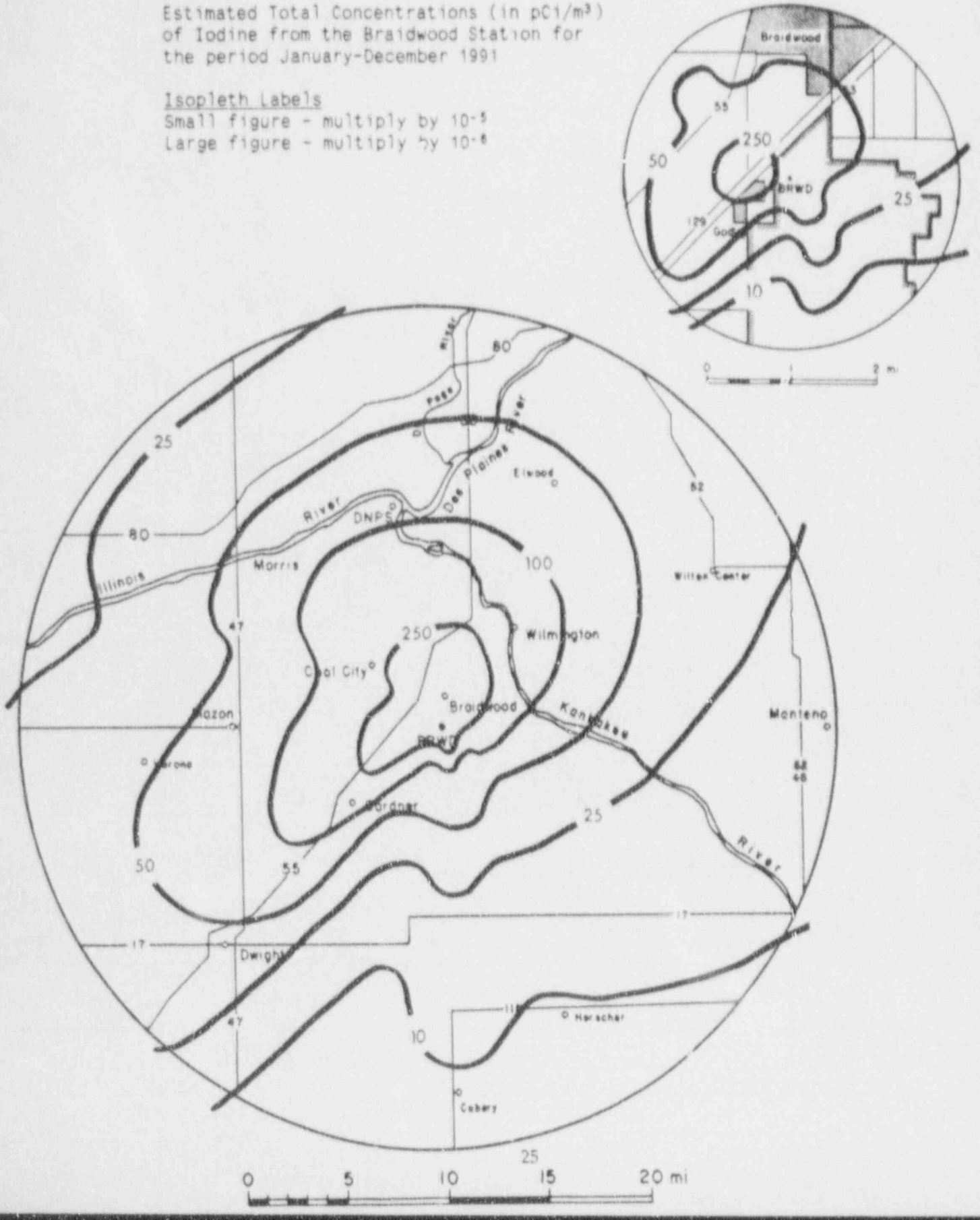
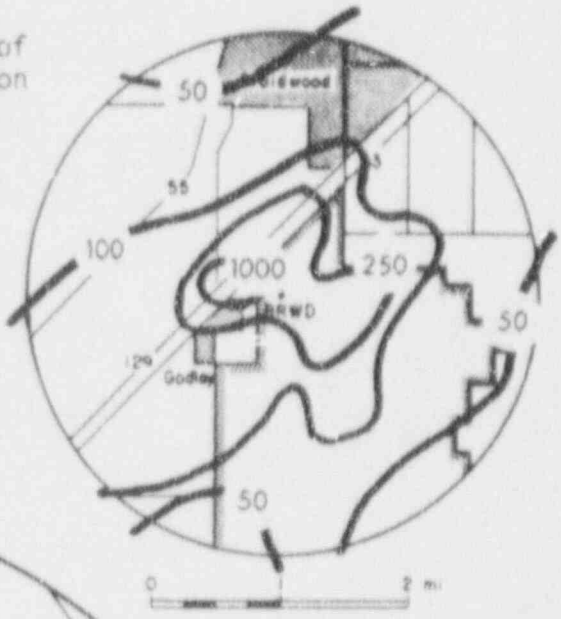


FIGURE 3.1-4

Estimated Total Concentrations (in pCi/m^3) of Particulate Matter from the Braidwood Station for the period January-December 1991

Isopleth Labels
Small figure - multiply by 10^{-7}
Large figure - multiply by 10^{-7}



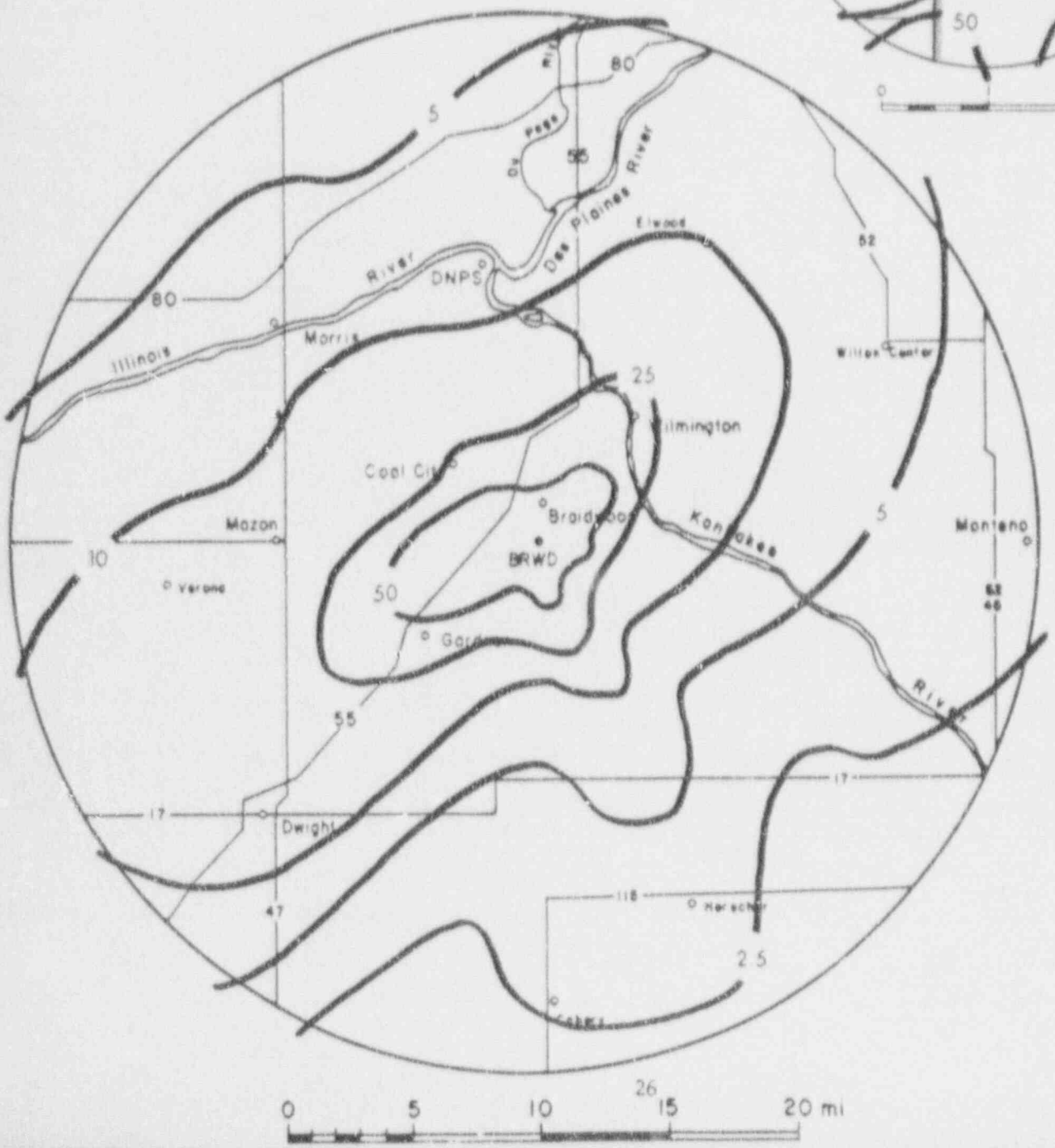


TABLE 3.1-1

BRAIDWOOD UNIT ONE

1991 ANNUAL REPORT
MAXIMUM DOSES RESULTING FROM AIRBORNE RELEASES
PERIOD OF RELEASE - 01/01/91 TO 12/31/91 CALCULATED 04/23/92
INFANT RECEPTOR

TYPE	1ST QUARTER JAN-MAR	2ND QUARTER APR-JUN	3RD QUARTER JUL-SEP	4TH QUARTER OCT-DEC	ANNUAL
GAMMA AIR (MRAD)	2.98E-02 (W)	3.11E-02 (W)	8.68E-03 (W)	7.83E-04 (W)	7.03E-02 (W)
BETA AIR (MRAD)	1.55E-01 (W)	1.61E-01 (W)	4.84E-02 (W)	4.42E-03 (W)	3.69E-01 (W)
TOT. BODY (MREM)	7.95E-03 (W)	8.41E-03 (W)	2.12E-03 (W)	1.85E-04 (W)	1.87E-02 (W)
SKIN (MREM)	7.32E-02 (W)	7.56E-02 (W)	2.20E-02 (W)	1.94E-03 (W)	1.73E-01 (W)
ORGAN (MREM)	3.28E-03 (E)	3.53E-02 (E)	1.15E-03 (E)	1.86E-02 (E)	5.84E-02 (E)
	THYROID	THYROID	THYROID	THYROID	THYROID

THIS IS A REPORT FOR THE CALENDAR YEAR 1991

COMPLIANCE STATUS - 10 CFR 50 APP. I
INFANT RECEPTOR

	QTRLY OBJ	1ST QTR JAN-MAR	2ND QTR APR-JUN	3RD QTR JUL-SEP	4TH QTR OCT-NOV	YRLY OBJ	% OF APP.I
		---------- % OF APP I. ----------					
GAMMA AIR (MRAD)	5.0	0.60	0.62	0.17	0.02	10.0	0.70
BETA AIR (MRAD)	10.0	1.55	1.61	0.48	0.04	20.0	1.85
TOT. BODY (MREM)	2.5	0.32	0.34	0.08	0.01	5.0	0.37
SKIN (MREM)	7.5	0.98	1.01	0.29	0.03	15.0	1.15
ORGAN (MREM)	7.5	0.04	0.47	0.02	0.25	15.0	0.39
		THYROID	THYROID	THYROID	THYROID		THYROID

TABLE 3.1-1 (continued)

BRAIDWOOD UNIT ONE

1991 ANNUAL REPORT
MAXIMUM DOSES RESULTING FROM AIRBORNE RELEASES
PERIOD OF RELEASE - 01/01/91 TO 12/31/91 CALCULATED 04/23/92
ADULT RECEPTOR

TYPE	1ST QUARTER JAN-MAR	2ND QUARTER APR-JUN	3RD QUARTER JUL-SEP	4TH QUARTER OCT-DEC	ANNUAL
GAMMA AIR (MRAD)	2.98E-02 (W)	3.11E-02 (W)	8.68E-03 (W)	7.83E-04 (W)	7.03E-02 (W)
BETA AIR (MRAD)	1.55E-01 (W)	1.61E-01 (W)	4.84E-02 (W)	4.42E-03 (W)	3.69E-01 (W)
TOT. BODY (MREM)	7.95E-03 (W)	8.41E-03 (W)	2.12E-03 (W)	1.85E-04 (W)	1.87E-02 (W)
SKIN (MREM)	7.32E-02 (W)	7.56E-02 (W)	2.20E-02 (W)	1.94E-03 (W)	1.73E-01 (W)
ORGAN (MREM)	1.63E-03 (N)	6.35E-02 (N)	7.81E-03 (N)	6.46E-02 (N)	1.37E-01 (N)
	THYROID	THYROID	THYROID	THYROID	THYROID

THIS IS A REPORT FOR THE CALENDAR YEAR 1991

COMPLIANCE STATUS - 10 CFR 50 APP. I
ADULT RECEPTOR

	QTRLY OBJ	1ST QTR JAN-MAR	2ND QTR APR-JUN	3RD QTR JUL-SEP	4TH QTR OCT-NOV	YRLY OBJ	% OF APP. I
		---------- % OF APP I. ----------					
GAMMA AIR (MRAD)	5.0	0.60	0.62	0.17	0.02	10.0	0.70
BETA AIR (MRAD)	10.0	1.55	1.61	0.48	0.04	20.0	1.85
TOT. BODY (MREM)	2.5	0.32	0.34	0.08	0.01	5.0	0.37
SKIN (MREM)	7.5	0.98	1.01	0.29	0.03	15.0	1.15
ORGAN (MREM)	7.5	0.02	0.85	0.10	0.86	15.0	0.92
		THYROID	THYROID	THYROID	THYROID		THYROID

TABLE 3.1-1 (continued)

BRAIDWOOD UNIT TWO

1991 ANNUAL REPORT
MAXIMUM DOSES RESULTING FROM AIRBORNE RELEASES
PERIOD OF RELEASE - 01/01/91 TO 12/31/91 CALCULATED 04/23/92
INFANT RECEPTOR

TYPE	1ST QUARTER JAN-MAR	2ND QUARTER APR-JUN	3RD QUARTER JUL-SEP	4TH QUARTER OCT-DEC	ANNUAL
GAMMA AIR (MRAD)	6.88E-03 (W)	9.55E-03 (W)	2.19E-02 (W)	2.34E-04 (W)	3.86E-02 (W)
BETA AIR (MRAD)	3.87E-02 (W)	5.24E-02 (W)	1.22E-01 (W)	1.35E-03 (W)	2.14E-01 (W)
TOT. BODY (MREM)	1.66E-03 (W)	2.39E-03 (W)	5.43E-03 (W)	5.61E-05 (W)	9.53E-03 (W)
SKIN (MREM)	1.73E-02 (W)	2.38E-02 (W)	5.49E-02 (W)	5.98E-04 (W)	9.67E-02 (W)
ORGAN (MREM)	3.86E-04 (E)	2.98E-02 (E)	1.09E-03 (E)	1.45E-03 (E)	3.27E-02 (E)
	THYROID	THYROID	THYROID	THYROID	THYROID

THIS IS A REPORT FOR THE CALENDAR YEAR 1991

COMPLIANCE STATUS - 10 CFR 50 APP. I
INFANT RECEPTOR

	QTRLY OBJ	1ST QTR JAN-MAR	2ND QTR APR-JUN	3RD QTR JUL-SEP	4TH QTR OCT-NOV	YRLY OBJ	% OF APP.I
		---------- % OF APP I. ----------					
GAMMA AIR (MRAD)	5.0	0.14	0.19	0.44	0.00	10.0	0.39
BETA AIR (MRAD)	10.0	0.39	0.52	1.22	0.01	20.0	1.07
TOT. BODY (MREM)	2.5	0.07	0.10	0.22	0.00	5.0	0.19
SKIN (MREM)	7.5	0.23	0.32	0.73	0.01	15.0	0.64
ORGAN (MREM)	7.5	0.01	0.40	0.01	0.02	15.0	0.22
		THYROID	THYROID	THYROID	THYROID		THYROID

TABLE 3.1-1 (continued)

BRAIDWOOD UNIT TWO

1991 ANNUAL REPORT
MAXIMUM DOSES RESULTING FROM AIRBORNE RELEASES
PERIOD OF RELEASE - 01/01/91 TO 12/31/91 CALCULATED 04/23/92
ADULT RECEPTOR

TYPE	1ST QUARTER JAN-MAR	2ND QUARTER APR-JUN	3RD QUARTER JUL-SEP	4TH QUARTER OCT-DEC	ANNUAL
GAMMA AIR (MRAD)	6.88E-03 (W)	9.55E-03 (W)	2.19E-02 (W)	2.34E-04 (W)	3.86E-02 (W)
BETA AIR (MRAD)	3.87E-02 (W)	5.24E-02 (W)	1.22E-01 (W)	1.35E-03 (W)	2.14E-01 (W)
TOT. BODY (MREM)	1.66E-03 (W)	2.39E-03 (W)	5.43E-03 (W)	5.61E-05 (W)	9.53E-03 (W)
SKIN (MREM)	1.73E-02 (W)	2.38E-02 (W)	5.49E-02 (W)	5.98E-04 (W)	9.67E-02 (W)
ORGAN (MREM)	2.56E-04 (N)	5.32E-02 (N)	3.98E-03 (N)	3.93E-03 (N)	6.14E-02 (N)
	THYROID	THYROID	THYROID	THYROID	THYROID

THIS IS A REPORT FOR THE CALENDAR YEAR 1991

COMPLIANCE STATUS - 10 CFR 50 APP. I
ADULT RECEPTOR

	QTRLY OBJ	% OF APP I. 1ST QTR JAN-MAR	2ND QTR APR-JUN	3RD QTR JUL-SEP	4TH QTR OCT-NOV	YRLY OBJ	% OF APP.I
GAMMA AIR (MRAD)	5.0	0.14	0.19	0.44	0.00	10.0	0.39
BETA AIR (MRAD)	10.0	0.39	0.52	1.22	0.01	20.0	1.07
TOT. BODY (MREM)	2.5	0.07	0.10	0.22	0.00	5.0	0.19
SKIN (MREM)	7.5	0.23	0.32	0.73	0.01	15.0	0.64
ORGAN (MREM)	7.5	0.00	0.71	0.05	0.05	15.0	0.41
		THYROID	THYROID	THYROID	THYROID		THYROID

TABLE 3.2-1

BRAIDWOOD UNIT ONE
ADULT RECEPTOR

1991 ANNUAL REPORT
MAXIMUM DOSES (MREM) RESULTING FROM LIQUID EFFLUENTS
PERIOD OF RELEASE - 01/01/91 TO 12/31/91 CALCULATED 02/27/92

DOSE TYPE	1ST QUARTER JAN-MAR	2ND QUARTER APR-JUN	3RD QUARTER JUL-SEP	4TH QUARTER OCT-DEC	ANNUAL
TOTAL BODY	4.09E-03	5.40E-03	5.25E-03	1.44E-02	2.92E-02
INTERNAL ORGAN	1.92E-02	1.80E-01	3.86E-02	2.51E-02	2.63E-01
	GI-LLI	GI-LLI	GI-LLI	GI-LLI	GI-LLI

THIS IS A REPORT FOR THE CALENDAR YEAR 1991

COMPLIANCE STATUS - 10 CFR 50 APP. I

	QTRLY OBJ	% OF APP I. 1ST QTR JAN-MAR	2ND QTR APR-JUN	3RD QTR JUL-SEP	4TH QTR OCT-NOV	YRLY OBJ	% OF APP.I
TOTAL BODY (MREM)	1.5	0.27	0.36	0.35	0.96	3.0	0.97
CRIT. ORGAN(MREM)	5.0	0.38	3.59	0.77	0.50	10.0	2.63
		GI-LLI	GI-LLI	GI-LLI	GI-LLI		GI-LLI

TABLE 3.2-1 (continued)

BRAIDWOOD UNIT TWO
ADULT RECEPTOR

1991 ANNUAL REPORT
MAXIMUM DOSES (MREM) RESULTING FROM LIQUID EFFLUENTS
PERIOD OF RELEASE - 01/01/91 TO 12/31/91 CALCULATED 02/27/92

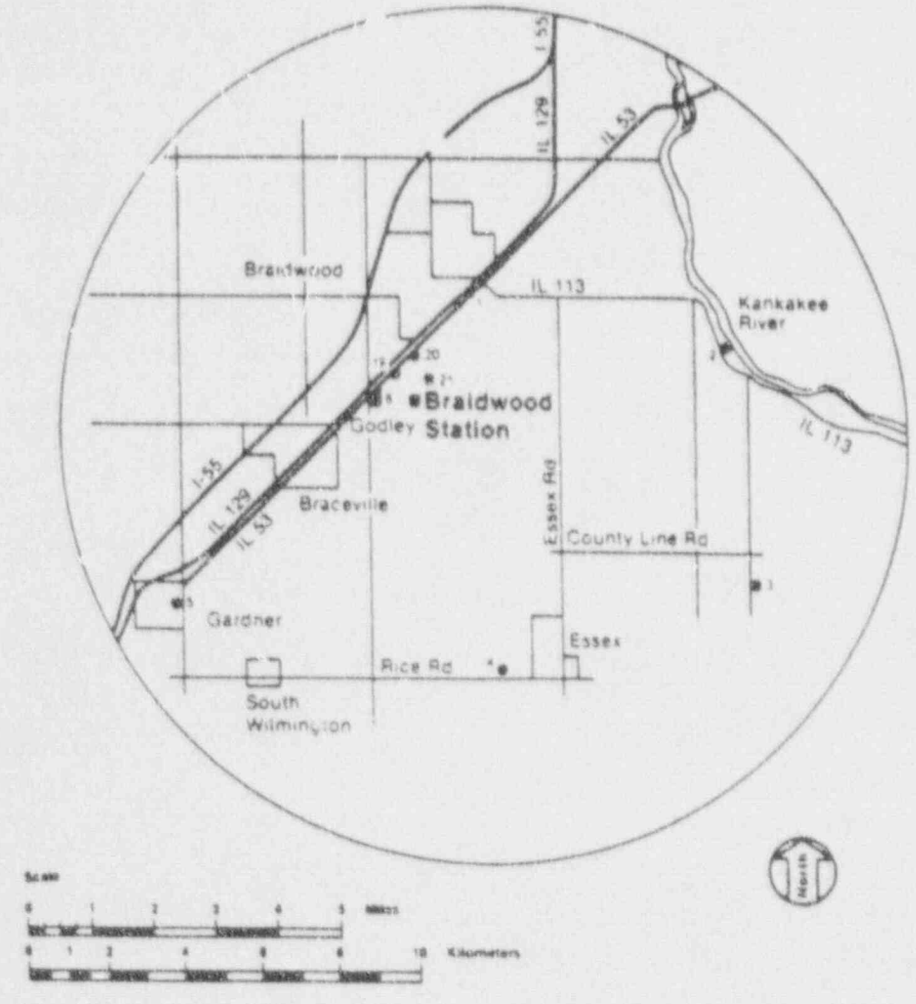
DOSE TYPE	1ST QUARTER JAN-MAR	2ND QUARTER APR-JUN	3RD QUARTER JUL-SEP	4TH QUARTER OCT-DEC	ANNUAL
TOTAL BODY	4.09E-03	3.40E-03	5.25E-03	1.44E-02	2.92E-02
INTERNAL ORGAN	1.92E-02	1.80E-01	3.86E-02	2.51E-02	2.63E-01
	GI-LLI	GI-LLI	GI-LLI	GI-LLI	GI-LLI

THIS IS A REPORT FOR THE CALENDAR YEAR 1991

COMPLIANCE STATUS - 10 CFR 50 APP. I

	QTRLY OBJ	% OF APP I. 1ST QTR JAN-MAR	2ND QTR APR-JUN	3RD QTR JUL-SEP	4TH QTR OCT-NOV	YRLY OBJ	% OF APP.I
TOTAL BODY (MREM)	1.5	0.27	0.36	0.35	0.96	3.0	0.97
CRIT. ORGAN(MREM)	5.0	0.38	3.59	0.77	0.50	10.0	2.63
		GI-LLI	GI-LLI	GI-LLI	GI-LLI		GI-LLI

FIGURE 5.0-1



BD-01 Braidwood
BD-02 Custer Park
BD-03 County Line Road
BD-04 Essex
BD-05 Gardner
BD-06 Godley
BD-19 Near Site Northwest
BD-20 Near Site North
BD-21 Near Site Northeast

BRAIDWOOD STATION

FIXED AIR SAMPLING AND TLD SITES

FIGURE 5.0-2

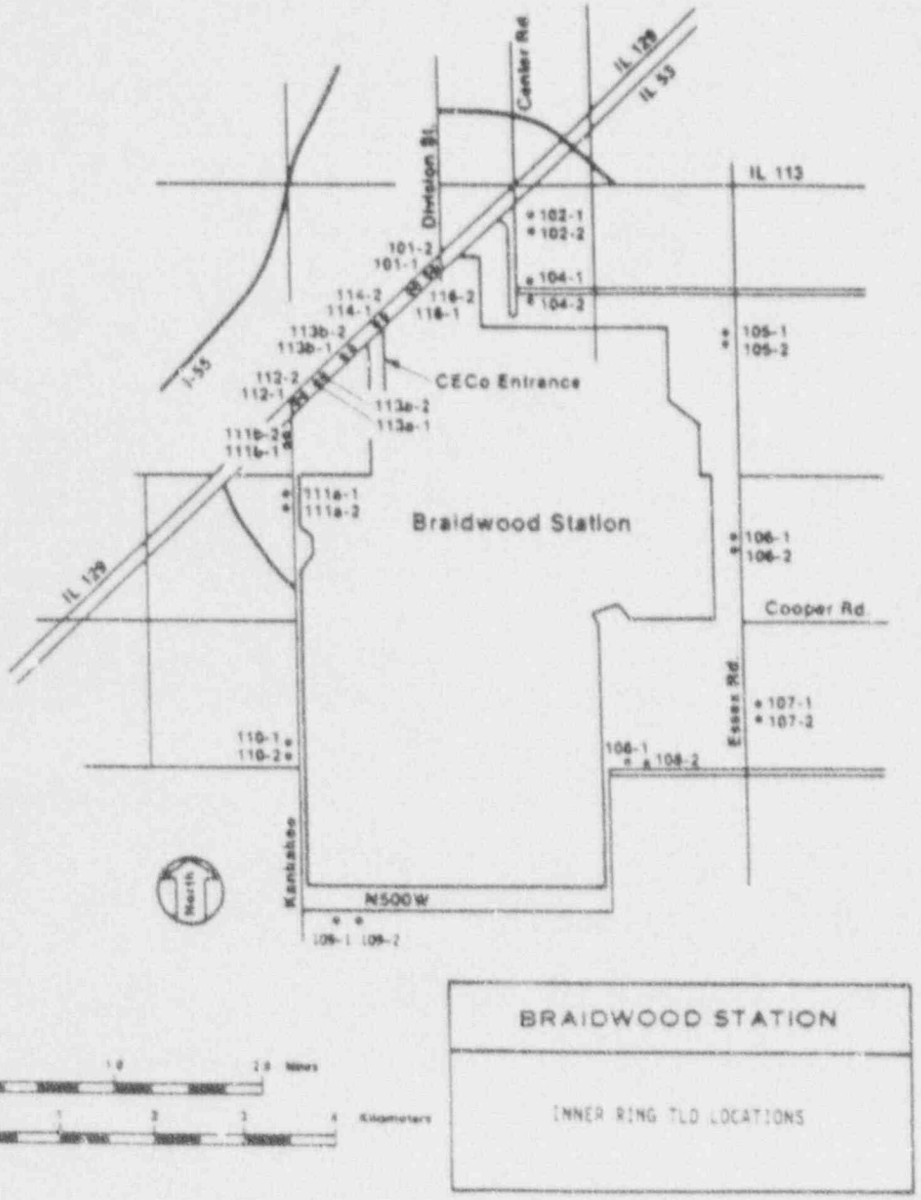
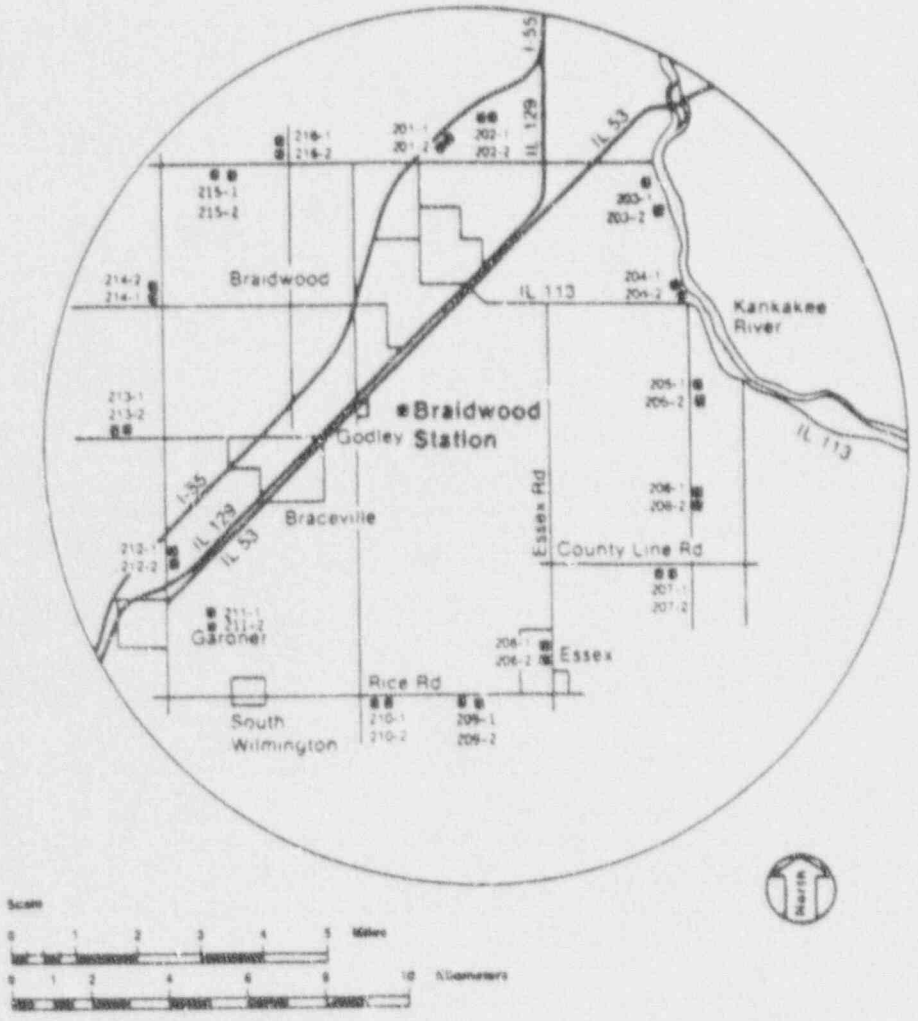

Canlan Rd
IL 129
IL 53
IL 113
Division St
102-1
102-2
101-2
101-1
104-1
104-2
114-2
114-1
116-2
116-1
113b-2
113b-1
105-1
105-2
I-55
112-2
112-1
CECo Entrance
113a-2
113a-1
111b-2
111b-1
111a-1
111a-2
Braidwood Station
106-1
106-2
IL 129
Cooper Rd.
Essex Rd
107-1
107-2
110-1
110-2
106-1
108-2
Kankakee
North
N500W
109-1 109-2
Scale
0 1 2 Miles
0 1 2 3 4 Kilometers
BRAIDWOOD STATION
INNER RING TLD LOCATIONS

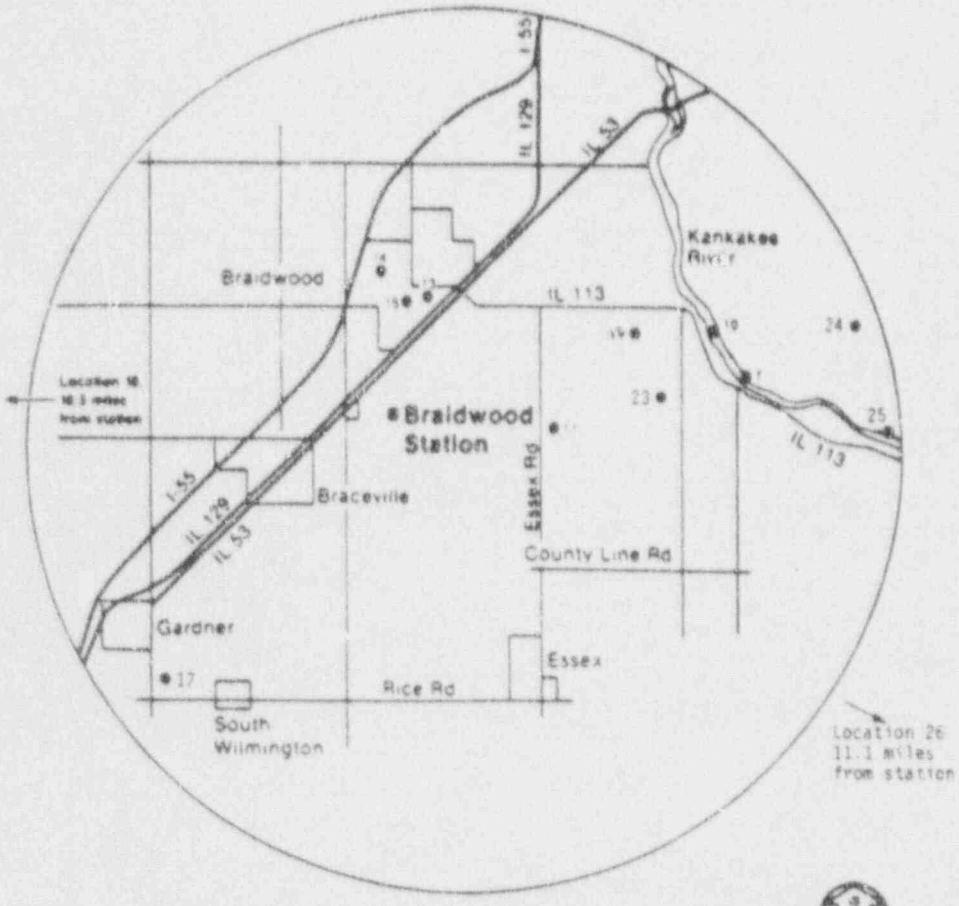
FIGURE 5.0-3

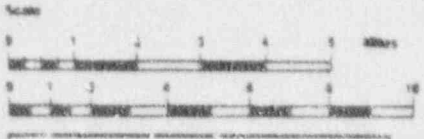


BRAIDWOOD STATION

OUTER RING TLD LOCATIONS

FIGURE 5.0-4





BD-07 Kankakee River (upstream)
BD-10 Kankakee River (downstream)
BD-*1 Mack-Morris Dairy
BD-13 Braidwood City Hall Well
BD-14 Pinnick Farm
BD-15 Cirot Farm
BD-16 Clark Farm
BD-17 Halpin's Dairy
BD-18 Biro's Dairy
BD-23 Klausing Dairy*
BD-24 Goodwin Dairy
BD-25 Kankakee River (upstream)
BD-26 Gaddis Dairy

*Klausing Dairy replaced by Gaddis Dairy on October 26, 1991

BRAIDWOOD STATION

INGESTION AND WATERBORNE EXPOSURE PATHWAY SAMPLE LOCATIONS

TABLE 5.0-1

Braidwood Station
Radiological Environmental Monitoring
Locations

	Air Sampling TLD	Cooling Water	Fish	Lake Water	Milk	Public Water	Rabbits	Sediments	Surface Water	Vegetables	Ground/Well Water
BD-01 Braidwood	O O										
BD-02 Custer Park	O O										
BD-03 County Line Road	O O										
BD-04 Essex	C O										
BD-05 Gardner	O O										
BD-06 Godley	O O										
BD-07 Kankakee River (upstream)			O						O		
BD-08 Intake		O									
BD-09 Discharge		O									
BD-10 Kankakee River (downstream)			O					O	O		
BD-11 Mack-Morris Dairy					O						
BD-13 Braidwood City Hall Well											O
BD-14 Pinnick Farm										O	
BD-15 Girot Farm										O	
BD-16 Clark Farm										O	
BD-17 Halpin's Dairy					O						
BD-18 Biro's Dairy					O						
BD-19 Near Site Northwest	O O										
BD-20 Near Site North	C O										
BD-21 Near Site Northeast	O O										
BD-22 Wilmington Water Plant						O					
BD-23 Klausing Dairy *					O						
BD-24 Goodwin Dairy					O						
BD-25 Kankakee River (upstream)									O		
BD-26 Gaddis Dairy					O						

*Klausing Dairy replaced by Gaddis Dairy on October 26, 1991

CENSUS

Dairy
Cattle
Residence

TABLE 5.0-2

BRAIDWOOD STATION

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SAMPLING LOCATIONS

1. AIR SAMPLERS

Site Code[a]	Location	Distance (miles)	Direction (°)
BD-01	Braidwood	1.5	34
BD-02	Custer Park	5.0	80
BD-03 (C)	County Line Road	6.2	120
BD-04	Essex	4.8	165
BD-05	Gardner	5.5	225
BD-06	Godley	0.5	245
BD-19	Near Site Northwest	0.3	314
BD-20	Near Site North	0.6	9
BD-21	Near Site Northeast	0.5	33

2. TLDs

a. Same as No. 1.

b. Special TLD Samplers

Site Code[a]	Distance (miles)	Direction (°)
Inner Ring		
BD-101-1	0.6	9
BD-101-2	0.62	10
BD-102-1	1.2	32
BD-102-2	1.1	33
BD-104-1,2	0.7	76
BD-105-1,2	1.5	85
BD-106-1,2	1.7	120
BD-107-1,2	2	135
BD-108-1,2	2	148
BD-109-1,2	2.5	190
BD-110-1,2	1.8	205
BD-111a-1	1.4	218
BD-111a-2	1.4	218.5
BD-111b-1	1.1	234
BD-111b-2	1.1	235
BD-112-1	0.7	252
BD-112-2	0.7	253
BD-113a-1	0.5	263
BD-113a-2	0.5	264
BD-113b-1	0.4	273
BD-113b-2	0.4	276

[a] Control (reference) locations are denoted by a "C" after site code. All other locations are indicator.

TABLE 5.0-2 (continued)

BRAIDWOOD STATION

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SAMPLING LOCATIONS

2. TLDs (continued)

b. Special TLD Samplers (continued)

Site Code[a]	Distance (miles)	Direction (°)
BD-114-1	0.4	294
BD-114-2	0.4	298
BD-116-1	0.4	342
BD-116-2	0.5	346
Outer Ring		
BD-201-1,2	4.2	11
BD-202-1,2	4.8	20
BD-203-1,2	4.9	45
BD-204-1,2	4.3	67
BD-205-1,2	4.0	86
BD-206-1,2	4.5	112
BD-207-1,2	4.1	113
BD-208-1,2	4.5	155
BD-209-1,2	4.8	185
BD-210-1,2	4.9	195
BD-211-1,2	4.8	220
BD-212-1,2	4.7	240
BD-213-1,2	4.5	260
BD-214-1,2	4.3	287
BD-215-1,2	4.5	315
BD-216-1,2	4.4	330

3. MILK

Site Code[a]	Location	Distance (miles)	Direction (°)
BD-11	Mack-Morris Dairy[c]	2.4	95
BD-17	Halpin's Dairy	5.5	200
BD-18 (C)	Biro's Dairy	10.5	270
BD-23	Klausing Dairy	4.3	83
BD-24	Goodwin Dairy[c]	7.3	78
BD-26 (C)	Gaddis Dairy[d,e]	11.1	122

[a] Control (reference) locations are denoted by a "C" after the site code. All other locations are indicators.

[c] Mack is the operator; Morris is the owner.

[d] Additional dairy was not required by ODCM but was included to ensure that the program has at least three dairies.

[e] Gaddis Dairy replaced Klausing Dairy on October 26, 1991.

BRAIDWOOD STATION

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SAMPLING LOCATIONS

4. VEGETABLES

Site Code	Location	Distance (miles)	Direction (°)
BD-14	Pinnick Farm	1.8	350
BD-15	Girot Farm	1.4	5
BD-16	Clark Farm	3.3	67

5. PUBLIC WATER

Site Code	Location	Distance (miles)	Direction (°)
BD-22	Wilmington	5.0	23

6. GROUND/WELL WATER

Site Code	Location	Depth	Distance (miles)	Direction (°)
BD-13	Braidwood City Hall		1.7	30

7. SURFACE WATER

Site Code[a]	Location	Distance (miles)	Direction (°)
BD-07 (C)	Kankakee River (Upstream)	5.4	85
BD-10	Kankakee River (Downstream)	5.0	76
BD-25 (C)	Kankakee River (Upstream)	9.6	100

8. COOLING WATER

Site Code[a]	Location	Distance (miles)	Direction (°)
BD-08 (C)	Intake Pipe	5.0	90
BD-09	Discharge Pipe	5.0	90

[a] Control (reference) locations are denoted by a "C" after the site code. All other locations are indicators.

TABLE 5.0-2 (continued)

BRAIDWOOD STATION

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SAMPLE COLLECTION AND ANALYSES

Sample Media	Location Code[a]	Location Site	Collection Frequency	Type of Analysis	Frequency of Analysis	Remarks
1. Airborne Particulates	BD-01	Braidwood	Continuous operation for a week	Gross beta	Weekly	On all samples.
	BD-02	Custer Park		Gamma Isot	Quarterly	On quarterly composites from each location.
	BD-03 (C)	County Line Road		Gamma Isot	Weekly	If gross beta activity in air particulate samples >10 times the yearly mean of control samples.
	BD-04	Essex				
	BD-05	Gardner				
	BD-06	Godley		Filter Exchange	Weekly	
	BD-19	Near site Northwest				
	BD-20	Near site North				
	BD-21	Near site Northeast				
2. Airborne Iodine	Same as 1.		Continuous operation for a week	I-131	Weekly	On all samples.
3. Air Sampling Train	Same as 1.			Test and Maintenance	Weekly	On all samples.
4. TLD	Same as 1.		Quarterly	Gamma	Quarterly	Two TLDs at all AP locations.
	BD-101-1,2	Inner Ring			Quarterly	One TLD at all Inner and Outer Ring locations. All TLDs are read quarterly.
	102-1,2					
	104-1,2					
	105-1,2					
	106-1,2					
	107-1,2					
	108-1,2					
	109-1,2					
	110-1,2					

[a] Control (reference) locations are denoted by a "C" in this column. All other locations are indicators.
[b] New special TLD site for this specification.

TABLE 5.0-2 (continued)

BRAIDWOOD STATION

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SAMPLE COLLECTION AND ANALYSES

Sample Media	Location Code[a]	Location Site	Collection Frequency	Type of Analysis	Frequency of Analysis	Remarks
4. TLD's (continued)	BD-111a-1,2 111b-1,2 112-1,2 113a-1,2 113b-1,2 114-1,2 116-1,2					
	BD-201-1,2 202-1,2 203-1,2 204-1,2 205-1,2 206-1,2 207-1,2 208-1,2 209-1,2 210-1,2 211-1,2 212-1,2 213-1,2 214-1,2 215-1,2 216-1,2	Outer Ring				
5. Milk	BD-11 BD-17 BD-18 (C) BD-23 BD-24 BD-26 (C)	Mack-Morris Dairy Halpin's Dairy Birus Farm Klausing Dairy[c] Grodwind Dairy [c] Gaddis Dairy [c,d]	Semimonthly May-October Monthly November-April	Gamma Isot I-131	Semimonthly Monthly Semimonthly Monthly	On all samples.

[a] Control (reference) locations are denoted by a "C" in this column. All other locations are indicators.

[c] Additional dairy was not required by ODCM but was included to ensure that the program has at least three dairies.
[d] Klausing Dairy replaced by Gaddis Dairy on October 26, 1991.

TABLE 5.0-2 (continued)

BRAIDWOOD STATION

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SAMPLE COLLECTION AND ANALYSES

Sample Media	Location Code[a]	Location Site	Collection Frequency	Type of Analysis	Frequency of Analysis	Remarks
6. Vegetables	BD-14 BD-15 BD-16	Pinnick Farm Girot Farm Berta Farm	Annually	Gamma Isot	Annually	Four varieties from each location as available at harvest.
7. Ground/Well Water	BD-13	Braidwood City Hall Well	Biweekly	Gross Beta Tritium Gamma Isot I-131	Monthly Quarterly Monthly Biweekly	Monthly composite sample. Quarterly composite sample. Monthly composite sample. Analysis is done when compositing 2 week sample dose calculated for consumption of water >1 mrem per year.
8. Surface Water	BD-10 BD-07 (C) BD-25 (C)	Kankakee River (downstream) Kankakee River (upstream) Kankakee River (upstream)	Weekly	Tritium Gamma Isot	Quarterly Monthly	Quarterly analysis of weekly composites. A monthly composite
9. Fish	BD-10 BD-07 (C)	Kankakee River (downstream) Kankakee River (upstream)	Three times a year.	Gamma Isot	Three times a year.	Spring, Summer, and Fall. On edible portions only, at least two species.
10. Shoreline Sediments	BD-10	Kankakee River (downstream)	Semiannual	Gamma Isot	Semiannual	On all samples.

[a] Control (reference) locations are denoted by a "C" in this column. All other locations are indicators.

TABLE 5.0-2 (continued)

BRAIDWOOD STATION

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SAMPLE COLLECTION AND ANALYSES

Sample Media	Location Code	Location Site	Collection Frequency	Type of Analysis	Frequency of Analysis	Remarks
11. Dairy Census	a.	Site boundary to 2 miles	--	a. Enumeration by a door-to-door or equivalent counting technique.	Annually	During grazing season.
	b.	2 miles to 5 miles	--	b. Enumeration by referenced information from county agricultural agents or other reliable sources.	Annually	During grazing season.
	c.	At dairies listed in Item 5.	--	c. Inquire as to practices: (1) Pasture only. (2) Feed and chop only. (3) Pasture and feed: if both, ask farmer to estimate fraction of food from pasture: <25%, 25-50%, 50-75%, or >75%.	Annually	During grazing season.
12. Nearest Residence Census	In all 16 sectors up to 5 miles				Annually	

TABLE 5.0-3

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM QUARTERLY SUMMARY

Name of Facility Braidwood Nuclear Power Station Docket No. 50-456, 50-457
Location of Facility Will, Illinois Reporting Period 1st Quarter 1991
(County, State)

Sample Type (Units)	Type and Number of Analyses		LLD	Indicator Locations Mean[a] Range	Location with Highest Quarterly Mean Location	Location with Highest Quarterly Mean Mean Range	Control Locations Mean[a] Range	Number of Non-routine Results
Air Particulates (pCi/m^3)	Gross Beta	116	0.01	0.025 (103/103) (0.011-0.042)	BD-06[b], Godley, 0.5 mi @ 245°	0.026 (13/13) (0.014-0.041)	0.017 (12/13) (0.015-0.042)	0
	Gamma Spec.	9	0.01	<LLD	-	-	<LLD	0
Airborne Io-line (pCi/m^3)	I-131	116	0.07	<LLD	-	-	<LLD	0
Gamma Background (TLDs) (mR/Qtr.)	Gamma Dose	9	3.0	14.6 (8/8) (14-17)	BD-05, Gardner, 5.5 mi @ 225	17 (1/1)	15 (1/1)	0
Milk (pCi/L)	I-131	15	0.5	<LLD	-	-	<LLD	0
	Gamma Spec.	15						
	Cs-134		5.0	<LLD	-	-	<LLD	0
	Cs-137		5.0	<LLD	-	-	<LLD	0
	Other Gammas		10.0	<LLD	-	-	<LLD	0
Well Water (pCi/L)	Gross Beta	3	2.2	29.0 (3/3) (27.3-31.9)	BD-13, Braidwood City Hall Well, 1.7 mi @ 30°	29.0 (3/3) (27.3-31.9)	None	0
	Gamma Spec.	6						
	Cs-134		10	<LLD	-	-	<LLD	0
	Cs-137		10	<LLD	-	-	<LLD	0
	Other Gammas		15	<LLD	-	-	<LLD	0
	Tritium	2	200	<LLD	-	-	<LLD	0

TABLE 5.0-3 (continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM QUARTERLY SUMMARY

Name of Facility Braidwood Nuclear Power Station Docket No. 50-456, 50-457
Location of Facility Will, Illinois Reporting Period 1st Quarter 19..
(County, State)

Sample Type (Units)	Type and Number of Analyses	LLD	Indicator Locations Mean[a] Range	Location with Highest Quarterly Mean		Control Locations Mean[a] Range	Number of Non-routine Results
				Location	Mean Range		
Surface Water (pCi/L)	Gamma Spec. 9						
	Cs-134	10	<LLD	-	-	<LLD	0
	Cs-137	10	<LLD	-	-	<LLD	0
	Other Gammas	15	<LLD	-	-	<LLD	0
	Tritium 3	200	<LLD	-	-	<LLD	0
Drinking Water (pCi/L)	Gross Beta 3	1.0	2.7 (3/3) (2.1-3.5)	BD-22, Wilmington 5.0 mi NNE	2.7 (3/3) (2.1-3.5)	None	0
	Gamma Spec. 3						
	Cs-134	10	<LLD	-	-	None	0
	Cs-137	10	<LLD	-	-	None	0
	Other Gammas	10	<LLD	-	-	None	0
	Tritium 1	200	594 (1/1)	BD-22, Wilmington 5.0 mi NNE	594 (1/1)	None	0
Cooling Water (pCi/L)	Gross Beta 26	1.0	11.4 (13/13) (3.5-30.4)	BD-09, Discharge Pipe at Station	11.4 (13/13) (3.5-30.4)	2.8 (13/13) (1.8-4.1)	0
	Tritium 2	100	38,552 (1/1)	BD-09, Discharge Pipe at Station	38,552 (1/1)	<LLD	0

[a] Mean and range based on detectable measurements only. Fractions indicated in parentheses.

[b] Four locations all had a quarterly mean of 0.026 pCi/m^3: BD-0E, BD-06, BD-19, BD-21. Only BD-06 is detailed in Summary Table.

TABLE 5.0-4

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM QUARTERLY SUMMARY

Name or Facility Braidwood Nuclear Power Station Docket No. 50-456, 50-457
Location of Facility Will, Illinois Reporting Period 2nd Quarter 1991
(County, State)

Sample Type (Units)	Type and Number of Analyses		LLD	Indicator Locations Mean[a] Range	Location with Highest Quarterly Mean		Control Locations Mean[a] Range	Number of Non-routine Results
					Location	Mean Range		
Air Particulates (pCi/m^3)	Gross Beta	117	0.01	0.017 (104/104) (0.007-0.024)	BD-04, Braidwood 4.8 mi @ 165° BD-05, Gardner 5.5 mi @ 225°	0.018 (13/13) (0.011-0.023) 0.018 (13/13) (0.012-0.023)	0.015 (13/13) (0.010-0.021)	0
	Gamma Spec.	9	0.01	<LLD	-	-	<LLD	0
Airborne Iodine (pCi/m^3)	I-131	117	0.07	<LLD	-	-	<LLD	0
Gamma Background (TLDs) (mR/Qtr.)	Gamma Dose	9	3.0	13.7 (8/8) (11.7±17.4)	BD-21, Near Site NE 0.5 mi @ 33°	17.4 (1/1)	13.0 (1/1)	0
Milk (pCi/L)	I-131	25	0.5	<LLD	-	-	<LLD	0
	Gamma Spec.	25						
	Cs-134		5.0	<LLD	-	-	<LLD	0
	Cs-137		5.0	<LLD	-	-	<LLD	0
	Other Gammas		10.0	<LLD	-	-	<LLD	0
Surface Water (pCi/L)	Gamma Spec.	9			-	-		
	Cs-134		10	<LLD	-	-	<LLD	0
	Cs-137		10	<LLD	-	-	<LLD	0
	Other Gammas		15	<LLD	-	-	<LLD	0
	Tritium	3	200	<LLD	-	-	<LLD	0

TABLE 5.0-4 (continued)

RADIOLOGICAL ENVIPONMENTAL MONITORING PROGRAM QUARTERLY SUMMARY

Name of Facility Braidwood Nuclear Power Station Docket No. 50-4546 50-457
Location of Facility Will, Illinois Reporting Period 2nd Quarter 1993
(County, State)

Sample Type (Units)	Type and Number of Analyses		LLD	Indicator Locations Mean[a] Range	Location with Highest Quarterly Mean Location	Location with Highest Quarterly Mean Mean Range	Control Locations Mean[a] Range	Number of Non-routine Results
Well Water (pCi/L)	Gross Beta	3	1.2	27.1 (3/3) (26.1-28.5)	BD-13, Braidwood City Hall, 1.7 mi @ 30°	27.1 (3/3) (26.1-28.5)	None	0
	Gamma Spec.	3						
	Cs-134		10	<LLD	-	-	None	0
	Cs-137		10	<LLD	-	-	None	0
	Other Gammas		20	<LLD	-	-	None	0
	Tritium	1	200	<LLD	-	-	None	0
Public Water (pCi/L)	Gross Beta	3	1.0	3.9 (3/3) (3.3-4.4)	BD-22, Wilmington	3.9 (3/3) (3.3-4.4)	None	0
	Gamma Spec.	3						
	Cs-134		10	<LLD	-	-	None	0
	Cs-137		10	<LLD	-	-	None	0
	Other Gammas		20	<LLD	-	-	None	0
	Tritium	1	200	371 (1/1)	BD-22, Wilmington	371 (1/1)	None	0
Cooling Water (pCi/L)	Gross Beta	26	1.0	26.2 (13/13) (7.8-62.7)	BD-09, Discharge at Station	26.2 (13/13) (7.8-62.6)	2.9 (13/13) (2.0-3.9)	0
	Tritium	2	200	39,985 (1/1)	BD-09, Discharge at Station	39,985 (1/1)	201 (1/1)	0

TABLE 5.0-4 (continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM QUARTERLY SUMMARY

Name of Facility Braidwood Nuclear Power Station Docket No. 50-456, 50-457
Location of Facility Will, Illinois Reporting Period 2nd Quarter 1991
(County, State)

Sample Type (Units)	Type and Number of Analyses	LLD	Indicator Locations Mean[a] Range	Location with Highest Quarterly Mean Location	Mean Range	Control Locations Mean[a] Range	Number of Non-routine Results
Bottom Sediments (pCi/g dry)	Gamma Spec. 1						
	Cs-134	0.1	<LLD	-	-	None	0
	C-137	0.1	0.20 (1/1)	BD-10, Kankakee River Monitoring site No. 5; 5.0 mi @ 76°	-	None	0
	Other Gammas	0.2	<LLD	-	-	None	0
Fish (pCi/g wet)	Gamma Spec. 2						
	Cs-134	0.10	<LLD	-	-	<LLD	0
	Cs-137	0.10	<LLD	-	-	<LLD	0
	Other Gammas	0.13	<LLD	-	-	<LLD	0

[a] Mean and range based on detectable measurements only. Fractions indicated in parenthesis

TABLE 5.0-5

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM QUARTERLY SUMMARY

Name of Facility Braidwood Nuclear Power Station Docket No. 50-456, 50-457
Location of Facility Will, Illinois Reporting Period 3rd Quarter 1991
(County, State)

Sample Type (Units)	Type and Number of Analyses		LLD	Indicator Locations Mean[a] Range	Location with Highest Quarterly Mean Location	Mean Range	Control Locations Mean[a] Range	Number of Non-routine Results
Air Particulates (pCi/m^3)	Gross Beta	117	0.01	0.021 (104/104) (0.011-0.029)	BD-04[b], Essex, 4.8 mi @ 165°	0.022 (13/13) (0.014-0.029)	0.022 (13/13) (0.014-0.027)	0
	Gamma Spec.	9	0.01	<LLD	-	-	<LLD	0
Airborne Iodine (pCi/m^3)	I-131	117	0.07	<LLD	-	-	<LLD	0
Gamma Background (TLDs) (mR/Qtr.)	Gamma Dose	9	3.0	14.5 (8/8) (13.7-17.0)	BD-05, Gardner 5.5 mi @ 225°	17.0 (1/1)	15.3 (1/1)	0
Milk (pCi/L)	I-131	30	0.5	<LLD	-	-	<LLD	0
	Gamma Spec.	30						
	Cs-134		5.0	<LLD		-	<LLD	0
	Cs-137		5.0	<LLD	-	-	<LLD	0
	Other Gammas		10.0	<LLD	-	-	<LLD	0
Surface Water (pCi/L)	Gamma Spec.	9			-	-		
	Cs-134		10	<LLD	-	-	<LLD	0
	Cs-137		10	<LLD	-	-	<LLD	0
	Other Gammas		15	<LLD	-	-	<LLD	0
	Tritium	3	200	1518 (1/3)	BD-10, Kankakee River Downstream, 5.0 mi @ 76°	1518 (1/1)	<LLD	0

TABLE 5.0-5 (continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM QUARTERLY SUMMARY

Name of Facility Braidwood Nuclear Power Station Docket No. 50-4546 50-457
Location of Facility Will, Illinois Reporting Period 3rd Quarter 1991
(County, State)

Sample Type (Units)	Type and Number of Analyses		LLD	Indicator Locations Mean[a] Range	Location with Highest Quarterly Mean		Control Locations Mean[a] Range	Number of Non-routine Results
					Location	Mean Range		
Well Water (pCi/L)	Gross Beta	3	1.2	4.0 (3/3) (2.8-5.9)	BD-22, Wilmington 5.0 mi NNE	40 (3/3) (2.8-5.9)	None	0
	Gamma Spec.	3						
	Cs-134		10	<LLD	-	-	None	0
	Cs-137		10	<LLD	-	-	None	0
	Other Gammas		10	<LLD	-	-	None	0
	Tritium	1	250	1104 (1/1)	BD-22, Wilmington 5.0 mi NNE	1104 (1/1)	None	0
Public Water (pCi/L)	Gross Beta	3	1.0	31.4 (3/3) (30.5-32.8)	BD-13, Braidwood City Hall Well, 1.7 mi @ 30°	31.4 (3/3) (30.5-32.8)	None	0
	Gamma Spec.	3						
	Cs-134		10	<LLD	-	-	None	0
	Cs-137		10	<LLD	-	-	None	0
	Other Gammas		20	<LLD	-	-	None	0
	Tritium	1	200	<LLD	-	-	None	0
Cooling Water (pCi/L)	Gross Beta	26	1.0	18.4 (13/13) (9.5-38.2)	BD-09, Discharge Pipe at Plant	18.4 (13/13) (9.5-38.2)	3.4 (13/13) (1.6-7.3)	0
	Tritium	2	200	70,767 (1/1)	BD-09, Discharge Pipe at Plant	70,767 (1/1)	<LLD	0

TABLE 5.0-5 (continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM QUARTERLY SUMMARY

Name of Facility Braidwood Nuclear Power Station Docket No. 50-456, 50-457
Location of Facility Will, Illinois Reporting Period 3rd Quarter 1991
(County, State)

Sample Type (Units)	Type and Number of Analyses	LLD	Indicator Locations Mean[a] Range	Location with Highest Quarterly Mean Location	Location with Highest Quarterly Mean Mean Range	Control Locations Mean[a] Range	Number of Non-routine Results
Vegetables (pCi/g wet)	Gamma Spec. 12						
	Cs-134	0.06	<LLD	-	-	None	0
	C-137	0.08	<LLD	-	-	None	0
	Other Gammas	0.2	<LLD	-	-	None	0
	I-131 3	0.06	<LLD	-	-	None	0
Fish (pCi/g wet)	Gamma Spec. 5						
	Cs-134	0.1	<LLD	-	-	<LLD	0
	Cs-137	0.1	0.23 (1/3)	BD-10, Kankakee River Downstream, 5.0 mi @ 76°	0.23 (1/3)	0.20 (1/2)	0
	Other Gammas	0.13	<LLD	-	-	<LLD	0

[a] Mean and range based on detectable measurements only. Fractions indicated in parentheses.
[b] Four locations BD-03, BD-04, BD-05, and BD-06 had identical quarterly means (0.022 pCi/m^3). Only BD-04 is detailed here.

TABLE 5.0-6

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM QUARTERLY SUMMARY

Name of Facility Braidwood Nuclear Power Station Docket No. 50-456, 50-457
Location of Facility Will, Illinois Reporting Period 4th Quarter 1991
(County, State)

Sample Type (Units)	Type and Number of Analyses		LLD	Indicator Locations Mean[a] Range	Location with Highest Quarterly Mean		Control Locations Mean[a] Range	Number of Non-routine Results
					Location	Mean Range		
Air Particulates (pCi/m^3)	Gross Beta	126	0.01	0.024 (112/112) (0.013-0.034)	BD-06, Godley 0.5 mi @ 245°	0.026 (14/14) (0.014-0.034)	0.024 (14/14) (0.014-0.033)	0
	Gamma Spec.	9	0.01	<LLD	-	-	<LLD	0
Airborne Iodine (pCi/m^3)	I-131	117	0.07	<LLD	-	-	<LLD	0
Gamma Background (TLDs) (mR/Qtr.)	Gamma Dose	9	3.0	13.8 (8/8) (12.9±15.6)	BD-05, Gardner 5.5 mi @ 225°	15.6 (1/1)	13.5 (1/1)	0
Milk (pCi/L)	I-131	20	0.5	<LLD	-	-	<LLD	0
	Gamma Spec.	20						
	Cs-134		5.0	<LLD	-	-	<LLD	0
	Cs-137		5.0	<LLD	-	-	<LLD	0
	Other Gammas		10.0	<LLD	-	-	<LLD	0
Surface Water (pCi/L)	Gamma Spec.	9			-	-		
	Cs-134		10	<LLD	-	-	<LLD	0
	Cs-137		10	<LLD	-	-	<LLD	0
	Other Gammas		15	<LLD	-	-	<LLD	0
	Tritium	3	200	<LLD	-	-	<LLD	0

TABLE 5.0-6 (continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM QUARTERLY SUMMARY

Name of Facility Braidwood Nuclear Power Station Docket No. 50-456, 50-457
Location of Facility Will, Illinois Reporting Period 4th Quarter 1991
(County, State)

Sample Type (Units)	Type and Number of Analyses		LLD	Indicator Locations Mean[a] Range	Location with Highest Quarterly Mean Location	Location with Highest Quarterly Mean Mean Range	Control Locations Mean[a] Range	Number of Non-routine Results
Air Particulates (pCi/m^3)	Gross Beta	126	0.01	0.024 (112/112) (0.013-0.034)	BD-06, Godley 0.5 mi @ 245°	0.026 (14/14) (0.014-0.034)	0.024 (14/14) (0.014-0.033)	0
	Gamma Spec.	9	0.01	<LLD	-	-	<LLD	0
Airborne Iodine (pCi/m^3)	I-131	117	0.07	<LLD	-	-	<LLD	0
Gamma Background (TLDs) (mR/Qtr.)	Gamma Dose							
Milk (pCi/L)	I-131	20	0.5	<LLD	-	-	<LLD	0
	Gamma Spec.	20						
	Cs-134		5.0	<LLD	-	-	<LLD	0
	Cs-137		5.0	<LLD	-	-	<LLD	0
	Other Gammas		10.0	<LLD	-	-	<LLD	0
Surface Water (pCi/L)	Gamma Spec.	9			-	-		
	Cs-134		10	<LLD	-	-	<LLD	0
	Cs-137		10	<LLD	-	-	<LLD	0
	Other Gammas		15	<LLD	-	-	<LLD	0
	Tritium	3	200	<LLD	-	-	<LLD	0

TABLE 5.0-6 (continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM QUARTERLY SUMMARY

Name of Facility Braidwood Nuclear Power Station Docket No. 50-4546 50-457
Location of Facility Will, Illinois Reporting Period 4th Quarter 1991
(County, State)

Sample Type (Units)	Type and Number of Analyses		LLD	Indicator Locations Mean[a] Range	Location with Highest Quarterly Mean		Control Locations Mean[a] Range	Number of Non-routine Results
					Location	Mean Range		
Drinking Water (pCi/L)	Gross Beta	3	1.2	3.2 (3/3) (2.7-3.9)	BD-22, Wilmington 5.0 mi NNE	3.2 (3/3) (2.7-3.9)	None	0
	Gamma Spec.	3						
	Cs-134		10	<LLD	-	-	None	0
	Cs-137		10	<LLD	-	-	None	0
	Other Gammas		10	<LLD	-	-	None	0
	Tritium	1	200	215 (1/1)	BD-22, Wilmington 5.0 mi NNE	215 (1/1)	None	0
Well Water (pCi/L)	Gross Beta	3	1.0	25.5 (3/3) (22.4-29.3)	BD-13, Braidwood City Hall Well, 1.7 mi @ 30°	25.5 (3/3) (22.4-29.3)	None	0
	Gamma Spec.	3						
	Cs-134		10	<LLD	-	-	None	0
	Cs-137		10	<LLD	-	-	None	0
	Other Gammas		20	<LLD	-	-	None	0
	Tritium	1	200	<LLD	-	-	None	0
Cooling Water (pCi/L)	Gross Beta	28	1.0	16.9 (14/14) (7.1-39.1)	BD-09, Discharge Pipe at Plant	16.9 (14/14) (7.1-30.1)	3.3 (14/14) (2.1-4.7)	0
	Tritium	2	200	45,369 (1/1)	BD-09, Discharge Pipe at Plant	45,369 (1/1)	<LLD	1

TABLE 5.0-6 (continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM QUARTERLY SUMMARY

Name of Facility Braidwood Nuclear Power Station Docket No. 50-456, 50-457
Location of Facility Will, Illinois Reporting Period 4th Quarter 1991
(County, State)

Sample Type (Units)	Type and Number of Analyses	LLD	Indicator Locations Mean[a] Range	Location with Highest Quarterly Mean		Control Locations Mean[a] Range	Number of Non-routine Results
				Location	Mean Range		
Bottom Sediments (pCi/g dry)	Gamma Spec. 1						
	Mn-54	0.2	0.34 (1/1)	BD-10, Kankakee River (upstream) Site No. 5: 5.0 mi @ 76°	0.34 (1/1)	None	0
	Co-58	0.2	4.47 (1/1)	BD-10	4.47 (1/1)	None	1
	Co-60	0.2	1.59 (1/1)	BD-10	1.59 (1/1)	None	0
	Cs-134	0.1	0.16 (1/1)	BD-10	0.16 (1/1)	None	0
	Cs-137	0.1	0.25 (1/1)	BD-10	0.25 (1/1)	None	0
	Other Gammas	0.2	<LLD	-	-	None	0
Fish (pCi/g wet)	Gamma Spec. 2						
	Cs-134	0.10	<LLD	-	-	<LLD	0
	Cs-137	0.10	<LLD	-	-	<LLD	0
	Other Gammas	0.13	<LLD	-	-	<LLD	0

[a] Mean and range based on detectable measurements only. Fractions indicated in parentheses.

APPENDIX II

METEOROLOGICAL DATA

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - JANUARY-MARCH 1991
STABILITY CLASS - EXTREMELY UNSTABLE (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	2	2
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	2	2

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 3

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - JANUARY-MARCH 1991
STABILITY CLASS - MODERATELY UNSTABLE (DIFF TEMP 199 30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	1	2	0	3
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	1	0	0	1
S	0	0	0	0	1	0	1
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	0	0	2	3	0	5

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 3

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - JANUARY-MARCH 1991
STABILITY CLASS - SLIGHTLY UNSTABLE (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	0	1	0	1
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	1	1
SE	0	0	1	2	0	0	3
SSE	0	0	0	1	0	0	1
S	0	0	0	1	2	0	3
SSW	0	0	0	0	2	0	2
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	1	2	0	0	3
WNW	0	0	2	3	0	0	5
NW	0	0	0	0	0	0	0
NNW	0	0	0	5	0	0	5
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	0	4	14	5	1	24

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 3

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - JANUARY-MARCH 1991
STABILITY CLASS - NEUTRAL (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	5	12	26	11	0	54
NNE	0	0	2	19	1	0	22
NE	1	4	3	10	0	0	18
ENE	1	2	7	14	3	0	27
E	1	2	9	8	5	2	27
ESE	0	0	6	7	5	1	19
SE	0	3	11	21	8	0	43
SSE	0	3	11	9	7	1	31
S	0	3	1	13	18	6	41
SSW	0	5	8	15	14	13	55
SW	0	2	21	22	7	2	54
WSW	0	5	12	31	3	1	52
W	0	5	28	24	5	8	70
WNW	1	9	23	24	29	17	103
NW	1	13	21	23	10	12	80
NNW	2	8	24	28	16	8	86
VARIABLE	0	0	0	0	0	0	0
TOTAL	7	69	199	294	142	71	782

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 7
Hours of missing stability measurements in all stability classes: 3

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - JANUARY-MARCH 1991
STABILITY CLASS - SLIGHTLY STABLE (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	1	10	35	23	8	0	77
NNE	0	3	21	16	2	0	42
NE	0	4	12	19	0	0	35
ENE	3	6	18	11	0	0	38
E	2	5	19	22	7	9	64
ESE	3	3	11	13	5	0	35
SE	0	4	2	6	8	8	28
SSE	0	1	6	14	15	13	49
S	0	3	4	17	25	23	72
SSW	0	3	17	36	46	14	116
SW	1	0	18	54	33	10	116
WSW	1	5	28	40	3	6	83
W	0	10	20	32	10	4	76
WNW	1	1	27	28	18	4	79
NW	1	9	29	55	15	0	109
NNW	0	15	40	29	8	8	100
VARIABLE	0	0	0	0	0	0	0
TOTAL	13	82	307	415	203	99	1119

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 43
Hours of missing stability measurements in all stability classes: 3

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - JANUARY-MARCH 1991
STABILITY CLASS - MODERATELY STABLE (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	1	5	0	0	6
NNE	0	1	2	2	0	0	5
NE	0	1	2	4	0	0	7
ENE	0	1	3	2	0	0	6
E	2	2	2	5	0	0	11
ESE	0	2	1	3	0	0	6
SE	0	0	1	1	0	0	2
SSE	0	2	4	1	0	0	7
S	1	1	2	3	0	0	7
SSW	0	2	1	2	3	0	8
SW	0	1	2	3	9	0	15
WSW	0	0	1	12	1	4	18
W	1	1	10	16	0	0	28
WNW	0	2	8	9	1	0	20
NW	0	1	3	0	0	0	4
NNW	0	1	1	2	0	0	4
VARIABLE	0	0	0	0	0	0	0
TOTAL	4	18	44	70	14	4	154

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 3

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - JANUARY-MARCH 1991
STABILITY CLASS - EXTREMELY STABLE (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	2	0	0	0	2
E	0	0	0	0	0	0	0
ESE	0	0	0	2	0	0	2
SE	0	0	0	0	0	0	0
SSE	0	0	0	1	0	0	1
S	0	0	2	0	0	0	2
SSW	0	0	0	2	0	0	2
SW	1	0	1	0	0	0	2
WSW	0	0	0	0	0	0	0
W	0	0	1	2	1	0	4
WNW	0	0	1	2	1	0	4
NW	0	0	1	0	0	0	1
NNW	0	0	0	1	0	0	1
VARIABLE	0	0	0	0	0	0	0
TOTAL	1	0	8	10	2	0	21

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 3

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - APRIL-JUNE 1991
STABILITY CLASS - EXTREMELY UNSTABLE (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4-7	8-12	13-18	19-24	GT 24	TOTAL
N	0	1	1	0	0	0	2
NNE	0	2	7	1	0	0	10
NE	0	2	11	6	0	0	19
ENE	0	1	7	1	0	0	9
E	0	0	1	2	1	0	4
ESE	0	2	0	2	1	0	5
SE	0	0	0	2	0	0	2
SSE	0	1	2	0	0	0	3
S	0	0	5	6	1	0	12
SSW	0	0	2	14	2	0	18
SW	0	0	6	0	0	0	6
WSW	0	0	1	0	0	0	1
W	0	0	3	0	0	0	3
WNW	0	1	0	0	0	0	1
NW	0	0	0	0	0	0	0
NNW	0	1	0	1	0	0	2
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	11	46	35	5	0	97

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 22

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - APRIL-JUNE 1991
STABILITY CLASS - MODERATELY UNSTABLE (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	1	4	0	0	0	5
NNE	0	3	3	2	0	0	8
NE	0	1	3	4	0	0	8
ENE	0	1	2	3	0	0	6
E	0	1	1	1	1	0	4
ESE	0	2	3	3	0	0	8
SE	0	3	0	2	0	1	6
SSE	0	2	3	0	0	0	5
S	0	1	1	2	1	0	5
SSW	0	0	2	3	3	0	8
SW	0	0	0	0	0	0	0
WSW	0	0	3	0	0	0	3
W	0	1	1	0	0	0	2
WNW	0	0	0	2	1	0	3
NW	0	1	2	3	1	0	7
NNW	0	0	0	1	0	0	1
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	17	28	26	7	1	79

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 22

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - APRIL-JUNE 1991
STABILITY CLASS - SLIGHTLY UNSTABLE (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	1	1	2	0	0	4
NNE	0	1	6	6	0	0	13
NE	0	3	3	4	0	0	10
ENE	0	3	6	3	0	0	12
E	1	2	1	1	0	0	5
ESE	0	3	2	2	3	0	10
SE	1	3	4	3	0	0	11
SSE	0	2	0	0	0	0	2
S	0	1	1	1	1	1	5
SSW	0	0	1	3	2	0	6
SW	0	1	2	0	0	0	3
WSW	0	0	2	1	1	0	4
W	0	0	1	0	3	2	6
WNW	0	0	3	1	0	0	4
NW	0	2	3	2	0	0	7
NNW	0	1	1	1	0	0	3
VARIABLE	0	0	0	0	0	0	0
TOTAL	2	23	37	30	10	3	105

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 22

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - APRIL-JUNE 1991
STABILITY CLASS - NEUTRAL (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	1	8	8	6	0	0	23
NNE	0	7	10	22	2	0	41
NE	0	10	30	38	6	0	84
ENE	0	10	33	34	0	0	77
E	0	8	21	19	1	4	55
ESE	1	7	18	8	3	3	40
SE	3	16	21	6	6	0	52
SSE	2	11	26	10	3	0	52
S	1	7	18	10	7	5	48
SSW	0	2	19	25	13	7	66
SW	1	7	16	28	15	3	70
WSW	0	2	10	17	22	6	57
W	0	8	7	8	10	11	44
WNW	1	2	9	4	0	10	26
NW	0	4	7	1	2	0	14
NNW	2	6	8	1	0	0	17
VARIABLE	0	0	0	0	0	0	0
TOTAL	12	115	261	237	92	49	766

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 22

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - APRIL-JUNE 1991
STABILITY CLASS - SLIGHTLY STABLE (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	4	4	7	1	0	16
NNE	0	2	6	11	6	1	26
NE	2	9	28	29	6	0	74
ENE	2	12	74	11	0	0	99
E	0	6	30	32	18	1	87
ESE	2	5	10	36	10	0	63
SE	2	1	17	25	12	0	57
SSE	0	6	23	24	5	0	58
S	0	4	25	44	28	4	105
SSW	1	6	21	47	30	3	108
SW	0	7	20	33	2	1	69
WSW	1	5	23	8	4	9	50
W	0	2	13	4	1	6	26
WNW	0	2	11	8	13	0	32
NW	1	4	4	9	4	0	22
NNW	0	1	6	4	0	1	12
VARIABLE	0	0	0	0	0	0	0
TOTAL	11	76	319	332	140	26	904

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 22

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - APRIL-JUNE 1991
STABILITY CLASS - MODERATELY STABLE (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	2	2	0	0	0	4
NNE	0	0	1	0	0	0	1
NE	1	3	4	0	0	0	8
ENE	1	4	14	1	0	0	20
E	0	4	11	8	0	0	23
ESE	0	0	7	10	0	0	17
SE	0	1	7	8	0	0	16
SSE	0	1	6	0	0	0	7
S	0	6	10	4	0	0	20
SSW	1	2	2	2	3	0	10
SW	0	3	6	4	0	0	13
WSW	0	2	2	4	0	0	8
W	0	2	6	3	0	0	11
WNW	1	0	3	3	0	0	7
NW	0	2	2	1	0	0	5
NNW	0	0	1	0	0	0	1
VARIABLE	0	0	0	0	0	0	0
TOTAL	4	32	84	48	3	0	171

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 22

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - APRIL-JUNE 1991
STABILITY CLASS - EXTREMELY STABLE (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	1	0	0	0	0	0	1
NNE	0	0	1	0	0	0	1
NE	0	0	0	0	0	0	0
ENE	0	1	2	0	0	0	3
E	2	0	2	1	0	0	5
ESE	0	0	4	2	0	0	6
SE	0	1	2	1	0	0	4
SSE	0	0	1	0	0	0	1
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	2	1	0	0	3
W	0	0	5	4	0	0	9
WNW	0	2	3	1	0	0	6
NW	0	0	1	0	0	0	1
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
TOTAL	3	4	23	10	0	0	40

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 22

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - JULY-SEPTEMBER 1991
STABILITY CLASS - EXTREMELY UNSTABLE (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	2	8	8	0	0	18
NNE	0	4	9	4	0	0	17
NE	0	3	7	0	0	0	10
ENE	0	4	8	0	0	0	12
E	0	1	8	0	0	0	9
ESE	0	1	0	1	0	0	2
SE	0	0	2	2	0	0	4
SSE	0	1	2	0	0	0	3
S	0	2	3	4	1	0	10
SSW	0	1	12	10	10	3	36
SW	0	0	8	4	0	0	12
WSW	0	0	5	6	0	0	11
W	0	1	2	0	0	0	3
WNW	0	1	1	1	0	0	3
NW	0	2	3	7	3	0	15
NNW	0	0	15	3	2	0	20
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	23	93	50	16	3	185

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - JULY-SEPTEMBER 1991
STABILITY CLASS - MODERATELY UNSTABLE (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	2	3	3	0	0	8
NNE	0	5	10	0	0	0	15
NE	0	4	3	1	1	0	9
ENE	0	4	4	1	0	0	9
E	1	4	4	0	0	0	9
ESE	0	0	3	1	0	0	4
SE	0	2	4	0	0	0	6
SSE	0	1	2	1	0	0	4
S	0	4	3	2	0	0	9
SSW	0	1	4	0	5	0	10
SW	0	2	9	4	2	0	17
WSW	0	1	12	3	0	0	16
W	0	0	1	0	0	0	1
WNW	0	1	2	2	1	0	6
NW	0	0	1	4	1	0	6
NNW	0	4	6	3	0	0	13
VARIABLE	0	0	0	0	0	0	0
TOTAL	1	35	71	25	10	0	142

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - JULY-SEPTEMBER 1991
STABILITY CLASS - SLIGHTLY UNSTABLE (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	2	3	1	0	0	6
NNE	0	3	6	0	0	0	9
NE	1	1	5	5	0	0	12
ENE	1	7	8	1	0	0	17
E	1	4	6	1	0	0	12
ESE	1	4	4	2	0	0	11
SE	0	3	2	0	0	0	5
SSE	0	4	3	2	0	0	9
S	0	6	5	1	0	0	12
SSW	0	1	3	2	0	1	12
SW	0	1	5	6	2	0	14
WSW	0	1	8	4	0	0	13
W	0	1	4	2	0	0	7
WNW	0	1	0	1	2	0	4
NW	0	3	4	3	0	0	10
NNW	1	5	12	1	0	0	19
VARIABLE	0	0	0	0	0	0	0
TOTAL	5	47	83	32	4	1	172

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - JULY-SEPTEMBER 1991
STABILITY CLASS - NEUTRAL (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	3	5	6	7	0	0	21
NNE	3	7	12	17	0	0	39
NE	5	7	15	8	5	0	40
ENE	1	16	26	3	0	0	46
E	2	10	26	4	0	0	42
ESE	1	7	11	6	0	0	25
SE	5	8	21	7	0	0	41
SSE	1	8	14	11	5	0	39
S	0	11	11	2	2	0	26
SSW	3	8	12	30	11	1	65
SW	2	4	31	23	11	0	71
WSW	2	13	22	15	9	2	63
W	2	5	9	6	3	1	25
WNW	0	2	7	5	12	0	26
NW	1	11	4	7	2	0	25
NNW	1	9	7	18	4	0	39
VARIABLE	0	0	0	0	0	0	0
TOTAL	32	131	234	168	64	4	633

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - JULY-SEPTEMBER 1991
STABILITY CLASS - SLIGHTLY STABLE (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	1	1	14	8	0	0	24
NNE	1	4	10	4	0	0	19
NE	1	4	34	2	0	0	41
ENE	0	3	44	0	0	0	53
E	0	1	20	9	0	0	30
ESE	0	10	23	29	0	0	62
SE	0	2	24	21	0	0	47
SSE	0	2	19	13	1	0	35
S	0	1	13	36	3	0	53
SSW	0	1	19	64	8	0	92
SW	1	6	29	28	1	0	65
WSW	0	1	20	7	1	0	29
W	1	3	19	5	1	0	29
WNW	0	4	10	12	0	0	26
NW	0	4	12	14	2	0	32
NNW	2	3	8	10	0	0	23
VARIABLE	0	0	0	0	0	0	0
TOTAL	7	56	318	262	17	0	660

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - JULY-SEPTEMBER 1991
STABILITY CLASS - MODERATELY STABLE (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	2	3	7	2	0	0	14
NNE	1	0	4	0	0	0	5
NE	0	[illegible]	9	1	0	0	12
ENE	0	9	26	0	0	0	35
E	1	0	12	8	0	0	21
ESE	0	3	4	8	0	0	15
SE	1	6	4	9	1	0	21
SSE	1	3	1	1	0	0	6
S	0	1	4	4	0	0	9
SSW	1	6	8	2	1	0	18
SW	0	2	8	7	0	0	17
WSW	1	3	5	3	0	0	12
W	1	0	9	17	0	0	27
WNW	0	4	13	19	0	0	36
NW	1	4	5	0	0	0	10
NNW	0	5	14	1	0	0	20
VARIABLE	0	0	0	0	0	0	0
TO	10	51	133	82	2	0	278

Hours of calm [illegible] this stability class: 1
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - JULY-SEPTEMBER 1991
STABILITY CLASS - EXTREMELY STABLE (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	3	12	0	0	0	15
NNE	0	1	7	0	0	0	8
NE	0	2	6	0	0	0	8
ENE	1	3	9	0	0	0	13
E	1	4	5	3	0	0	13
ESE	0	2	1	0	0	0	3
SE	1	3	1	0	0	0	5
SSE	0	3	0	0	0	0	3
S	1	5	1	1	0	0	8
SSW	3	5	3	0	0	0	11
SW	2	4	0	1	0	0	7
WSW	2	0	2	0	0	0	4
W	1	0	6	4	0	0	11
WNW	0	1	2	4	0	0	7
NW	0	1	7	2	0	0	10
NNW	1	4	6	0	0	0	11
VARIABLE	0	0	0	0	0	0	0
TOTAL	13	41	68	15	0	0	137

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - OCTOBER-DECEMBER 1991
STABILITY CLASS - EXTREMELY UNSTABLE (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	3	0	0	3
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	1	1
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	2	2
SSW	0	0	0	1	0	3	4
SW	0	0	0	0	0	1	1
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	1	0	0	1
NNW	0	0	0	1	0	0	1
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	0	0	6	0	7	13

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - OCTOBER-DECEMBER 1991
STABILITY CLASS - MODERATELY UNSTABLE (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	4	0	0	4
NNE	0	0	1	2	0	0	3
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	1	2	0	0	3
SSE	0	0	0	1	0	0	1
S	0	0	1	2	1	1	5
SSW	0	0	0	3	1	0	4
SW	0	0	0	0	0	0	0
WSW	0	0	0	1	0	0	1
W	0	0	0	2	0	0	2
WNW	0	0	0	0	0	0	0
NW	0	0	0	5	0	0	5
NNW	0	0	3	2	0	0	5
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	0	6	24	2	1	33

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - OCTOBER-DECEMBER 1991
STABILITY CLASS - SLIGHTLY UNSTABLE (DIFF TEMP '99-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	2	0	0	2
NNE	0	0	0	2	0	0	2
NE	0	1	0	1	0	0	2
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	4	0	1	5
S	0	1	1	0	2	3	7
SSW	0	0	1	2	3	1	7
SW	0	0	5	1	0	0	6
WSW	0	0	1	4	0	0	5
W	0	0	2	0	0	0	2
WNW	0	0	2	4	4	0	10
NW	0	0	2	0	1	0	3
NNW	0	0	2	2	0	0	4
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	2	16	22	10	5	55

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - OCTOBER-DECEMBER 1991
STABILITY CLASS - NEUTRAL (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	1	24	37	3	0	65
NNE	0	3	12	27	3	0	45
NE	1	4	33	22	5	0	65
ENE	0	4	34	6	0	0	44
E	0	4	4	11	6	0	25
ESE	3	3	0	2	14	3	25
SE	0	6	11	9	9	7	42
SSE	2	1	8	19	10	18	58
S	1	7	6	8	33	33	88
SSW	1	3	2	24	25	14	69
SW	1	10	18	13	10	13	65
WSW	1	16	31	16	36	15	5
W	0	9	20	22	38	15	[illegible]
WNW	2	16	22	31	35	3	109
NW	0	9	18	13	7	4	51
NNW	2	4	17	28	2	0	53
VARIABLE	0	0	0	0	0	0	0
TOTAL	14	100	260	288	236	125	1023

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - OCTOBER-DECEMBER 1991
STABILITY CLASS - SLIGHTLY STABLE (DIFF TEMP 199-30)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	5	13	6	0	0	24
NNE	1	3	11	8	0	0	23
NE	1	1	20	8	0	0	30
ENE	1	2	16	0	0	0	19
E	0	3	4	6	0	0	13
ESE	2	8	9	6	9	13	47
SE	0	8	24	20	9	2	63
SSE	1	2	20	19	13	9	64
S	0	4	13	54	75	41	187
SSW	0	1	17	71	41	16	146
SW	1	5	21	21	0	0	48
WSW	0	2	17	20	0	15	54
W	0	1	10	24	5	5	45
WNW	0	1	16	29	9	9	64
NW	2	5	22	7	6	0	42
NNW	1	4	21	14	2	0	42
VARIABLE	0	0	0	0	0	0	0
TOTAL	10	55	254	313	169	110	911

Hours of calm in this stability class: 2
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - OCTOBER-DECEMBER 1991
STABILITY CLASS - MODERATELY STABLE (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	3	5	1	0	0	9
NNE	0	2	5	0	0	0	7
NE	0	0	1	2	0	0	3
[illegible]	0	1	1	0	0	0	2
E	0	1	0	0	0	0	1
ESE	0	0	1	2	0	0	3
SE	0	0	4	0	0	0	4
SSE	0	3	9	1	0	0	13
S	0	3	8	6	0	0	17
SSW	0	1	2	2	0	0	5
SW	1	0	2	3	0	0	6
WSW	0	0	2	3	0	0	5
W	0	1	2	15	0	0	18
WNW	0	1	11	7	0	0	21
NW	0	0	11	2	0	0	13
NNW	0	[illegible]	[illegible]	2	0	0	10
VARIABLE	0	0	0	0	0	0	0
TOTAL	3	19	69	46	0	0	137

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

BRAIDWOOD NUCLEAR POWER STATION
PERIOD OF RECORD - OCTOBER-DECEMBER 1991
STABILITY CLASS - EXTREMELY STABLE (DIFF TEMP 199-30 FT)
WINDS MEASURED AT 203 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	2	3	0	0	0	5
NNE	0	0	1	0	0	0	1
NE	1	1	1	0	0	0	3
ENE	0	1	1	0	0	0	2
E	1	1	0	0	0	0	2
ESE	0	0	3	0	0	0	3
SE	0	0	1	0	0	0	1
SSE	0	0	1	0	0	0	1
S	0	1	0	0	0	0	1
[illegible]	0	0	0	0	0	0	0
[illegible]	0	1	0	0	0	0	1
[illegible]	0	2	0	0	0	0	2
[illegible]	0	0	1	1	0	0	2
WNW	0	1	0	1	0	0	2
NW	0	0	1	0	0	0	1
NNW	0	0	3	0	0	0	3
VARIABLE	0	0	0	0	0	0	0
TOTAL	2	10	16	2	0	0	30

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

APPENDIX III

1991 REMP SAMPLE RESULTS

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1.0 INTRODUCTION

The following constitutes the final Monthly Progress Report for the Environmental Radiological Monitoring Program conducted at the Braidwood Station, Braceville, Illinois. Results of completed analyses are presented in the attached tables. Missing entries indicate analyses that are not completed and 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 sampled.

For all gamma isotopic analyses, spectrum is computer scanned from 80 to 2048 KeV. Specifically included are Mn-54, Fe-59, Co-58, Co-60, Zn-65, Zr-95, 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 but not listed here. Data listed as "<" are at the 4.66 sigma level, others are 2 sigma. Cs-134 and Cs-137 are listed separately. All other gamma emitters are listed under "Other Gammas". Unless noted otherwise, the less than value ("<") reported under "Other Gammas" is for Co-60 and may be higher or lower for other radionuclides.

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

Deviations from Scheduled Sampling and Corrective Actions Taken

All samples were collected within the scheduled period unless notes otherwise in the Listing of Missed Samples.

Unusual Environmental Results

Sample Type	Location	Date Collected	Comments
Public Water	BD-22	1st Quarter	Tritium above background (Pg. 112).
Public Water	BD-22	2nd Quarter	Tritium above background (Pg. 112).
Surface Water	BD-10	3rd Quarter	Tritium above background (Pg. 108).
Public Water	BD-22	3rd Quarter	Tritium above background (Pg. 112).
Bottom Sediment	BD-10	10-11-91	Gamma-isotopic levels (Pg. 106).

2.0 LISTING OF MISSED SAMPLES

Sample Type	Location	Expected Collection Date	Reason
Air Particulate/ Air Iodine	BD-21	03-15-91	Road not accessible.

Table 1. Airborne Particulates and Iodine-131[a]
Collections: Weekly
Units: 10^{-2} pCi/m^3

Week Ended	Braidwood BD-01 Volume (m^3)	Braidwood BD-01 Gross Beta	Custer Park BD-02 Volume (m^3)	Custer Park BD-02 Gross Beta	County Line Rd. BD-03(C) Volume (m^3)	County Line Rd. BD-03(C) Gross Beta
01-04-91	275	3.7±0.4	273	3.3±0.4	274	3.7±0.4
01-11-91	287	2.8±0.4	288	3.1±0.4	287	3.3±0.4
01-18-91	290	3.5±0.4	290	4.2±0.4	290	4.2±0.4
01-25-91	285	3.0±0.4	284	3.1±0.4	284	3.1±0.4
02-01-91	283	2.1±0.3	286	2.5±0.3	287	3.0±0.4
02-08-91	279	2.4±0.4	280	2.6±0.4	280	2.8±0.4
02-15-91	290	2.0±0.3	305	2.3±0.3	289	1.6±0.3
02-22-91	286	1.1±0.3	280	1.2±0.3	285	1.5±0.3
03-01-91	284	2.4±0.4	288	2.3±0.3	288	2.4±0.3
03-08-91	280	2.8±0.4	280	2.6±0.4	280	2.9±0.4
03-15-91	245	2.3±0.4	245	2.4±0.4	177[b]	2.7±0.5
03-22-91	285	2.0±0.3	285	1.9±0.3	263	1.6±0.3
03-29-91	281	1.5±0.3	287	1.2±0.3	286	<0.4
1st Qtr. mean ± s.d.		2.4±0.7		2.5±0.8		1.7±0.8
04-05-91	305	1.5±0.3	289	1.9±0.3	290	1.3±0.3
04-11-91	278	1.7±0.3	279	1.5±0.3	278	1.4±0.3
04-19-91	285	1.3±0.2	286	1.3±0.2	285	1.2±0.2
04-26-91	285	1.7±0.3	287	1.6±0.3	268	1.6±0.3
05-03-91	287	1.5±0.3	281	1.4±0.3	285	1.4±0.3
05-10-91	281	1.3±0.4	286	1.4±0.3	285	1.4±0.4
05-17-91	287	1.4±0.3	286	1.8±0.4	286	1.7±0.3
05-24-91	284	1.7±0.3	284	1.4±0.3	284	1.3±0.3
05-31-91	286	1.9±0.3	286	1.6±0.3	286	1.3±0.3
06-07-91	300	0.7±0.2	285	1.1±0.2	283	1.0±0.2
06-14-91	298	2.2±0.3	300	2.4±0.3	298	2.1±0.3
06-21-91	277	1.7±0.3	274	1.9±0.4	274	1.9±0.4
06-28-91	279	1.7±0.3	302	2.0±0.3	289	1.9±0.3
2nd Qtr. mean ± s.d.		1.6±0.4		1.6±0.4		1.5±0.3

[a] Iodine-131 concentrations are <0.10 pCi/m^3 unless noted otherwise.

[b] Low volume due to power interruption at sampler pump.

Table 1. Airborne Particulates and Iodine-131[a] (continued)

Week Ended	Braidwood BD-01 Volume (m^3)	Braidwood BD-01 Gross Beta	Custer Park BD-02 Volume (m^3)	Custer Park BD-02 Gross Beta	County Line Rd. BD-03(C) Volume (m^3)	County Line Rd. BD-03(C) Gross Beta
07-05-91	290	2.3±0.3	290	2.2±0.3	284	2.0±0.3
07-13-91	314	1.8±0.3	332	2.0±0.3	323	1.9±0.3
07-19-91	248	2.6±0.4	244	2.3±0.4	244	2.3±0.4
07-27-91	329	2.1±0.3	335	2.0±0.3	338	2.2±0.3
08-02	247	2.1±0.4	243[b]	2.4±0.4	243	2.3±0.4
08-10-91	323	1.7±0.3	323	1.8±0.3	323	1.8±0.3
08-16-91	248	2.2±0.4	248[b]	2.1±0.4	248	2.5±0.4
08-23-91	283	2.0±0.3	288	2.2±0.3	291	2.6±0.4
08-30-91	290	2.5±0.2	291	2.6±0.2	291	2.7±0.3
09-06-91	280	1.5 ±0.2	279	1.9±0.2	280	1.8±0.2
09-14-91	330	2.3±0.2	336	2.3±0.2	336	2.7±0.2
09-20-91	246	1.3±0.3	237	1.2±0.4	254	1.4±0.3
09-27-91	282	1.8±0.3	281	2.0±0.3	281	1.8±0.3
3rd Qtr. mean ± s.d.		2.0±0.4		2.1±0.3		2.2±0.4
10-04-91	276	2.4±0.4	292	2.2±0.3	292	2.5±0.3
10-11-91	297	2.5±0.4	282	2.1±0.4	282	2.2±0.4
10-18-91	303	1.6±0.3	289	1.6±0.3	289	1.5±0.3
10-25-91	229	2.9±0.4	282	2.6±0.4	272	2.5±0.4
11-01-91	294	1.4±0.3	289	1.5±0.3	299	1.4±0.3
11-08-91	285	2.9±0.4	284	2.7±0.4	285	2.6±0.4
11-16-91	329	2.9±0.3	329	2.9±0.3	300	3.3±0.4
11-22-91	251	2.4±0.4	246	2.1±0.4	247	1.9±0.4
11-29-91	291	1.9±0.3	280	1.8±0.3	280	1.8±0.3
12-06-91	300	2.6±0.4	294	2.2±0.4	295	2.0±0.3
12-13-91	278	2.7±0.4	284	3.1±0.4	287	3.3±0.4
12-20-91	313	2.8±0.4	284	2.8±0.4	284	2.7±0.4
12-26-91	237	1.9±0.4	236	2.2±0.4	237	2.3±0.4
01-03-91	356	3.1±0.3	334	2.5±0.3	339	2.9±0.3
4th Qtr. mean ± s.d.		2.4±0.5		2.3±0.5		2.4±0.6

[a] Iodine-131 concentrations are <0.10 pCi/m^3 unless noted otherwise.

[b] Timer reading in error; volume is estimated.

Table 2. Airborne Particulates and Iodine-131[a]
Collections: Weekly
Units: 10^{-2} pCi/m^3

Week Ended	Essex BD-04 Volume (m^3)	Essex BD-04 Gross Beta	Gardner BD-05 Volume (m^3)	Gardner BD-05 Gross Beta	Godley BD-06 Volume (m^3)	Godley BD-06 Gross Beta
01-04-91	274	4.2±0.4	274	4.1±0.4	274	4.1±0.4
01-11-91	237	3.0±0.4	287	3.5±0.4	284	3.1±0.4
01-18-91	290	4.0±0.4	291	3.8±0.4	290	4.1±0.4
01-25-91	283	2.5±0.4	284	3.1±0.4	285	2.6±0.4
02-01-91	286	2.6±0.3	286	2.9±0.4	286	2.8±0.4
02-08-91	280	2.5±0.4	281	2.7±0.4	279	2.8±0.4
02-15-91	303	1.1±0.3	289	2.0±0.3	290	2.2±0.3
02-22-91	280	1.5±0.3	281	1.6±0.3	282	1.9±0.4
03-01-91	288	2.4±0.4	284	1.9±0.3	288	2.2±0.3
03-08-91	280	2.8±0.4	280	3.0±0.4	243	2.5±0.4
03-15-91	274	2.1±0.3	274	1.7±0.3	231	2.3±0.4
03-22-91	286	1.9±0.3	286	1.9±0.3	285	2.2±0.3
03-29-91	286	1.4±0.3	286	1.5±0.3	286[b]	1.4±0.3
1st Qtr. mean ± s.d.		2.5±0.9		2.6±0.9		2.6±0.8
04-05-91	290	2.0±0.3	290	2.3±0.3	290	1.9±0.3
04-11-91	278	2.0±0.3	278	1.9±0.3	278	2.0±0.3
04-19-91	285	1.4±0.2	285	1.4±0.2	285	1.2±0.2
04-26-91	287	1.7±0.3	287	1.8±0.3	286	1.5±0.3
05-03-91	259	1.6±0.3	286	1.8±0.3	286	1.7±0.3
05-10-91	170	1.6±0.5	284	1.7±0.4	284	1.3±0.3
05-17-91	207	1.8±0.4	267	1.9±0.4	287	1.7±0.3
05-24-91	284	1.5±0.3	284	1.6±0.3	284	1.7±0.3
05-31-91	285	1.6±0.3	285	1.6±0.3	286	1.6±0.3
06-07-91	286	1.1±0.2	286	1.2±0.2	286	1.2±0.3
06-14-91	301	2.3±0.3	298	2.0±0.3	301	2.1±0.3
06-21-91	274	2.2±0.4	274	2.3±0.4	274	2.1±0.4
06-28-91	289	2.1±0.3	294	2.2±0.3	296	2.0±0.3
2nd Qtr. mean ± s.d.		1.8±0.3		1.8±0.3		1.7±0.3

a Iodine-131 concentrations are <0.10 pCi/m^3 unless noted otherwise.

b Volume is assumed; pump site damaged during construction work in area.

Table 2. Airborne Particulates and Iodine-131[a] (continued)

Week Ended	Essex BD-04 Volume (m^3)	Essex BD-04 Gross Beta	Gardner BD-05 Volume (m^3)	Gardner BD-05 Gross Beta	Godley BD-06 Volume (m^3)	Godley BD-06 Gross Beta
07-05-91	286	2.4±0.3	289	2.0±0.3	292	2.4±0.3
07-13-91	329	1.8±0.3	329	2.2±0.3	329	1.9±0.3
07-19-91	244	2.2±0.4	245	2.5±0.4	245	2.6±0.4
07-27-91	338	2.2±0.3	329	2.0±0.3	338	2.2±0.3
08-02-91	241	2.2±0.4	234	2.2±0.4	247	2.0±0.4
08-10-91	323	1.8±0.3	323	2.1±0.3	234	1.9±0.4
08-16-91	248	2.9±0.4	248	2.6±0.4	248	2.9±0.4
08-23-91	291	2.4±0.3	282	2.5±0.4	285	2.5±0.4
08-30-91	291	2.9±0.3	293	2.9±0.3	290	2.6±0.2
09-06-91	280	2.0±0.2	280	1.9±0.2	285	2.1±0.2
09-14-91	336	2.5±0.2	336	2.3±0.2	336	2.5±0.2
09-20-91	238	1.4±0.4	238	1.1±0.3	242	1.1±0.3
09-27-91	276	2.2±0.3	281	2.1±0.3	281	2.1±0.3
3rd Qtr. mean ± s.d.		2.2±0.4		2.2±0.4		2.2±0.4
10-04-91	302	2.5±0.3	292	2.4±0.3	292	2.3±0.3
10-11-91	282	2.0±0.4	282	2.3±0.4	282	2.1±0.4
10-18-91	288	2.0±0.3	299	1.7±0.3	289	1.9±0.3
10-25-91	277	2.6±0.4	264	2.6±0.4	281	2.5±0.3
11-01-91	289	1.4±0.3	152[b]	1.6±0.5	289	1.4±0.3
11-08-91	284	2.4±0.4	270	2.3±0.4	285	2.8±0.4
11-16-91	317	3.0±0.4	329	3.3±0.4	329	3.4±0.4
11-22-91	247	2.2±0.4	247	2.4±0.4	247	2.1±0.4
11-29-91	280	1.9±0.3	279	2.0±0.4	279	1.7±0.3
12-06-91	290	1.9±0.3	300	2.5±0.4	300	3.0±0.4
12-13-91	283	3.2±0.4	288	3.0±0.4	273	3.1±0.4
12-20-91	284	2.8±0.4	284	2.6±0.4	284	2.8±0.4
12-26-91	237	2.6±0.4	237	1.9±0.4	159	3.4±0.6
01-03-91	344	3.2±0.4	337	3.0±0.4	341	3.4±0.4
4th Qtr. mean ± s.d.		2.4±0.5		2.4±0.5		2.6±0.7

[a] Iodine-131 concentrations are <0.10 pCi/m^3 unless noted otherwise.

[b] Low volume due to power interruption at air sampler station.

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Table 3. Airborne Particulates and Iodine-131[a]
Collections: Weekly
Units: 10^{-2} pCi/m^3

Week Ended	Nearsite NW BD-19 Volume (m^3)	Nearsite NW BD-19 Gross Beta	Nearsite N BD-20 Volume (m^3)	Nearsite N BD-20 Gross Beta	Nearsite NE BD-21 Volume (m^3)	Nearsite NE BD-21 Gross Beta
01-04-91	275	4.2±0.4	275	3.9±0.4	275	3.7±0.4
01-11-91	287	3.2±0.4	287	3.1±0.4	287	3.4±0.4
01-18-91	290	4.1±0.4	290	3.6±0.4	289	3.9±0.4
01-25-91	285	2.8±0.4	285	3.2±0.4	285	2.7±0.4
02-01-91	286	2.5±0.3	283	2.4±0.4	286	3.0±0.4
02-08-91	279	2.5±0.4	279	2.5±0.4	282	2.6±0.4
02-15-91	290	1.8±0.3	290	1.8±0.3	286	2.1±0.3
02-22-91	280	1.4±0.3	285	1.6±0.3	286	1.7±0.3
03-01-91	288	2.6±0.4	288	2.2±0.3	288	2.5±0.4
03-08-91	267	3.0±0.4	280	3.0±0.4	281	2.4±0.3
03-15-91	248	2.6±0.4	282	2.1±0.3	NS[b]	----
03-22-91	285	1.9±0.3	285	2.0±0.3	561[c]	1.8±0.2
03-29-91	285	1.3±0.3	280	1.5±0.3	282	1.6±0.3
1st Qtr. mean ± s.d.		2.6±0.9		2.5±0.8		2.6±0.8
04-05-91	290	2.0±0.3	290	1.7±0.3	289	1.7±0.3
04-11-91	278	1.8±0.3	278	2.0±0.3	279	1.7±0.3
04-19-91	285	1.3±0.2	285	1.4±0.2	285	1.3±0.2
04-26-91	286	1.8±0.3	286	1.7±0.3	286	1.7±0.3
05-03-91	287	1.5±0.3	287	1.6±0.3	287	1.6±0.3
05-10-91	284	1.0±0.3	284	1.4±0.3	281	1.5±0.4
05-17-91	287	1.5±0.3	287	1.5±0.3	286[d]	1.7±0.3
05-24-91	284	1.3±0.3	284	1.4±0.3	284	1.3±0.3
05-31-91	286	1.5±0.3	209	1.2±0.4	286	1.7±0.3
06-07-91	286	1.0±0.2	286[d]	1.0±0.2	286[d]	1.0±0.2
06-14-91	301	2.3±0.3	298	2.0±0.3	298	2.1±0.3
06-21-91	277	2.0±0.4	278	2.0±0.4	275	2.1±0.4
06-28-91	301	2.2±0.3	289	2.1±0.3	286	2.1±0.3
2nd Qtr. mean ± s.d.		1.6±0.4		1.7±0.4		1.7±0.4

[a] Iodine-131 concentrations are <0.10 pCi/m^3 unless noted otherwise.

[b] NS = No sample; road to sampler station not accessible.

[c] Two week collection.

[d] Timer reading in error; volume is assumed.

Table 3. Airborne Particulates and Iodine-131[a] (continued)

Week Ended	Nearsite NW BD-19 Volume (m^3)	Nearsite NW BD-19 Gross Beta	Nearsite N BD-20 Volume (m^3)	Nearsite N BD-20 Gross Beta	Nearsite NE BD-21 Volume (m^3)	Nearsite NE BD-21 Gross Beta
07-05-91	288	2.0±0.3	289	2.1±0.3	289	2.1±0.3
07-13-91	308	1.8±0.3	323	2.1±0.3	323	1.6±0.3
07-19-91	249	2.7±0.4	249	2.6±0.4	244	2.5±0.4
07-27-91	338	2.4±0.3	329	2.2±0.3	335	1.9±0.3
08-02-91	247	1.8±0.4	251	2.1±0.4	250	2.3±0.4
08-10-91	328	1.8±0.3	323	2.0±0.3	323	1.6±0.3
08-16-91	248	2.4±0.4	248	1.2±0.4	246	2.6±0.4
08-23-91	292	2.2±0.3	273	2.2±0.4	298	2.4±0.3
08-30-91	295	2.8±0.3	290	2.9±0.3	289	2.8±0.3
09-06-91	290	1.9±0.2	280	1.9±0.2	280	1.8±0.2
09-14-91	331	2.3±0.2	324	2.0±0.2	324	2.4±0.2
09-20-91	238	1.5±0.4	246	1.3±0.3	237	1.3±0.4
09-27-91	282	1.9±0.3	287	1.8±0.3	294	2.0±0.3
3rd Qtr. mean ± s.d.		2.1±0.4		2.0±0.4		2.1±0.4
10-04-91	289	2.4±0.3	292	2.5±0.3	280	2.6±0.4
10-11-91	282	1.9±0.4	282	2.1±0.4	282	2.4±0.4
10-18-91	294	1.7±0.3	289	1.6±0.3	289	1.8±0.3
10-25-91	281	2.4±0.3	264	2.2±0.3	282	2.7±0.4
11-01-91	254	1.4±0.3	289	1.3±0.3	289	1.5±0.3
11-08-91	285	2.7±0.4	285	2.6±0.4	290	2.7±0.4
11-16-91	329	2.6±0.3	329	2.6±0.3	328	3.2±0.4
11-22-91	247	2.0±0.4	251	1.6±0.4	248	1.8±0.4
11-29-91	279	1.7±0.3	280	1.8±0.3	279	1.9±0.3
12-06-91	295	2.4±0.4	300	2.2±0.4	290	2.5±0.4
12-13-91	280	2.9±0.4	278	2.7±0.4	239	2.5±0.4
12-20-91	284	2.8±0.4	284	2.5±0.4	298	2.5±0.4
12-26-91	237	1.7±0.3	237	1.8±0.4	238	1.8±0.3
01-03-91	338	2.8±0.3	338	3.2±0.4	341	2.9±0.3
4th Qtr. mean ± s.d.		2.2±0.5		2.2±0.5		2.3±0.5

[a] Iodine-131 concentrations are <0.10 pCi/m^3 unless noted otherwise.

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Table 4. Airborne Particulates
Collection: Quarterly composites of weekly collections.
Units: pCi/m^3

Location	Lab Code	Volume (m^3)	Cs-134	Cs-137	Gammas[a]
		1st Quarter			
BD-01	BDAP-2623	3650	<0.01	<0.01	<0.01
BD-02	2624	3671	<0.01	<0.01	<0.01
BD-03	2625	3570	<0.01	<0.01	<0.01
BD-04	2626	3697	<0.01	<0.01	<0.01
BD-05	2627	3683	<0.01	<0.01	<0.01
BD-06	2628	3350	<0.01	<0.01	<0.01
BD-19	2629	3[illegible]5	<0.01	<0.01	<0.01
BD-20	2630	3689	<0.01	<0.01	<0.01
BD-21	2631	3688	<0.01	<0.01	<0.01
		2nd Quarter			
BD-01	BDAP-2746	3732	<0.01	<0.01	<0.01
BD-02	2747	3725	<0.01	<0.01	<0.01
BD-03	2748	3691	<0.01	<0.01	<0.01
BD-04	2749	3575	<0.01	<0.01	<0.01
BD-05	2750	3718	<0.01	<0.01	<0.01
BD-06	2751	3723	<0.01	<0.01	<0.01
BD-19	2752	3732	<0.01	<0.01	<0.01
BD-20	2753	3638	<0.01	<0.01	<0.01
BD-21	2754	3708	<0.01	<0.01	<0.01

[a] See Introduction.

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Table 4. Airborne Particulates
Collection: Quarterly composites of weekly collections.
Units: pCi/m^3

Location	Lab Code	Volume (m^3)	Cs-134	Cs-137	Gammas[a]
			3rd Quarter		
BD-01	BDAP-2861	3710	<0.01	<0.01	<0.01
BD-02	2862	3727	<0.01	<0.01	<0.01
BD-03	2863	3736	<0.01	<0.01	<0.01
BD-04	2864	3721	<0.01	<0.01	<0.01
BD-05	2865	3707	<0.01	<0.01	<0.01
BD-06	2866	3652	<0.01	<0.01	<0.01
BD-19	2867	3734	<0.01	<0.01	<0.01
BD-20	2868	3712	<0.01	<0.01	<0.01
BD-21	2869	3732	<0.01	<0.01	<0.01
			4th Quarter		
BD-01	BDAP-2976	4039	<0.01	<0.01	<0.01
BD-02	2977	4005	<0.01	<0.01	<0.01
BD-03	2978	3988	<0.01	<0.01	<0.01
BD-04	2979	4004	<0.01	<0.01	<0.01
BD-05	2980	3860	<0.01	<0.01	<0.01
BD-06	2981	3930	<0.01	<0.01	<0.01
BD-19	2982	3974	<0.01	<0.01	<0.01
BD-20	2983	3998	<0.01	<0.01	<0.01
BD-21	2984	3973	<0.01	<0.01	<0.01

[a] See Introduction.

Table 6. Milk
Collection: Semi-monthly May through October
Monthly November through April
Units: pCi/L

NON-GRAZING SEASON - NOVEMBER THROUGH APRIL

Collection Period	Lab Code	I-131	Cs-134	Cs-137	Other Gammas[a]
		Mack-Morris Dairy Farm BD-11			
01-04-91	BDMI-5773	<0.5	<5	<5	<10
02-01-91	5836	<0.5	<5	<5	<10
03-01-91	5908	<0.5	<5	<5	<10
04-05-91	6015	<0.5	<5	<5	<10
11-01-91	7140,1	<0.5	<5	<5	<10
12-06-91	7255	<0.5	<5	<5	<10

GRAZING SEASON - MAY THROUGH OCTOBER

Collection Period	Lab Code	I-131	Cs-134	Cs-137	Other Gammas[a]
		Mack-Morris Dairy Farm BD-11			
05-03-91	BDMI-6086	<0.5	<5	<5	<10
05-17-91	6177	<0.5	<5	<5	<10
06-07-91	6304,5	<0.5	<5	<5	<10
06-29-91	6427	<0.5	<5	<5	<10
07-05-91	6473	<0.5	<5	<5	<10
07-20-91	6557,8	<0.5	<5	<5	<10
08-02-91	6629	<0.5	<5	<5	<10
08-16-91	6697	<0.5	<5	<5	<10
09-06-91	6828	<0.5	<5	<5	<10
09-20-91	6921,2	<0.5	<5	<5	<10
10-04-91	6994	<0.5	<5	<5	<10
10-18-91	7084	<0.5	<5	<5	<10

[a] See In roduction.

Table 6. Milk (continued)

NON-GRAZING SEASON - NOVEMBER THROUGH APRIL

Collection Period	Lab Code	I-131	Cs-134	Cs-137	Other Gammas[a]
		Halpin's Dairy Farm BD-17			
01-04-91	BDMI-5774	<0.5	<5	<5	<10
02-01-91	5837	<0.5	<5	<5	<10
03-01-91	5909	<0.5	<5	<5	<10
04-05-91	6016	<0.5	<5	<5	<10
11-01-91	7142	<0.5	<5	<5	<10
12-06-91	7256	<0.5	<5	<5	<10

GRAZING SEASON - MAY THROUGH OCTOBER

Collection Period	Lab Code	I-131	Cs-134	Cs-137	Other Gammas[a]
		Halpin's Dairy Farm BD-17			
05-03-91	BDMI-6087	<0.5	<5	<5	<10
05-17-91	6178	<0.5	<5	<5	<10
06-07-91	6306	<0.5	<5	<5	<10
06-21-91	6377	<0.5	<5	<5	<10
07-05-91	6474	<0.5	<5	<5	<10
07-19-91	6559	<0.5	<5	<5	<10
08-02-91	6630	<0.5	<5	<5	<10
08-16-91	6698	<0.5	<5	<5	<10
09-06-91	6829	<0.5	<5	<5	<10
09-20-91	6923	<0.5	<5	<5	<10
10-04-91	6995	<0.5	<5	<5	<10
10-18-91	7085	<0.5	<5	<5	<10

[a] See Introduction.

Table 6. Milk (continued)

NON-GRAZING SEASON - NOVEMBER THROUGH APRIL

Collection Period	Lab Code	I-131	Cs-134	Cs-137	Other Gammas[a]
		Biros Dairy Farm BD-18			
01-04-91	BDMI-5775	<0.5	<5	<5	<10
02-01-91	5838	<0.5	<5	<5	<10
03-02-91	5910,11	<0.5	<5	<5	<10
04-06-91	6017	<0.5	<5	<5	<10
11-01-91	7143	<0.5	<5	<5	<10
12-06-91	7257	<0.5	<5	<5	<10

GRAZING SEASON - MAY THROUGH OCTOBER

Collection Period	Lab Code	I-131	Cs-134	Cs-137	Other Gammas[a]
		Biros Dairy Farm BD-18			
05-04-91	BDMI-6088	<0.5	<5	<5	<10
05-18-91	6179	<0.5	<5	<5	<10
06-07-91	6307	<0.5	<5	<5	<10
06-21-91	6378	<0.5	<5	<5	<10
07-05-91	6475	<0.5	<5	<5	<10
07-20-91	6560	<0.5	<5	<5	<10
08-02-91	6631	<0.5	<5	<5	<10
08-16-91	6699,700	<0.5	<5	<5	<10
09-06-91	6830	<0.5	<5	<5	<10
09-21-91	6924	<0.5	<5	<5	<10
10-04-91	6996	<0.5	<5	<5	<10
10-18-91	7086	<0.5	<5	<5	<10

[a] See Introduction.

Table 6. Milk (continued)

NON-GRAZING SEASON - NOVEMBER THROUGH APRIL

Collection Period	Lab Code	I-131	Cs-134	Cs-137	Other Gammas[a]
		Klausing Dairy Farm BD-23			
01-04-91	BDMI-5776	<0.5	<5	<5	<10
02-01-91	5839	<0.5	<5	<5	<10
03-01-91	5912	<0.5	<5	<5	<10
04-05-91	6018	<0.5	<5	<5	<10

GRAZING SEASON - MAY THROUGH OCTOBER

Collection Period	Lab Code	I-131	Cs-134	Cs-137	Other Gammas[a]
		Klausing Dairy Farm BD-23			
05-03-91	BDMI-6089	<0.5	<5	<5	<10
05-17-91	6180	<0.5	<5	<5	<10
06-07-91	6308	<0.5	<5	<5	<10
06-21-91	6379	<0.5	<5	<5	<10
07-06-91	6476	<0.5	<5	<5	<10
07-19-91	6561	<0.5	<5	<5	<10
08-02-91	6632	<0.5	<5	<5	<10
08-16-91	6701	<0.5	<5	<5	<10
09-06-91	6831,2	<0.5	<5	<5	<10
09-20-91	6925	<0.5	<5	<5	<10
10-04-91	6997,8	<0.5	<5	<5	<10
10-18-91	NS[b]	–	–	–	–

[a] See Introduction.

[b] Klausing Dairy Farm out of business; replaced by BD-26, p. 104.

Table 6. Milk (continued)

NON-GRAZING SEASON - NOVEMBER THROUGH APRIL

Collection Period	Lab Code	I-131	Cs-134	Cs-137	Other Gammas[a]
		Goodwin Dairy Farm[b] BD-24			
01-04-91	BDMI-5777	<0.5	<5	<5	<10
02-01-91	5840	<0.5	<5	<5	<10
03-01-91	5913	<0.5	<5	<5	<10
04-05-91	6019,20	<0.5	<5	<5	<10
11-01-91	7144	<0.5	<5	<5	<10
12-06-91	7258	<0.5	<5	<5	<10

GRAZING SEASON - MAY THROUGH OCTOBER

Collection Period	Lab Code	I-131	Cs-134	Cs-137	Other Gammas[a]
		Goodwin Dairy Farm BD-24			
05-03-91	BDMI-6090	<0.5	<5	<5	<10
05-17-91	6181	<0.5	<5	<5	<10
06-07-91	6309	<0.5	<5	<5	<10
06-29-91	6428	<0.5	<5	<5	<10
07-05-91	6477	<0.5	<5	<5	<10
07-19-91	6562	<0.5	<5	<5	<10
08-02-91	6633,4	<0.5	<5	<5	<10
08-16-91	6702	<0.5	<5	<5	<10
09-06-91	6833	<0.5	<5	<5	<10
09-20-91	6926	<0.5	<5	<5	<10
10-04-91	6999	<0.5	<5	<5	<10
10-18-91	7087,8	<0.5	<5	<5	<10

[a] See Introduction.

[b] Not required by Technical Specifications; Goodwin Farm is collected as an extra location.

Table 6. Milk (continued)

NON-GRAZING SEASON - NOVEMBER THROUGH APRIL

Collection Period	Lab Code	I-131	Cs-134	Cs-137	Other Gammas[a]
		Gaddis Dairy Farm[b] BD-26			
11-01-91	BDMI-7145	<0.5	<5	<5	<10
12-06-91	7259	<0.5	<5	<5	<10

GRAZING SEASON - MAY THROUGH OCTOBER

Collection Period	Lab Code	I-131	Cs-134	Cs-137	Other Gammas[a]
		Gaddis Dairy Farm[b] BD-26			
10-26-91	BDMI-7131,2	<0.5	<5	<5	<10

[a] See Introduction.

[b] Gaddis Dairy Farm (BD-26) replacement for Klausing Dairy Farm. First collection 10-26-91.

Table 7. Fish, Edible Portion
Collection: Three (3) times per year
Units: pCi/g wet weight

Collection Date	Type and Number Analyzed	Lab Code	Cs-134	Cs-137	Other Gammas[a]
		Kankakee River Upstream BD-07			
05-21-91	Carp (1)	BDF-1480	<0.10	<0.10	<0.13
07-25-91	Catfish (1)	1529	<0.10	<0.10	<0.13
07-25-91	Smallmouth Bass (1)	1530	<0.10	0.20±0.04	<0.13
10-29-91	Catfish (1)	1623	<0.10	<0.10	<0.13
		Kankakee River Downstream BD-10			
05-22-91	Buffalo (1)	BDF-1481	<0.10	<0.10	<0.13
07-24-91	Catfish (1)	1531,2	<0.10	<0.10	<0.13
07-24-91	Smallmouth Bass (1)	1533	<0.10	0.23±0.06	<0.13
07-24-91	Largemouth Bass (1)	1534	<0.10	<0.10	<0.13
10-30-91	Catfish (1)	1624	<0.10	<0.10	<0.13

[a] See Introduction.

Table 8. Bottom Sediments
Collection: Semiannually
Units: pCi/g dry weight

Collection Date	Lab Code	Cs-134	Cs-137	Other Gammas[a]
		Downstream BD-10		
05-03-91	BDBS-943	<0.1	0.20±0.05	<0.2
10-11-91	BDBS-1021	0.16±0.05	0.25±0.05	1.59±0.10[b]

a See Introduction.

b Result for Co-60; other gammas detected: Co-58 4.47±0.13 pCi/gdry
Mn-54 0.34±0.06 pCi/gdry

Table 9. Vegetables
Collection: Annually
Units: pCi/g wet weight

Collection Date	Type	Lab Code	I-31[a]	Cs-134	Cs-137	Other Gammas[b]
			BD-14 Pinnick Farm			
08-31-91	Collards	BDVE-1202	–	<0.06	<0.08	<0.2
08-31-91	Cabbage	1203	<0.06	<0.06	<0.08	<0.2
08-31-91	Corn	1204	–	<0.06	<0.08	<0.2
08-31-91	Potatoes	1205	–	<0.06	<0.08	<0.2
			BD-15 Girot Farm			
08-02-91	Onions	BDVE-1146	–	<0.06	<0.08	<0.2
08-02-91	Cabbage	1147	<0.06	<0.06	<0.08	<0.2
08-02-91	Tomatoes	1148	–	<0.06	<0.08	<0.2
08-02-91	Eggplant	1149	–	<0.06	<0.08	<0.2
			BD-16 Clark Farm			
08-02-91	Onions	BDVE-1150	–	<0.06	<0.08	<0.2
08-02-91	Cabbage	1151	<0.06	<0.06	<0.08	<0.2
08-02-91	Tomatoes	1152	–	<0.06	<0.08	<0.2
08-02-91	Zucchini	1153,4	–	<0.06	<0.08	<0.2

[a] Analysis for I-131 required for green leafy vegetation only.

[b] See Introduction.

Table 10. Surface Water
Collection: Weekly
Units: pCi/L

MONTHLY COMPOSITES

1991 Collection Period	Lab Code	Cs-134	Cs-137	Other Gammas[a]
		Kankakee River Downstream BD-10[b]		
January	BDSW-9638	<10	<10	<15
February	9930	<10	<10	<15
March	404	<10	<10	<15
April	779	<10	<10	<15
May	1141	<10	<10	<15
June	1658	<10	<10	<15
July	2004,5	<10	<10	<15
August	2368	<10	<10	<15
September	3154	<10	<10	<15
October	3321	<10	<10	<15
November	3767	<10	<10	<15
December	4236	<10	<10	<15

[a] See Introduction.
[b] Collected on west bank of river as of 02-15-91.

QUARTERLY COMPOSITES

Composite Period	Lab Code	Tritium
	Kankakee River Downstream BD-10[a]	
1st Quarter	BDSW-648	<200
2nd Quarter	1351	<200
3rd Quarter	2586	1518±129[b]
4th Quarter	3901	<200

[a] Collected on west bank of river as of 02-15-91.
[b] Analysis was repeated; result of reanalysis 1663±133 pCi/L.

Table 10. Surface Water (continued)

MONTHLY COMPOSITES

1991 Collection Period	Lab Code	Cs-134	Cs-137	Other Gammas[a]
		Kankakee River Upstream BD-7		
January	BDSW-9637	<10	<10	<15
February	9929	<10	<10	<15
March	403	<10	<10	<15
April	782	<10	<10	<15
May	1144	<10	<10	<15
June	1657	<10	<10	<15
July	2003	<10	<10	<15
August	2367	<10	<10	<15
September	3153	<10	<10	<15
October	3320	<10	<10	<15
November	3766	<10	<10	<15
December	4208	<10	<10	<15

[a] See Introduction.

QUARTERLY COMPOSITES

Composite Period	Lab Code	Tritium
	Kankakee River Upstream BD-7	
1st Quarter	BDSW-647	<200
2nd Quarter	1350	<200
3rd Quarter	2587	<200
4th Quarter	3900	<200

Table 10. Surface Water (continued)

MONTHLY COMPOSITES

1991 Collection Period	Lab Code	Cs-134	Cs-137	Other Gammas[a]
		Kankakee River Upstream BD-25		
January	BDSW-9639	<10	<10	<15
February	9931	<10	<10	<15
March	406	<10	<10	<15
April	780	<10	<10	<15
May	1143	<10	<10	<15
June	1659	<10	<10	<15
July	2006	<10	<10	<15
August	2512	<10	<10	<15
September	3157,8	<10	<10	<15
October	3322	<10	<10	<15
November	3768	<10	<10	<15
December	4211	<10	<10	<15

[a] See Introduction.

QUARTERLY COMPOSITES

Composite Period	Lab Code	Tritium
	Kankakee River Upstream BD-25	
1st Quarter	BDSW-649	<200
2nd Quarter	1352	<200
3rd Quarter	2585	<200
4th Quarter	3902	<200

Table 11. Well Water
Collection: Semimonthly
Units: pCi/L

1991 Collection Period	Lab Code	Gross Beta	Cs-134	Cs-137	Other Gammas[a]
		MONTHLY COMPOSITES			
		Braidwood City Hall Well BD-13			
January	BDWW-9641,2	31.9±2.0	<10	<10	<20
February	9935	27.3±2.7	<10	<10	<20
March	408	27.8±2.9	<10	<10	<20
April	784,5	26.7±1.9	<10	<10	<20
May	1142	28.5±2.8	<10	<10	<20
June	1663	26.1±2.7	<10	<10	<20
July	2032	32.8±2.9	<10	<10	<20
August	2514	31.0±2.9	<10	<10	<20
September	3155	30.5±2.8	<10	<10	<20
October	3324	24.8±2.6	<10	<10	<20
November	3764	29.3±2.8	<10	<10	<20
December	4210	22.4±1.8	<10	<10	<20

[a] See Introduction.

Composite Period	Lab Code	Tritium
	QUARTERLY COMPOSITES	
	Braidwood City Hall Well BD-13	
1st Quarter	BDWW-241	<200
2nd Quarter	1906	<200
3rd Quarter	2589	<200
4th Quarter	3906	<200

Table 12. Public Water
Collection: Weekly
Units: pCi/L

MONTHLY COMPOSITES

1991 Collection Period	Lab Code	Gross Beta	Cs-134	Cs-137	Other Gammas[a]
		Wilmington BD-22			
January	BDPW-9640	3.5±1.2	<10	<10	<20
February	9933,4	2.6±0.8	<10	<10	<20
March	405	2.1±1.5	<10	<10	<20
April	786	3.9±1.4	<10	<10	<20
May	1145	3.3±1.2	<10	<10	<20
June	1662	4.4±1.4	<10	<10	<20
July	2029	5.9±1.4	<10	<10	<20
August	2510,1	3.4±0.9	<10	<10	<20
September	3156	2.8±1.2	<10	<10	<20
October	3323	3.9±1.6	<10	<10	<20
November	3765	2.7±1.2	<10	<10	<20
December	4209	3.1±1.5	<10	<10	<20

[a] See Introduction.

QUARTERLY COMPOSITES

Composite Period	Lab Code	Tritium
	Wilmington BD-22	
1st Quarter	BDPW-240	594±108
2nd Quarter	1907	371±105
3rd Quarter	2588	1104±118[a]
4th Quarter	3903	215±97

[a] Analysis was repeated; results of reanalysis 798±115.

Table 13. Cooling Water[a]
Collection : Weekly
Units pCi/L

Collection Date	Lab Code	Gross Beta	Lab Code	Gross Beta
	Intake Pipe BD-08 (C)		Discharge Pipe BD-09	
01-04-91	BDCW-9127	1.8±1.0	BDCW-9128	3.5±1.2
01-11-91	9238	4.1±1.3	9239	8.5±1.6
01-18-91	9304	3.5±1.2	9305	7.5±1.5
01-25-91	9359	2.5±1.1	9360	5.7±1.3
02-01-91	9438	3.2±1.2	9439,40	7.5±1.0
02-08-91	9544	3.6±1.0	9545	11.7±1.3
02-15-91	9599	3.8±0.9	9600	6.8±1.0
02-22-91	9664,5	2.4±0.6	9666	9.4±1.2
03-01-91	9737	2.4±0.8	9738	10.4±1.8
03-08-91	9832	2.3±1.4	9833	29.1±2.7
03-15-91	9911	1.9±1.4	9912	30.4±2.7
03-22-91	9975	2.9±1.4	9976	10.3±1.9
03-29-91	73	2.4±1.4	74	7.1±1.7
1st Qtr. mean ± s.d.		2.8±0.7		11.4±8.4
04-05-91	BDCW-251	2.2±1.4	BDCW-252	7.8±1.8
04-12-91	357,8	3.0±0.6	359	9.4±1.2
04-19-91	429	2.4±0.8	430	9.8±1.2
04-26-91	484	3.7±0.9	485	21.6±1.6
05-03-91	574	2.5±0.9	575,6	37.4±1.4
05-10-91	682	3.2±1.3	683	28.4±2.6
05-17-91	744	3.1±1.2	745	8.8±1.6
05-25-91	811	2.5±1.2	812,3	24.1±0.4
05-31-91	902	2.0±1.1	903,4	3[illegible]±0.6
06-07-91	1024	3.1±1.3	1025	6[illegible].6±3.6
06-14-91	1104	3.9±1.3	1105	26.4±2.4
06-21-91	1165	3.6±1.3	1166	22.4±2.4
06-28-91	1287	2.3±1.3	1288	50.3±3.3
2nd Qtr. mean ± s.d.		2.9±0.6		26.2±16.6

a Intake and discharge sample points are not required by Technical Specifications. Data are provided for information only.

Table 13. Cooling Water[a] (continued)

Collection Date	Lab Code	Gross Beta	Lab Code	Gross Beta
	Intake Pipe BD-08 (C)		Discharge Pipe BD-09	
07-05-91	BDCW-1434	3.4±1.5	BDCW-1435	38.2±3.0
07-12-91	1586	3.4±1.5	1587	14.8±2.1
07-19-91	1653	3.0±1.5	1654	12.3±2.0
07-26-91	1731	2.0±1.4	1732	18.7±2.3
08-02-91	1863	1.6±1.4	1864	9.6±1.9
08-09-91	1982	3.1±1.3	1983	25.8±2.5
08-16-91	2053	2.4±1.2	2054	29.3±2.6
08-23-91	2110	4.5±1.4	2111	21.8±2.4
08-30-91	2229	3.6±1.3	2229,30	12.7±1.3
09-07-91	2327	3.8±1.3	2328,9	12.0±1.3
09-14-91	2405	7.3±1.5	2406	25.0±2.5
09-20-91	2491	2.9±1.4	2492	9.5±1.4
09-27-91	2576	2.7±1.2	2577	9.6±1.2
3rd Qtr. mean ± s.d.		3.4±1.4		18.4±9.0
10-04-91	2756	2.4±1.1	2757,8	25.2±1.7
10-11-91	2879,80	2.6±0.9	2881	9.8±1.7
10-18-91	2973	2.9±1.2	2974	13.7±2.0
10-25-91	3036	3.1±1.2	3037	11.8±1.8
11-01-91	3166	3.5±1.3	3167	7.1±1.6
11-08-91	3272	3.6±1.3	3273,4	17.5±1.5
11-15-91	3358	4.7±1.3	3359	30.1±2.7
11-22-91	3426	2.7±1.2	3427	22.6±2.4
11-29-91	3512	3.6±1.1	3513	12.5±1.5
12-06-91	3646	3.3±1.2	3647	24.6±2.5
12-13-91	3686	4.1±1.6	3687	27.4±2.9
12-20-91	3790	4.3±1.6	3791	15.6±2.4
12-27-91	3886	2.8±0.9	3887	9.7±1.2
01-03-92	3978	2.1±1.4	3979	9.6±1.9
4th Qtr. mean ± s.d.		3.3±0.8		16.9±7.6

a Intake and discharge sample points are not required by Technical Specifications. Data are provided for information only.

Table 13. Cooling Water (continued)

1991 Composite Period	Lab Code	Tritium[a]
	QUARTERLY COMPOSITES OF WEEKLY COLLECTIONS	
	Intake Pipe BD-08 (C)	
1st Quarter	BDCW-650	<200
2nd Quarter	1904	201±99
3rd Quarter	3064	<200
4th Quarter	3904	<200
	Discharge Pipe BD-09	
1st Quarter	BDCW-651	38,552±522
2nd Quarter	1905	39,985±554
3rd Quarter	3065	70,767±700
4th Quarter	3905	45,369±587

[a] Tritium analysis not required in Technical Specifications.

BRAIDWOOD

MILCH ANIMALS, NEAREST RESIDENCE AND NEAREST CATTLE CENSUS

BRAIDWOOD

MILCH ANIMALS CENSUS, 1991

There is one dairy (BD-11) within a five mile radius of Braidwood.

BD-11 Mack-Morris Dairy Farm
2.4 miles @ 95°

Number of cows - 75
Number of fresh cows - 60

Diet consists of feed and grass.

BD-17 Halpins Dairy Farm
5.6 miles @ 200°

Number of cows - 68
Number of fresh cows - 54

Diet consists of feed and grass.

BD-18 Biros Dairy Farm
10.5 miles @ 270°

Number of cows - 84
Number of fresh cows - 65

Diet consists of feed and grass.

BRAIDWOOD

MILCH ANIMALS CENSUS, 1991 (continued)

BD-23 Klausing Dairy Farm
4.3 miles @ 83°

Number of cows - 2
Number of fresh cows - 2

Diet consists of feed and grass.

BD-24 Goodwin Dairy Farm
7.3 miles @ 78°

Number of cows - 31
Number of fresh cows - 22

Diet consists of feed and grass.

Census conducted by A. Lewis on August 20, 1991.

NEAREST RESIDENCE CENSUS, 1991

Nearest resident of the Braidwood Station within a five (5) mile radius.

Direction	Distance
N	0.5 miles
NNE	0.7 miles
NE	1.2 miles
ENE	1.1 miles
E	0.7 miles
ESE	2.2 miles
SE	2.8 miles
SSE	3.2 miles
S	3.9 miles
SSW	0.9 miles
SW	0.7 miles
WSW	0.4 miles
W	0.3 miles
WNW	0.4 miles
NW	0.3 miles
NNW	0.4 miles

Census conducted by A. Lewis on August 20, 1991. There was no change from 1990.

BRAIDWOOD

NEAREST CATTLE CENSUS, 1991

Nearest cattle of the Braidwood Station within a five (5) mile radius.

Direction	Distance
N	3.2 miles
NNE	No cattle
NE	4.9 miles
ENE	2.5 miles
E	2.7 miles
ESE	4.5 miles
SE	2.6 miles
SSE	4.2 miles
S	No cattle
SSW	2.8 miles
SW	3.4 miles
WSW	1.7 miles
W	2.5 miles
WNW	No cattle
NW	2.0 miles
NNW	No cattle

Census conducted by A. Lewis on August 20, 1991.

BRAIDWOOD

3.0 TLD DATA *

* TLD Data provided by Commonwealth Edison Company.

Commonwealth Edison Company - Version 3.1 System
Computer Systems Department - Technical Center
1319 S. First Ave.
Maywood, Il. 60153

Date: 24-JAN-92 | Environmental Report for BRAIDWOOD | Page: 1

Gamma Radiation Measured in mR by TLDs

		Quarter 1 1991	Quarter 2 1991	Quarter 3 1991	Quarter 4 1991
Inner Ring, Near Site Boundary, Indicator Locations					
BD101-1,2	NORTH	14	12.4	14.0	13.4
BD102-1,2	NORTH NORTHEAST	14	11.1	13.7	12.3
BD104-1,2	EAST NORTHEAST	14	12.5	13.8	12.6
BD105-1,2	EAST	14	12.9	14.2	13.1
BD106-1,2	EAST SOUTHEAST	14	12.4	14.0	13.1
BD107-1,2	SOUTHEAST	15	12.8	14.3	13.4
BD108-1,2	SOUTH SOUTHEAST	14	12.0	13.8	12.8
BD109-1,2	SOUTH	14	12.3	13.6	12.9
BD110-1,2	SOUTH SOUTHWEST	15	12.9	13.8	13.3
BD111a-1,2	SOUTHWEST	14	12.3	13.9	13.1
BD111b-1,2	SOUTHWEST	14	11.0	13.0	12.0
BD112-1,2	WEST SOUTHWEST	14	11.1	13.3	12.0
BD113a-1,2	WEST	14	12.1	13.4	12.3
BD113b-1,2	WEST	15	13.4	14.1	13.2
BD114-1,2	WEST NORTHWEST	15	12.1	14.4	13.5
BD116-1,2	NORTH NORTHWEST	14	13.3	14.5	13.8
Mean ± S.D.		14 ± 1	12.3 ± 0.9	14.4 ± 1.0	12.4 ± 0.8
Outer Ring, Near 5 Mile Radius, Indicator Locations					
BD201-1,2	NORTH	18	12.4	17.2	15.0
BD202-1,2	NORTH NORTHEAST	14	15.6	14.4	13.8
BD203-1,2	NORTHEAST	14	13.1	14.7	14.6
BD204-1,2	EAST NORTHEAST	13	13.4	13.2	12.7
BD205-1,2	EAST	13	11.7	13.4	12.7
BD206-1,2	EAST SOUTHEAST	15	13.4	14.2	13.7
BD207-1,2	EAST SOUTHEAST	14	13.6	14.2	13.1
BD208-1,2	SOUTH SOUTHEAST	14	12.9	13.8	12.4
BD209-1,2	SOUTH	15	12.9	13.8	12.6
BD210-1,2	SOUTH SOUTHWEST	14	12.2	13.2	12.1
BD211-1,2	SOUTHWEST	17	16.5	17.5	16.6
BD212-1,2	WEST SOUTHWEST	16	15.6	16.5	15.9
BD213-1,2	WEST	14	12.6	14.6	13.4
BD214-1,2	WEST NORTHWEST	15	14.6	15.6	14.8
BD215-1,2	NORTHWEST	14	12.0	13.8	12.8
BD216-1,2	NORTH NORTHWEST	15	13.3	14.0	13.7
Mean ± S.D.		15 ± 2	13.3 ± 1.8	15.4 ± 2.0	14.6 ± 2.0
RESTRICTED AREA MONITORING PROGRAM					
BD9X5	FOSSIL AREA	14	11.8	14.0	13.7
BDS11	PARKING LOT	13	13.0	12.9	12.2
Mean ± S.D.		14 ± 1	12.4 ± 0.9	13.4 ± 0.8	12.9 ± 1.1
FAR FIELD INDICATORS AND CONTROL					
BD02	CUSTER PARK	14	15.4	15.1	13.7
BD03	COUNTY LINE ROAD(CONTROL)	15	13.0	13.1	13.5
BD04	ESSEX	14	11.9	14.0	13.6
BD05	GARDNER	17	14.8	15.0	14.6
MEAN ± S.D.		15 ± 1	13.9 ± 1.9	15.4 ± 1.2	14.0 ± 1.1
ON-SITE AND NEAR FIELD					
BD01	BRAIDWOOD	14	11.9	13.9	13.6
BD06	GODLEY	14	11.7	13.7	13.5
BD19	NEAR SITE NORTHWEST	15	13.7	14.6	14.8
BD07	NEAR SITE NORTH	14	13.4	14.6	13.9
BD01	NEAR SITE NORTHEAST	15	11.4	13.9	13.4
Mean ± S.D.		14 ± 1	13.4 ± 2.3	14.0 ± 0.2	13.5 ± 0.5

APPENDIX IV

INTERLABORATORY COMPARISON PROGRAM RESULTS

Appendix IV

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] TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	Control Limits
STW-521	Water	Jan 1988	Sr-89	27.3±5.0	30.0±5.0	21.3-38.7
			Sr-90	15.3±1.2	15.0±1.5	12.4-17.6
STW-523	Water	Jan 1988	Gr. alpha	2.3±1.2	4.0±5.0	0.0-12.7
			Gr. beta	7.7±1.2	8.0±5.0	0.0-16.7
STF-524	Food	Jan 1988	Sr-89	44.0±4.0	46.0±5.0	37.3-54.7
			Sr-90	53.0±2.0	55.0±2.8	50.2-59.8
			I-131	102.3±4.2	102.0±10.2	84.3-119.7
			Cs-137	95.7±6.4	91.0±5.0	82.3-99.7
			K	1011±158	1230±62	1124-1336
STW-525	Water	Feb 1988	Co-60	69.3±2.3	69.0±5.0	60.3-77.7
			Zn-65	99.0±3.4	94.0±9.4	77.7-110.3
			Ru-106	92.7±14.4	105.0±10.5	86.8-123.2
			Cs-134	61.7±8.0	64.0±5.0	55.3-72.7
			Cs-137	99.7±3.0	94.0±5.0	85.3-102.7
STW-526	Water	Feb 1988	H-3	3453±103	3327±362	2700-3954
STW-527	Water	Feb 1988	Uranium	3.0±0.0	3.0±6.0	0.0-13.4
STM-528	Milk	Feb 1988	I-131	4.7±1.2	4.0±0.4	3.3-4.7
STW-529	Water	Mar 1988	Ra-226	7.1±0.6	7.6±1.1	5.6-9.6
			Ra-228	NA[e]	7.7±1.2	5.7-9.7
STW-530	Water	Mar 1988	Gr. alpha	4.3±1.2	6.0±5.0	0.0-14.7
			Gr. beta	13.3±1.3	13.0±5.0	4.3-21.7
STAF-531	Air Filter	Mar 1988	Gr. alpha	21.0±2.0	20.0±5.0	11.3-28.7
			Gr. beta	48.0±0.0	50.0±5.0	41.3-58.7
			Sr-90	16.7±1.2	17.0±1.5	14.4-19.6
			Cs-137	18.7±1.3	16.0±5.0	7.3-24.7
STW-532	Water	Apr 1988	I-131	9.0±2.0	7.5±0.8	6.2-8.8

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[b] TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	Control Limits
STW-533 534	Water (Blind)	Apr 1988				
	Sample A		Gr. alpha	ND[f]	46.0±11.0	27.0-65.0
			Ra-226	ND	6.4±1.0	4.7-8.1
			Ra-228	ND	5.6±0.8	4.2-7.0
			Uranium	6.0±6.0	6.0±6.0	0.0-16.4
	Sample B		Gr. beta	ND	57.0±5.0	48.3-65.7
			Sr-89	2.3±1.2	5.0±5.0	0.0-13.7
			Sr-90	5.3±1.2	5.0±1.5	2.4-7.6
			Co-60	63.3±1.3	50.0±5.0	41.3-58.7
			Cs-134	7.7±1.2	7.0±5.0	0.0-15.7
			Cs-137	8.3±1.2	7.0±5.0	0.0-15.7
STU-535	Urine	Apr 1988	H-3	6483±155	6202±620	5128-7276
STW-536	Water	Apr 1988	Sr-89	14.7±1.3	20.0±5.0	11.3-28.7
			Sr-90	20.0±2.0	20.0±1.5	17.4-22.6
STW-538	Water	Jun 1988	Cr-51	331.7±13.0	302.0±30.0	250.0-354.0
			Co-60	16.0±2.0	15.0±5.0	6.3-23.7
			Zn-65	107.7±11.4	101.0±10.0	83.7-118.3
			Ru-106	191.3±11.0	195.0±20.0	160.4-229.6
			Cs-134	18.3±4.6	20.0±5.0	11.3-28.7
			Cs-137	26.3±1.2	25.0±5.0	16.3-33.7
STW-539	Water	Jun 1988	H-3	5586±92	5565±557	4600-6530
STM-541	Milk	Jun 1988	Sr-89	33.7±11.4	40.0±5.0	31.3-48.7
			Sr-90	55.3±5.8	60.0±3.0	54.8-65.2
			I-131	103.7±3.1	94.0±9.0	78.4-109.6
			Cs-137	52.7±3.1	51.0±5.0	42.3-59.7
			K	1587±23	1600±80	1461-1739
STW-542	Water	Jul 1988	Gr. alpha	8.7±4.2	15.0±5.0	6.3-23.7
			Gr. beta	5.3±1.2	4.0±5.0	0.0-12.7
STF-543	Food	Jul 1988	Sr-89	ND[f]	33.0±5.0	24.3-41.7
			Sr-90	ND	34.0±2.0	30.5-37.5
			I-131	115.0±5.3	107.0±11.0	88.0-126.0
			Cs-137	52.7±6.4	49.0±5.0	40.3-57.7
			K	1190±66	1240±62	1133-1347

Table A-1. (continued)

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

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[b] TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	Control Limits
STM-554	Milk	Oct 1988	Sr-89	40.3±7.0	40.0±5.0	31.3-48.7
			Sr-90	51.0±2.0	60.0±3.0	54.8-65.2
			I-131	94.0±3.4	91.0±9.0	75.4-106.6
			Cs-137	45.0±4.0	50.0±5.0	41.3-58.7
			K	1500±45	1600±80	1461-1739
STU-555	Urine	Nov 1988	H-3	3030±209	3025±359	2403-3647
STW-556	Water	Nov 1988	Gr. alpha	9.0±3.5	9.0±5.0	0.3-17.7
			Gr. beta	9.7±1.2	9.0±5.0	0.3-17.7
STW-557	Water	Dec 1988	I-131	108.7±3.0	115.0±12.0	94.2-135.8
STW-559	Water	Jan 1989	Sr-89	40.0±8.7	40.0±5.0	31.3-48.7
			Sr-90	24.3±3.1	25.0±1.5	22.4-27.6
STW-560	Water	Jan 1989	Pu-239	5.8±1.1	4.2±0.4	3.5-4.9
STW-561	Water	Jan 1989	Gr. alpha	7.3±1.2	8.0±5.0	0.0-16.7
			Gr. beta	5.3±1.2	4.0±5.0	0.0-12.7
STW-562	Water	Feb 1989	Cr-51	245±46	235±24	193.4-276.6
			Co-60	10.0±2.0	10.0±5.0	1.3-18.7
			Zn-65	170±10	159±16	139.2-186.7
			Ru-106	181±7.6	178±18	146.8-209.2
			Cs-134	9.7±3.0	10.0±5.0	1.3-18.7
			Cs-137	11.7±1.2	10.0±5.0	1.3-18.7
STW-563	Water	Feb 1989	I-131	109.0±4.0	106.0±11.0	86.9-125.1
STW-564	Water	Feb 1989	H-3	2820±20	2754±356	2137-3371
STW-565	Water	Mar 1989	Ra-226	4.2±0.3	4.9±0.7	3.7-6.1
			Ra-228	1.9±1.0	1.7±0.3	1.2-2.2
STW-566	Water	Mar 1989	U	5.0±0.0	5.0±6.0	0.0-15.4
STAF-567	Air Filter	Mar 1989	Gr. alpha	21.7±1.2	21.0±5.0	12.3-29.7
			Gr. beta	68.3±4.2	62.0±5.0	53.3-70.7
			Sr-90	20.0±2.0	20.0±1.5	17.4-22.6
			Cs-137	21.3±1.2	20.0±5.0	11.3-28.7

Table A-1. (continued)

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

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[b] TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	Control Limits
STW-580	Water	Sep 1989	Sr-89	14.7±1.2	14.0±5.0	5.3-22.7
			Sr-90	9.7±1.2	10.0±1.5	7.4-12.6
STW-581	Water	Sep 1989	Gr. alpha	5.0±0.0	4.0±5.0	0.0-12.7
			Gr. beta	8.7±2.3	6.0±5.0	0.0-14.7
STW-583	Water	Oct 1989	Ba-133	60.3±10.0	59.0±6.0	48.6-69.4
			Co-60	29.0±4.0	30.0±5.0	21.1-38.7
			Zn-65	132.3±6.0	129.0±13.0	106.5-151.5
			Ru-106	155.3±6.1	161.0±16.0	133.3-188.7
			Cs-134	30.7±6.1	29.0±5.0	20.3-37.7
			Cs-137	66.3±4.6	59.0±5.0	50.3±67.7
STW-584	Water	Oct 1989	H-3	3407±150	3496±364	2866±4126
STW-585 586	Water (Blind)	Oct 1989				
	Sample A		Gr. alpha	41.7±9.4	49.0±12.0	28.2-69.8
			Ra-226	7.9±0.4	8.4±1.3	6.2-10.6
			Ra-228	4.4±0.8	4.1±0.6	3.1-5.1
			U	12.0±0.0	12.0±6.0	1.6-22.4
	Sample B		Gr. beta	31.7±2.3	32.0±5.0	23.3-40.7
			Sr-89	13.3±4.2	15.0±5.0	6.3-23.7
			Sr-90	7.0±2.0	7.0±3.0	4.4-9.6
			Cs-134	5.0±0.0	5.0±5.0	0.0-13.7
			Cs-137	7.0±0.0	5.0±5.0	0.0-13.7
STW-587	Water	Nov 1989	Ra-226	7.9±0.4	8.7±1.3	6.4-11.0
			Ra-228	8.9±1.2	9.3±1.2	6.9-11.7
STW-588	Water	Nov 1989	U	15.0±0.0g	15.0±6.0	4.6-25.4
STW-589	Water	Jan 1990	Sr-89	22.7±5.0	25.0±5.0	16.3-33.7
			Sr-90	17.3±1.2	20.0±1.5	17.4-22.6
STW-591	Water	Jan 1990	Gr. alpha	10.3±3.0	12.0±5.0	3.3-20.7
			Gr. beta	12.3±1.2	12.0±5.0	3.3-20.7

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[b] TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	Control Limits
STW-592	Water	Jan 1990	Co-60	14.7±2.3	15±5.0	6.3-23.7
			Zn-65	135.0±6.9	139.0±14.0	114.8-163.2
			Ru-106	133.3±13.4	139.0±14.0	114.8-163.2
			Cs-134	17.3±1.2	18.0±5.0	9.3-26.7
			Cs-137	19.3±1.2	18.0±5.0	9.3-26.7
			Ba-133	78.0±0.0	74.0±7.0	61.9-86.1
STW-593	Water	Feb 1990	H-3	4827±83	4976±498	4113-5839
STW-594	Water	Mar 1990	Ra-226	5.0±0.2	4.9±0.7	4.1-5.7
			Ra-228	13.5±0.7	12.7±1.9	9.4-16.0
STW-595	Water	Mar 1990	U	4.0±0.0	[illegible]6.0	0.0-14.4
STAF-596	Air Filter	Mar 1990	Gr. alpha	7.3±1.2	5.0±5.0	0.0-13.7
			Gr. beta	34.0±0.0	31.0±5.0	22.3-39.7
			Sr-90	10.0±0.0	10.0±1.5	7.4-12.6
			Cs-137	9.3±1.2	10.0±5.0	1.3-18.7
STW-597 598	Water (Blind)	Apr 1990				
	Sample A		Gr. alpha	81.0±3.5	90.0±23.0	50.1-129.9
			Ra-226	4.9±0.4	5.0±0.8	3.6-6.4
			Ra-228	10.6±0.3	10.2±1.5	7.6-12.8
			U	18.7±3.0	20.0±6.0	9.6-30.4
	Sample B		Gr. beta	51.0±10.1	52.0±5.0	43.3-60.7
			Sr-89	9.3±1.2	10.0±5.0	1.3-18.7
			Sr-90	10.3±3.1	10.0±1.5	8.3-11.7
			Cs-134	16.0±0.0	15.0±5.0	6.3-23.7
			Cs-137	19.0±2.0	15.0±5.0	6.3-23.7
STM-599	Milk	Apr 1990	Sr-89	21.7±3.1	23.0±5.0	14.3-31.7
			Sr-90	21.0±7.0	23.0±5.0	14.3-31.7
			I-131	98.7±1.2	99.0±10.0	81.7-116.3
			Cs-137	26.0±6.0	24.0±5.0	15.3-32.7
			K	1300.0±69.2	1550.0±78.0	1414.7-1685.3
STW-600	Water	May 1990	Sr-89	6.0±2.0	7.0±5.0	0.0-15.7
			Sr-90	6.7±1.2	7.0±5.0	0.0-15.7
STW-601	Water	May 1990	Gr. alpha	11.0±2.0	22.0±6.0	11.6-32.4
			Gr. beta	12.3±1.2	15.0±5.0	6.3-23.7

Table A-1. (continued)

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

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[b] TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	Control Limits
STW-614 615	Water	Oct 1990				
	Sample A		Gr. alpha	68.7±7.2	62.0±16.0	34.2-89.8
			Ra-226	12.9±0.3	13.6±2.0	10.1-17.1
			Ra-228	4.2±0.6	5.0±1.3	2.7-7.3
			U	10.4±0.6	10.2±3.0	5.0-15.4
	Sample B		Gr. beta	55.0±8.7	53.0±5.0	44.3-61.7
			Sr-89	15.7±2.9	20.0±5.0	11.3-28.7
			Sr-90	12.0±2.0	15.0±5.0	6.3-23.7
			Cs-134	9.0±1.7	7.0±5.0	0.0-15.7
			Cs-137	7.7±1.2	5.0±5.0	0.0-13.7
STW-616	Water	Nov 1990	Ra-226	6.8±1.0	7.4±1.1	5.5-9.3
			Ra-228	5.3±1.7	7.7±1.9	4.4-11.0
STW-617g	Water	Nov 1990	U	35.0±0.4	35.5±3.6	29.3±41.7
STW-618	Water	Jan 1991	Sr-89	4.3±1.2	5.0±5.0	0.0 -13.7
			Sr-90	4.7±1.2	5.0±5.0	0.0-13.7
STW-619	Water	Jan 1991	Pu-239	3.6±0.2	3.3±0.3	2.8-3.8
STW-620	Water	Jan 1991	Gr. alpha	6.7±3.0	5.0±5.0	0.0-13.7
			Gr. beta	6.3±1.2	5.0±5.0	0.0-13.7
STW-621	Water	Feb 1991	Co-60	41.3±8.4	40.0±5.0	31.3-48.7
			Zn-65	166.7±19.7	149.0±15.0	123.0-175.0
			Ru-106	209.7±18.6	186.0±19.0	153.0-219.0
			Cs-134	9.0±2.0	8.0±5.0	0.0-16.7
			Cs-137	9.7±1.2	8.0±5.0	0.0-16.7
			Ba-133	85.7±9.2	75.0±8.0	61.1-88.9
STW-622	Water	Feb 1991	I-131	81.3±6.1	75.0±8.0	61.1-88.9
STW-623	Water	Feb 1991	H-3	4310.0±144.2	4418.0±442.0	3651.2-5184.8
STW-624	Water	Mar 1991	Ra-226	31.4±3.2	31.8±4.8	23.5-40.1
			Ra-228	ND[h]	21.1±5.3	11.9-30.3
STW-625	Water	Mar 1991	U	6.7±0.4	7.6±3.0	2.4-12.8

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[b] TIML Result ±2σ[c]	EPA Result[d] 1s, N=1	Control Limits
STAF-626	Filter	Mar 1991	Gr. alpha	38.7±1.2	25.0±6.0	14.6-35.4
			Gr. beta	130.0±4.0	124.0±6.0	113.6-134.4
			Sr-90	35.7±1.2	40.0±5.0	31.3-48.7
			Cs-137	33.7±4.2	40.0±5.0	31.3-48.7
STW-627 628	Water	Apr 1991				
	Sample A		Gr. alpha	51.0±6.0	54.0±14.0	29.7-78.3
			Ra-226	7.0±0.8	8.0±1.2	5.9-10.1
			Ra-228	9.7±1.9	15.2±3.8	8.6-21.8
			U	27.7±2.4	29.8±3.0	24.6-35.0
	Sample B		Gr. beta	93.3±6.4	115.0±17.0	85.5-144.5
			Sr-89	21.0±3.5	28.0±5.0	19.3-36.7
			Sr-90	23.0±0.0	26.0±5.0	17.3-34.7
			Cs-134	27.3±1.2	24.0±5.0	15.3-32.7
			Cs-137	29.0±2.0	25.0±5.0	16.3-33.7
STM-629	Milk	Apr 1991	Sr-89	24.0±8.7	32.0±5.0	23.3-40.7
			Sr-90	28.0±2.0	32.0±5.0	23.3-40.7
			I-131	65.3±14.7	60.0±6.0	49.6-70.4
			Cs-137	54.7±11.0	49.0±5.0	40.3-57.7
			K	1591.7±180.1	1650.0±83.0	1506.0-1794
STW-630	Water	May 1991	Sr-89	40.7±2.3	39.0±5.0	30.3-47.7
			Sr-90	23.7±1.2	24.0±5.0	15.3-32.7
STW-631	Water	May 1991	Gr. alpha	27.7±5.8	24.0±6.0	13.6-34.4
			Gr. beta	46.0±0.0	46.0±5.0	37.3-54.7
STW-632	Water	Jun 1991	Co-60	11.3±1.2	10.0±5.0	1.3-18.7
			Zn-65	119.3±16.3	108.0±11.0	88.9-127.
			Ru-106	162.3±19.0	149.0±15.0	123.0-175.
			Cs-134	15.3±1.2	15.0±5.0	6.3 23.7
			Cs-137	16.3±1.2	14.0±5.0	5.3-22.7
			Ba-133	74.0±6.9	62.0±6.0	51.6-72.4
STW-633	Water	Jun 1991	H-3	13470.0±385.8	12480.0±1248.0	10314.8-1464
STW-634	Water	Jul 1991	Ra-226	14.9±0.4	15.9±2.4	11.7-20.1
			Ra-228	17.6±1.8	16.7±4.2	9.4-24.0

Table A-1. (continued)

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

Table A-1. (continued)

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

[a] Results obtained by Teledyne Isotopes Midwest Laboratory as a participant in the environmental samp crosscheck program operat.. by the Intercomparison and Calibration Section, Quality Assurance Branc Environmental Monitoring and Support Laboratory, U.S. Environmental Protection Agency (EPA), L Vegas, Nevada.

[b] All results are in pCi/l, except for elemental potassium (K) data in milk, which are in mg/l; air filt 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 ± 2 standard deviations for thr determinations.

[d] USEPA results are presented as the known values and expected laboratory precision (1s, 1 determinatio 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 analyse.

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

Lab Code	TLD Type	Measurement ±2σ[a]	mR: Teledyne Result Value[c]	mR: Known	mR: Average ±2σ[d] of Participants
2nd International Intercomparison[b]					
115-2	CaF_2:Mn Bulb	Field	17.0±1.9	17.1	16.4±7.7
		Lab	20.8±4.1	21.3	18.8±7.6
3rd International Intercomparison[e]					
115-3	CaF_2:Mn Bulb	Field	30.7±3.2	34.9±4.8	31.5±3.0
		Lab	89.6±6.4	91.7±14.6	86.2±24.0
4th International Intercomparison[f]					
115-4	CaF_2:Mn Bulb	Field	14.1±1.1	14.1±1.4	16.0±9.0
		Lab (Low)	9.3±1.3	12.2±2.4	12.0±7.4
		Lab (High)	40.4±1.4	45.8±9.2	43.9±13.2
5th International Intercomparison[g]					
115-5A	CaF_2:Mn Bulb	Field	31.4±1.8	30.0±6.0	30.2±14.6
		Lab at beginning	77.4±5.8	75.2±7.6	75.8±40.4
		Lab at the end	96.6±5.8	88.4±8.8	90.7±31.2
115-5B	LiF-100 Chips	Field	30.3±4.8	30.0±6.0	30.2±14.6
		Field at beginning	81.1±7.4	75.2±7.6	75.8±40.4
		Lab at the end	85.4±11.7	88.4±8.8	90.7±31.2
7th International Comparison[h]					
115-7A	LiF-100 Chips	Field	75.4±2.6	75.8±6.0	75.1±29.8
		Lab (Co-60)	80.0±3.5	79.9±4.0	77.9±27.6
		Lab (Cs-137)	66.6±2.5	75.0±3.8	73.0±22.2

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

Lab Code	TLD Type	Measurement ±2σ[a]	mR		
			Teledyne Result Value[c]	Known	Average ±2σ[d] (All Participants)
115-7B	CaF_2:Mn Bulbs	Field	71.5±2.6	75.8±6.0	75.1±29.8
		Lab (Co-60)	84.8±6.4	79.9±4.0	77.9±27.6
		Lab (Cs-137)	78.8±1.6	75.0±3.8	73.0±22.2
115-7C	$CaSO_4$:Dy Cards	Field	76.8±2.7	75.8±6.0	75.1±29.8
		Lab (Co-60)	82.5±3.7	79.9±4.0	77.9±27.6
		Lab (Cs-137)	79.0±3.2	75.0±3.8	73.0±22.2
8th International Intercomparison[i]					
115-8A	LiF-100 Chips	Field Site 1	29.5±1.4	29.7±1.5	28.9±12.4
		Field Site 2	11.3±0.8	10.4±0.5	10.1±9.06
		Lab (Cs-137)	13.7±0.9	17.2±0.9	16.2±6.8
115-8B	CaF_2:Mn Bulbs	Field Site 1	32.3±1.2	29,7±1.5	28.9±12.4
		Field Site 2	9.0±1.0	10.4±0.5	10.1±9.0
		Lab (Cs-137)	15.8±0.9	17.2±0.9	16.2±6.8
115-8C	$CaSO_4$:Dy Cards	Field Site 1	32.2±0.7	29.7±1.5	28.9±12.4
		Field Site 2	10.6±0.6	10.4±0.5	10.1±9.0
		Lab (Cs-137)	18.1±0.8	17.2±0.9	16.2±6.8
Teledyne Testing[j]					
89-1	LiF-100 Chips	Lab	21.0±0.4	22.4	–
89-2	Teledyne $CaSO_4$:Dy Cards	Lab	20.9±1.0	20.3	–

Table A-2. (continued)

Lab Code	TLD Type	Measurement ±2σ[a]	mR		
			Teledyne Result Value[c]	Known	Average ±2σ[d] (All Participants)
Teledyne Testing[j]					
90-1[k]	Teledyne $CaSO_4$:Dy Cards	Lab	20.6±1.4	19.6	–
90-1[l]	Teledyne $CaSO_4$:Dy Cards	Lab	100.8±4.3	100.0	–
91-1[m]	Teledyne $CaSO_4$:Dy Cards	Lab	33.4±2.0	32.0	–
			55.2±4.7	58.8	–
			87.8±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 sponsored by the U.S. Department of Energy, The U.S. Nuclear Regulatory Commission, and 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 TIML Result n=1	Known Activity	Expected Precision 1s, n=1[a]
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±b.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	15.1±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 TIML Result n=1	Known Activity	Expected Precision 1s, n=1[a]
QC-W-45	Water	Oct 1988	H-3	4109±43	4153±300	724
QC-MI-20	Milk	Oct 1988	I-131	59.8±0.9	60.6±5.0	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 TIML Result n=1	Known Activity	Expected Precision 1s, n=1[a]
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±3.3	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 TIML Result n=1	Known Activity	Expected Precision 1s, n=1[a]
QC-W-63	Water	Apr 1990	I-131	63.5±8.0	66.0±6.7	6.6
QC-W-64	Water	Apr 1990	H-3	1941±130	1826.0±350.0	724
QC-W-65	Water	Jun 1990	Ra-226	6.4±0.2	6.9±1.0	1.0
QC-W-66	Water	Jun 1990	U	6.2±0.2	6.0±6.0	6.0
QC-MI-30	Milk	Jul 1990	Sr-89	12.8±0.4	18.4±10.0	8.7
			Sr-90	18.2±1.4	18.7±6.0	5.2
			Cs-134	46.0±1.3	49.0±5.0	8.7
			Cs-137	27.6±1.3	25.3±5.0	8.7
QC-W-68	Water	Jun 1990	Gr. alpha	9.8±0.3	10.6±6.0	8.7
			Gr. beta	11.4±0.6	11.3±7.0	8.7
QC-MI-31	Milk	Aug 1990	I-131	68.8±1.6	61.4±12.3	10.4
QC-W-69	Water	Sep 1990	Sr-89	17.7±1.6	19.2±10.0	8.7
			Sr-90	13.9±1.6	17.4±10.0	5.2
QC-MI-32	Milk	Oct 1990	I-131	34.8±0.2	32.4±6.5	8.7
			Cs-134	25.8±1.2	27.3±10.0	8.7
			Cs-137	25.3±2.0	22.4±10.0	8.7
QC-W-70	Water	Oct 1990	H-3	2355±59	2276±455	605
QC-W-71	Water	Oct 1990	I-131	55.9±0.9	51.8±10.4	10.4
QC-W-73	Water	Oct 1990	Co-60	18.3±2.7	16.8±5.0	8.7
			Cs-134	28.3±2.3	27.0±5.0	8.7
			Cs-137	22.7±1.3	22.4±5.0	8.7
QC-W-74	Water	Dec 1990	Gr. alpha	21.4±1.0	26.1±6.5	11.3
			Gr. beta	25.9±1.0	22.3±5.6	9.7
QC-MI-33	Milk	Jan 1991	Sr-89	20.7±3.3	21.6±5.0	5.0
			Sr-90	19.0±1.4	23.0±3.0	3.0
			Cs-134	22.2±1.7	19.6±5.0	5.0
			Cs-137	26.1±1.6	22.3±5.0	5.0
QC-MI-34	Milk	Feb 1991	I-131	40.7±1.8	40.1±6.0	6.0
QC-W-75	Water	Mar 1991	Sr-89	18.8±1.5	23.3±5.0	5.0
			Sr-90	16.0±0.8	17.2±3.0	3.0

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

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

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

ATTACHMENT B

ACCEPTANCE CRITERIA FOR "SPIKED" SAMPLES

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

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

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 geometery between standard used in the TIML lab and EPA filter.
STW-632	Ba-133	74.0±6.9	51.6-72.4	Sample was reanalyzed. Results of the reanalyses were 63.8±6.9 pCi/L within EPA limit.
STM-641	I-131	130.7±16.8	88.9-127.1	The cause of high result is unknown. In-house spike sample was prepared with activity of I-131 68.3±6.8 pCi/L. Result of the analysis was 69.1±9.7 pCi/L.

[a] Reported in pCi/L unless otherwise noted.
[b] Concentrations are reported in mg/kg.
[c] Concentrations are reported in mg/L.

APPENDIX V

ANALYTICAL PROCEDURES

ANALYTICAL PROCEDURES MANUAL

TELEDYNE ISOTOPES MIDWEST LABORATORY

PREPARED FOR

COMMONWEALTH EDISON COMPANY

Note: Only procedures applicable to the CECo Radiological Environmental Monitoring Program are included in this manual.

Compiled by: _____

B. Grob
Lab Supervisor, TIML

Approved by: _____

L. G. Huebner
General Manager, TIML

Approved by: _____

J. C. Golden
Emergency Preparedness Supervisor, CECo

Issued 27 January 1992

Copy No: 51-1

CECo

List of Procedures

Procedure Number		Revision Number	Revision Date
SP-01	Sample Preparation	0	07-02-86
AP-02	Determination of Gross Alpha and/ or Gross Beta in Air Particulate Filters	1	07-15-91
AP-03	Procedure fc Compositing Air Particulate Filters for Gamma Spectroscopic Analysis	0	12-15-89
W(DS)-01	Determination of Gross Alpha and/ or Gross Beta in Water (Dissolved Solids or Total Residue)	2	05-03-91
W(SS)-02	Determination of Gross Alpha and/ or Gross Beta in Water (Suspended Solids)	0	11-22-85
AB-01	Determination of Gross Alpha and/ or Gross Beta in Solid Samples	0	08 -86
GS-01	Determination of Gamma Emitters by Gamma Spectroscopy	0	07-21-86
T-02	Determination of Tritium in Water	1	09-27-91
I-131-01	Determination of I-131 in Milk by Anion Exchange (Batch Method)	3	04-10-91
I-131-02	Determination of Airborne I-131 in Charcoal Cartridges by Gamma Spectroscopy	0	07-04-86
COMP-01	Procedure for Compositing Water and Milk Samples	0	11-07-88

TELEDYNE ISOTOPES

MIDWEST LABORATORY

700 LANDWEHR ROAD

NORTHBROOK, ILLINOIS 60062-2310

(312) 564-0700 FAX (312) 564-4517

SAMPLE PREPARATION

PROCEDURE NO. TIML-SP-01

Prepared by

Teledyne Isotopes Midwest Laboratory

Copy No. _____

Revision No.	Date	Pages	Prepared by	Approved by
0	07-02-86	11		

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SAMPLE PREPARATION

Principle of Method

Different classes of samples require different preparations. In general, food products are prepared as for home use, while others are dried and ashed as received.

Reagents

Formaldehyde

Apparatus

Balance
Blender
Ceramic Dishes
Counting Containers
Cutting Board
Drying Oven
Drying Pans
Grinder
High Temperature Marking Pen
Knives
Muffle Furnace
Plastic Bags
Pulverizer
Scissors
Spatulas

Procedure for Packing Counting Containers

A. 3.5 l - Place 3.5 l of water into the container. Mark the level and then empty the container. Fill with the sample to the mark.

B. 500 ml - Fill to the rim of the inside wall, which is 1/4" from the top.

C. 4 oz - Fill to the 100 ml mark.

Pack the sample tightly. When filling with soil and bottom sediments, make sure it is level.

A. Vegetables and Fruits

1. Wash and prepare vegetables and fruits as for eating.

2. Homogenize in a blender.

3. Transfer blended sample to a standard calibrated container (3.5 l, 500 ml, or 4 oz); use the largest size possible for the amount of sample available. Record the wet weight.

4. Add a few cc of formaldehyde to prevent spoilage.

5. Seal with cover. Attach paper tape on top of the cover and write sample number, net weight, and date and time collected.

6. Submit to the counting room for gamma spectroscopic analysis without delay or store in a cooler until counting (for short period).

   NOTE: If I-131 analysis is required, it is imperative that the sample be prepared and submitted to the counting room immediately. Mark "I-131" on the tape.

7. After gamma scanning is completed, transfer the sample to a drying pan and dry at 110° C.

   NOTES: If only gamma scan is required, skip drying and ashing (Steps 7 through 11). Transfer the sample to a plastic bag, seal, label, and store in the cooler until disposal.

   If there is sufficient quantity, use surplus sample for drying and ashing instead of waiting for gamma scanning to be completed.

8. Cool, weigh, and record dry weight. Grind.

9. Weigh out accurately in a tarred ceramic dish 100-120 g of the ground sample. Record the weight. (If sample weight is less than 100 g, use two dishes; mark one as "A" and the second one as "B.") Ash in a muffle furnace by gradually increasing the temperature to 600° C. Ash overnight.

   NOTE: If ashing is incomplete (black carbon remains), cool the dish, crush the ash with spatula, and continue ashing overnight at 600° C. At this stage, it is not necessary to increase the temperature gradually. Set the temperature at 600° C and turn on the furnace.

10. Cool and weigh the ashed sample and record the ash weight. Grind to pass a 30 mesh screen. Transfer to 4 oz container, seal, and write sample number, weight, analysis required, and date and time of collection. The sample is now ready for analysis.

11. Store remaining ground sample in a plastic bag for possible future rechecking.

B. Grass and Cattle Feed

1. Take approximately 1 kg of fresh grass or 2 kg of cattle feed or silage.

2. Cut up grass into approximately 1" - 2" long stems and pack into a standard calibrated container (3.5 l or 500 ml). Pack cattle feed and silage as is; use 3.5 l size if enough sample is available. Record the wet weight.

3. Add a few cc of formaldehyde.

4. Seal with cover. Attach paper tape on top of the cover and label with sample number, net weight, and date and time collected.

5. Submit to the counting room for gamma spectroscopic analysis or store in a cooler until counting (for a short period) without delay.

   NOTE: If I-131 analysis is required, it is imperative that the sample be prepared and submitted to the counting room immediately Mark "I-131" on the tape.

6. After gamma scanning is completed, transfer the sample to a drying pan and dry at 110° C.

   NOTES: If only gamma scan is required, skip drying and ashing (Steps 6 through 10). Transfer the sample to a plastic bag, seal, label, and store in the cooler until disposal.

   If there is sufficient quantity, use surplus sample for dryng and ashing instead of waiting for gamma scanning to be completed.

7. Cool, weigh, and record dry weight. Grind.

8. Weigh out accurately in a tarred ceramic dish 100-120 g. of the ground sample. Record the weight. (If sample weight is less than 100 g, use two dishes; mark one as "A" and the second one as "B.") Ash in a muffle furnace by gradually increasing the temperature to 600° C. Ash overnight.

   NOTE: If ashing is incomplete (black carbon remains), cool the dish, crush the ash with spatula, and continue ashing overnight at 600° C. At this stage, it is not necessary to increase the temperature gradually. Set the temperature at 600° C and turn on the furnace.

9. Cool and weigh the ashed sample and record the ash weight. Grind to pass a 30 mesh screen. Transfer to 4 oz container, seal, and write sample number, weight, analyses required, and date and time of collection. The sample is now ready for analyses.

10. Store the remaining ground sample in a plastic bag for possible future rechecking.

C. Fish

1. Wash the fish.

2. Fillet and place the flesh immediately (to prevent moisture loss) in a 500 ml or 4 oz standard calibrated container. Use 500 ml size if enough sample is available. Record the wet weight.

3. Add a few cc of formaldehyde.

4. Seal with cover. Attach paper tape on top of the cover and label with sample number, weight, and date and time of collection.

   NOTE: If bones are to be analyzed, boil remaining fish in water for about 1 hour. Clean the bones. Air dry, weigh, and record as wet weight. Dry at 110° C. Record dry weight. Ash at 800° C, cool, weigh, and record the ash weight. Grind to a homogeneous sample. The sample is ready for analysis.

4. Submit to the counting room for gamma spectroscopic analysis without delay or store in a refrigerator until counting.

   NOTE: If I-131 analysis is required, it is imperative that the sample be prepared and submitted to the counting room immediately. Mark "I-131" on the tape.

5. After gamma spectroscopic analysis is completed, transfer the sample to a drying pan and dry at 110° C.

   NOTES: If only gamma scan is required skip drying and ashing (Steps 5 through 9). Transfer the sample to a plastic bag, seal, label, and store in the freezer until disposal.

   If there is sufficient quantity, use surplus flesh for drying and ashing instead of waiting for gamma scanning to be completed.

6. Cool, weigh, and record dry weight.

7. Transfer to a tarred ceramic dish. Record dry weight for ashing.

8. Ash in a muffle furnace by gradually increasing the temperature to 450° C. If considerable amount of carbon remains after overnight ashing, the sample should be brushed and placed back in the muffle furnace until ashing is completed.

9. Cool and weigh the ashed sample and record the ash weight. Grind to pass a 30 mesh screen. Transfer to a 4 oz container, seal, and write sample number, weight, analyses required, and date and time of collection. The sample is now ready for analysis.

D. Waterfowl, Meat, and Wildlife

1. Skin and clean the animal. Remove a sufficent amount of flesh to fill an appropriate standard calibrated container (500 or 4 oz). Weigh without delay (to prevent moisture loss), and record the wet weight.

2. Add a few cc of formaldehyde.

   NOTE: If bones are to be analyzed, boil remaining flesh in water for about 1 hour. Clean the bones. Air dry, weigh, and record as wet weight. Dry at 110° C. Record dry weight. Ash at 800° C, cool, weigh, and record the ash weight. Grind to a homogeneous sample. The sample is ready for analyses.

3. Seal with the cover. Attach paper tape on top of the cover and label with sample number, wet weight, and date and time of collection.

4. Submit to the counting room for gamma spectroscopic analysis without delay or store in a refrigerator until counting (for short period).

   NOTE: If I-131 analysis is required, it is imperative that the sample be prepared and submitted to the counting room immediately. Mark "I-131" on the tape.

5. After the gamma scanning is completed, transfer the sample to a drying pan and dry at 110° C.

6. Cool, weigh, and record dry weight.

7. Transfer to a tarred ceramic dish. Record dry weight for ashing.

8. Ash in a muffle furnace by gradually increasing the temperature to 450° C. If considerable amounts of carbon remain after overnight ashing, the sample should be brushed and placed back in the muffle furnace until ashing is completed.

9. Cool and weigh the ashed sample and record the ash weight. Grind to pass a 30 mesh screen. Transfer to a 4 oz container. Seal and write sample number, weight, analyses required, and date and time of collection. The sample is now ready for analyses.

E. Eggs

1. Remove the egg shells and mix the eggs with a spatula. Use about one (1) dozen eggs.

2. Transfer the mixed eggs to a standard calibrated 500 ml container. Record the wet weight.

3. Add a few cc of formaldehyde.

4. Seal with cover. Attach paper tape on top of the cover and label with sample number, wet weight, and date and time of collection.

5. Submit to the counting room for gamma spectroscopic analysis without delay or store in a refrigerator until counting (for short period).

6. After gamma spectrascopic analysis is completed, transfer the sample to a plastic bag, seal, label, and store in a freezer until disposal.

   NOTE: If only a gamma scan is required, skip Steps 7 through 11.

7. Weigh the rest of the sample, record wet weight, and dry in an oven at 110° C.

8. Cool, weigh, and record dry weight.

9. Weigh out accurately 100-120 g of the sample in a tarred ceramic dish. Record the weight. Ash in a muffle furnace by gradually increasing the temperature to 550° C. If a considerable amount of carbon remains after overnight ashing, the sample should be crushed and placed back in the muffle furnace until ashing is completed.

10. Cool and weigh the ashed sample and record the weight. Grind to pass a 30 mesh screen. Transfer to a 4 oz container, seal, and write sample number, weight, analyses required, and date and time of collection. The sample is now ready for analysis.

11. Store the remaining ground sample in a plastic bag for possible future rechecking.

F. Slime and Aquatic Vegetation

1. Remove foreign materials.

2. Place the sample in a sieve pan and wash until all sand and dirt is removed (turn the sample over several times.)

3. Squeeze out the water by hand.

4. Place the sample in a standard calibrated 500 ml or 4 oz container; weigh and record wet weight. Use 500 ml container if enough sample is available.

5. Add a few cc of formaldehyde.

6. Seal with cover. Attach paper tape on top of the cover and label with sample number, weight, and date and time of collection.

7. Submit to the counting room without delay. Slime decomposes quickly even with formaldehyde. If gamma scanning must be delayed, freeze.

   NOTE: If I-131 analysis is required, it is imperative that the sample be prepared and analyzed immediately. Mark "I-131" on the tape.

8. After gamma scanning is completed, transfer the sample to a drying pan and dry at 110° C.

   NOTE: If only gamma scan is required, skip drying and ashing (Steps 8 through 11). Transfer the sample to a plastic bag, seal, label, and store in the freezer until disposal.

9. Cool, weigh, and record dry weight.

10. Transfer to a tarred ceramic dish, and record dry weight for ashing. Ash in a muffle furnace by gradually increasing the temperature to 600° C.

    NOTE: If ashing is incomplete (black carbon remains), cool the dish, crush the ash with spatula, and continue ashing overnight at 600° C. At this stage, it is not necessary to increase the temperature gradually. Set the temperature at 600° C. and turn on the furnace.

11. Cool and weigh the ashed sample and record ash weight. Grind to pass a 30 mesh screen. Transfer to a 4 oz container, seal, and label with sample number, weight, analyses required, and date and time of collection. The sample is now ready for analyses.

G. Bottom Sediments and Soil

1. Remove rocks, roots, and any other foreign materials.

2. Place approximately 1 kg of sample on the drying pan and dry at 110° C.

3. Seal, label, and save remaining sample.

4. Grind or pulverize the dried sample and sieve through a No. 20 mesh screen.

5. For gamma spectroscopic analysis, transfer sieved sample to a standard calibrated 500 ml container or to 4 oz container.

6. Seal with cover. Weigh and record dry weight. Attach paper tape on top of the cover and write sample number, weight, and date and time of collection.

7. Submit to the counting room for gamma spectroscopic analysis without delay.

8. For other analyses, e.g. gross beta, radiostrontium, etc., fill 4 oz container to the top, seal, and write sample number, types of analyses required, and date and time of collection.

9. Store the remaining sieved sample in a plastic bag for possible future rechecking.

10. After the gamma scanning is completed, transfer the sample to a plastic bag, seal, label, and store until disposal.

H. Drinking (Clear) Water (EPA Method 900.0)

A representative sample must be collected from a free-flowing source of drinking water and should be large enough so that adequate aliquots can be taken to obtain the required sensitivity.

It is recommended that samples be preserved at the time of collection by adding enough 1N HNO_3 to the sample to bring it to pH 2 (15 ml 1N HNO_3 per liter of sample is usually sufficient). If samples are to be collected without preservation, they should be brought to the laboratory within 5 days, then preserved and held in the original container for a minimum of 16 hours before analysis or transfer of the sample.

The container choice should be plastic over glass to prevent loss due to breakage during transportation and handling.

If the sample was not acidified at the time of collection, use the following procedure:

Procedure

1. Remove 100 ml of sample for tritium analysis and 1 l for I-131 analysis, if required.
2. At 15 ml of 1:1 HNO_3 per gallon of sample in the original container.
3. Hold the sample in the original container for a minimum of 16 hours before analysis or transfer of the sample.
4. When taking an aliquot for analysis, take acid addition into account. For example:

Sample Volume to Be analyzed	Volume of Aliquot Required
200 ml	203 ml
400 ml	406 ml
600 ml	609 ml
800 ml	812 ml
1000 ml	1015 ml
2000 ml	2030 ml
3000 ml	3045 ml
3500 ml	3552 ml

For other volumes, adjust aliquots accordingly, at the rate of 1.5 ml per 100 ml of sample.

TELEDYNE ISOTOPES

MIDWEST LABORATORY

700 LANDWEHR ROAD

NORTHBROOK, ILLINOIS 60062-2310

(708) 564-0700 FAX (708) 564-4517

DETERMINATION OF GROSS ALPHA AND/OR GROSS BETA IN AIR PARTICULATE FILTERS

PROCEDURE NO. TIML-AP-02

Prepared by

Teledyne Isotopes Midwest Laboratory

Copy No. _____

Revised Pages	Revision No.	Date	Pages	Prepared by	Approved by
	0	07-11-86	3	B. Dab	L.G. Huebner
2	1	07-15-91	3	B. Dab	LG Huebner

DETERMINATION OF GROSS ALPHA AND/OR GROSS BETA IN AIR PARTICULATE FILTERS

Principle of Method

Air particulate filters are stored for at least 72 hours to allow for the | 1
decay of short-lived radon and thoron daughters and then counted in the proportional counter.

Apparatus

Forceps
Loading Sheet
Proportional Counter
Stainless Steel Planchets (standard 2" x 1/8")

Procedure

1. Store the filters for at least 72 hours from the day of collection. | 1

2. Place filters on a stainless steel planchet.

3. Fill out sample loading sheet. Fill in the date, counter number, counting time, sample identification number, sample collection date, and initials.

   NOTES: When loading samples in the holder, load blanks (unexposed filter paper) in positions 1, 12, 23, 34, 45, etc.

   If filters from more than one project are loaded, make sure that the appropriate blanks are loaded with each batch. Load the counter blank planchet as a last sample.

4. Count in a proporational counter long enough to obtain the required LLDs.

5. After counting is completed, return the filters to the original envelopes.

6. Submit the counter printout, field collection sheet, and the loading sheet to the data clerk for calculations.

Calculations

Gross alpha (beta) concentration:

$$(\text{pCi/liter}) = \frac{A}{B \times C \times 2.22} \cdot \pm \frac{2\sqrt{E_{sb}^2 + E_b^2}}{B \times C \times 2.22}$$

Where:

A = Net alpha (beta) count (cpm)

B = Efficiency for counting alpha (beta) activity (cpm/dpm)

C = Volume of sample

E_{sb} = Counting error of sample plus background

E_b = Counting error of background

TELEDYNE ISOTOPES

MIDWEST LABORATORY

700 LANDWEHR ROAD

NORTHBROOK, ILLINOIS 60062-2310

(708) 564-0700 FAX (708) 564-4517

PROCEDURE FOR COMPOSITING AIR PARTICULATE FILTERS FOR GAMMA SPECTROSCOPIC ANALYSIS

PROCEDURE NO. TIML-AP-03

Prepared by

Teledyne Isotopes Midwest Laboratory

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Revision No.	Date	Pages	Prepared by	Approved by
0	12-15-89	3	B. Gale	L. J. Huebner

PROCEDURE FOR COMPOSITING AIR PARTICULATE FILTERS FOR GAMMA SPECTROSCOPIC ANALYSIS

Principle of Meth

AP filters are pla.a in a Petrie Dish in chronological order, labeled and submitted to counting room for analysis.

Materials

Forceps (long)
Blank filter paper
Small Petrie Dish
Scotch Tape

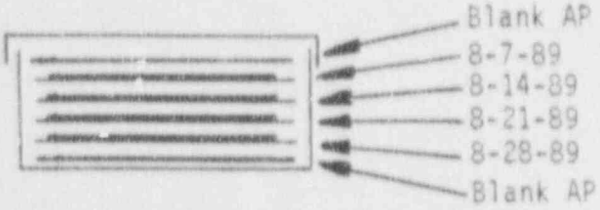
Procedure

1. Stack APs from each location in chrono.ogical order, with the latest collection date on top.
2. Place blank filter paper in the Petrie Dish.
3. Starting from the top of the stack, remove each AP from the envelope and place it in the Petrie Dish with the deposit facing up.
4. Continue transferring AP's from envelopes to the Petrie Dish until all are transferred.
5. Place blank filter paper on top.
6. Cap the Petrie Dish. Use scotch tape to hold cap in place, if needed.
7. Record sample ID (project), sample No., location, last date of collection, collection period and date composited in the Recording Book.
8. Write sample ID, sample No., last date of collection and collection period on the Petrie Dish using black marker.
9. Submit the samples to the counting room.
10. After counting, return AP's to the original envelopes in reverse order.

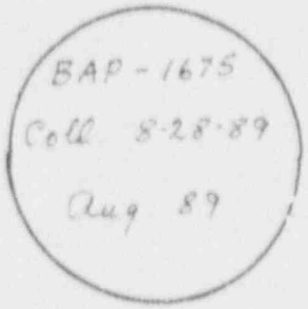
Example

Project: BAP
Location: 2
Sample No.: 1675
Last Collection Date: 08-28-89
Collection period: August, 1989
Samples collected: 8-7, 8-14, 8-21, 8-28

Side View



Top View



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MIDWEST LABORATORY

700 LANDWEHR ROAD

NORTHBROOK, ILLINOIS 60062-2310

(708) 564-0700 FAX (708) 564-4517

DETERMINATION OF GROSS ALPHA AND/OR GROSS BETA IN WATER

(DISSOLVED SOLIDS OR TOTAL RESIDUE)

PROCEDURE NO. TIML-W(DS)-01

Prepared by

Teledyne Isotopes Midwest Laboratory

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	0	11-25-85	4		
2,3	1	02-28-91	4		
3	2	05-03-91	4		

DETERMINATION OF GROSS ALPHA AND/OR GROSS BETA IN WATER (Dissolved Solids or Total Residue[a,b])

Principle of Method

Water samples containing suspended matter are filtered through a membrane filter and the filtrate is analyzed. The filtered water sample is evaporated and the residue is transferred to a tared planchet for counting gross alpha and gross beta activity.

Reagents

All chemicals should be of "reagent-grade" or equivalent whenever they are commercially available.

Lucite: 0.5 mg/ml in acetone
Nitric acid, HNO_3: 16 N (concentrated), 3 N (187 ml of 16 N HNO_3 diluted to 1 liter), 1 N (62 ml of 16 N HNO_3 diluted to 1 liter)

Apparatus

Filter, Millipore, membrane Type AA, 0.08
Filtration equipment
Planchets (Standard 2" x 1/8" ringed planchet)
Proportional counter
Electric hot plate
Drying oven
Muffle furnace

Procedure

1. Filter a volume of sample containing not more than 100 mg of dissolved solids for alpha assay, or not more than 200 mg of dissolved solids for beta assay.[a,b] |1

   NOTE: For gross alpha and gross beta assay in the same sample, limit the amount of solids to 100 mg.

---

[a] For analysis of total residue (for clear water), proceed as described above but do not filter the water. Measure out the appropriate amount and proceed to Step 3.

[b] For Duquesne Light Company samples ONLY - Procedure, Step 1: Do NOT filter. Shake well and immediately withdraw required aliquot. Do not allow solids to settle. |1

2. Transfer assembly holding filter paper to another filtering flask and wash the non-filterable solids on the filter paper with D.I. water. Discard wash water. (Save the filters with suspended matter for separate analysis. See Procedure No. TIML-W-02.)

3. Evaporate the filtrate to NEAR dryness on a hot plate.

4. Add 25 ml of concentrated HNO_3 and evaporate to NEAR dryness again.

   NOTE: If water samples are known or suspected to contain chloride salts, these chloride salts should be converted to nitrate salts before the sample residue is transferred to a stainless steel planchet. (Chlorides will attack stainless steel and increase the sample solids. No correction can be made for these added solids.) Chloride salts can be converted to nitrate salts by adding concentrated HNO_3 and evaporating to near dryness.

5. With D.I. water and a few drops of 3 N HNO_3, transfer the residue to a 50 ml beaker using a rubber policeman to wash the walls. Evaporate to NEAR dryness.

6. Transfer quantitatively the residue to a TARED PLANCHET, using an unused plastic disposable pipette for each sample, (not more than 1 mL at a time) evaporating each portion to dryness under the lamp. Spread residue uniformly on the planchet.

   NOTE: Non-uniformity of the sample residue in the counting planchet interferes with the accuracy and precision of the method.

7. Wash the beaker with a minimum amount of 1 N HNO_3 several times and combine the washings and the residue in the planchet, using the rubber policeman to wash the walls. Evaporate to dryness.[c]

   NOTE: Rinse the rubber policeman with D.I. water between samples.

8. Bake in muffle furnace at 450°C for 45 minutes, cool and weigh.

9. Add a few drops (6 - 7) of the lucite solution and dry under the infrared lamp for 10 - 20 minutes.

10. Store the sample in a dessicator until ready to count because vapors from the moist residue can damage the detector and the window and can cause erratic measurements.

---

[c] For Duquesne Light Company and CH_2M Hill samples ONLY - Procedure, Step 7: Do NOT bake. Proceed directly to Step 9. | 2

11. Count the gross alpha and/or the gross beta activity in a low background proportional counter.

    NOTE: If the gas-flow internal proportional counter does not discriminate for the higher energy alpha pulses at the beta plateau, the activity must be subtracted from the beta plus alpha activity. This is particularly important for samples with high alpha activity.

    Samples may be counted for beta activity immediately after baking; alpha counting should be delayed at least 72 hours (until equilibrium has occurred).

Calculations

Gross alpha (beta) activity:

$$(\text{pCi/liter}) = \frac{A}{B \times C \times D \times 2.22} \pm \frac{2\sqrt{E_{sb}^2 + E_b^2}}{B \times C \times D \times 2.22}$$

Where:

A = Net alpha (beta) count (cpm)

B = Efficiency for counting alpha (beta) activity (cpm/dpm)

C = Volume of sample (liters)

D = Correction factor for self-absorption in the sample

E_{sb} = Counting error of sample plus background

E_b = Counting error of background

References: Radioassay Procedures for Environmental Samples, U.S. Department of Health, Education and Welfare. Environmental Health Series, January 1967.

EPA Prescribed Procedures for Measurement of Radioactivity in Drinking Water. August 1980.

TELEDYNE ISOTOPES

MIDWEST LABORATORY

700 LANDWEHR ROAD

NORTHBROOK, ILLINOIS 60062-2310

(312) 564-0700 FAX (312) 564-4517

DETERMINATION OF GROSS ALPHA AND/OR GROSS BETA IN WATER

(SUSPENDED SOLIDS)

PROCEDURE NO. TIML-W(SS)-02

Prepared by

Teledyne Isotopes Midwest Laboratory

Copy No. _____

Revision No.	Date	Pages	Prepared by	Approved by
0	11-22-85	3	L. G. Huebner	L G Huebner

DETERMINATION OF GROSS ALPHA AND/OR GROSS BETA IN WATER

(SUSPENDED SOLIDS)

Principle of Method

The sample is filtered through a tared membrane filter. The filter containing the solids is transferred to a stainless steel planchet, dried, and fixed to the planchet. The gross alpha and gross beta activities are measured in a low background internal proportional counter. If the sample contains sand, it is placed in the separatory funnel, the sand allowed to settle to the bottom and drained off.

Reagents

Acetone

Apparatus

Filter, Millipore, membrane Type AA 0.08
Filtration equipment
Planchets (Standard 2" x 1/8" planchet)
Proportional counter

Procedure

1. Filter one liter of sample through a TARED membrane filter. Wash the non-filterable solids on the filter with D.I. water.

   Note: If the sample contains sand, place it in the separatory funnel, allow the sand to settle for 30 minutes, then drain off the sand at the bottom. Shake the funnel and repeat as above two (2) more times.

2. Place the filter in a planchet, placing the ring over it to prevent curling, and air dry for 24 hours.

3. Dry under the infared lamp for 20-30 minutes. Dessicate to constant weight and weigh.

4. Fix the filter to the planchet at four peripheral points using glue. Air dry.

5. Count for gross alpha and gross beta activity using a proportional counter.

6. Calculate the activity in pCi/l using the computer program designed for this analysis.

Calculations

Gross alpha (beta) activity:

$$(pCi/liter) = \frac{A}{B \times C \times D \times 2.22} \pm \frac{2\sqrt{E_{sb}^2 + E_b^2}}{B \times C \times D \times 2.22}$$

Where:

A = Net alpha (beta) count (cpm)

B = Efficiency for counting alpha (beta) activity (cpm/dpm)

C = Volume of sample (liters)

D = Correction factor for self-absorption in the sample

E_{sb} = Counting error of sample plus background

E_b = Counting error of background

References: Radioassay Procedures for Environmental Samples, U.S. Department of Health, Education and Welfare. Environmental Health Series, January 1967.

TELEDYNE ISOTOPES

MIDWEST LABORATORY

700 LANDWEHR ROAD

NORTHBROOK, ILLINOIS 60062-2310

(312) 564-0700 FAX (312) 564-4517

DETERMINATION OF GROSS ALPHA AND/OR GROSS BETA IN SOLID SAMPLES

PROCEDURE NO. TIML-AB-01

Prepared by

Teledyne Isotopes Midwest Laboratory

Copy No. _____

Revision No.	Date	Pages	Prepared by	Approved by
0	08-04-86	5	B. Gobb	L. J. Huebner

DETERMINATION OF GROSS ALPHA AND/OR GROSS BETA IN SOLID SAMPLES

Principle of Method

100 mg to 200 mg of sample is distributed evenly on a 2" ringed planchet, counted in a proportional counter, and concentrations of gross alpha and/or gross beta are calculated.

Reagents

Lucite: 0.5 mg/ml in acetone

Appartus

Balance
Infrared lamp
Planchets (standard 2" x 1/8" ringed planchet)
Proportional counter

A. Gross Alpha and/or Gross Beta in Vegetation

Procedure

1. Weigh out accurately in a planchet no more than 100 mg of ashed or dried and ground sample for gross alpha assay and no more than 200 mg for gross beta assay.

   NOTE: If both gross alpha and gross beta analyses are required, do not use more than 100 mg.

2. Add a few drops of water and spread uniformly over the area of the planchet. Dry under the infrared lamp.

3. Add ? - 3 drops of lucite solution in acetone and dry again under the infrared lamp.

4. Store the planchets in a desiccator until counting.

5. Count the gross alpha and gross beta activity in a low background proportional counter.

Calculations

Gross alpha (beta) concentration:

$$(\text{pCi/g wet}) = \frac{A}{B \times C \times D \times F \times 2.22} \pm \frac{2\sqrt{E_{sb}^2 + E_b^2}}{B \times C \times D \times F \times 2.22}$$

Where:

A = Net alpha (beta) count (cpm)

B = Efficiency for counting alpha (beta) activity (cpm/dpm)

C = Weight of sample (grams), ash or dry

D = Correction factor for self-absorption in the sample

E_{sb} = Counting error of sample plus background

E_b = Counting error of background

F = Ratio of wet weight to ashed or dry weight

REFERENCE: Radioassay Procedures for Environmental Samples, U. S. Department of Health, Education and Welfare. Environmental Health Series, January 1967.

B. Gross Alpha and/or Gross Beta in Meat, Fish, and Wildlife

Procedure

1. Weigh out accurately in a planchet no more than 100 mg of ashed sample for gross alpha assay and no more than 200 mg for gross beta assay.

   NOTE: If both gross alpha and gross beta analyses are required, do not use more than 100 mg.

2. Add a few drops of water and spread uniformly over the area of the planchet. Dry under the infrared lamp.

3. Add 2 - 3 drops of lucite solution in acetone and dry again under the infrared lamp.

4. Store the planchets in a desiccator until counting.

5. Count the gross alpha and gross beta activity in a low background proportional counter.

Calculations

Gross alpha (beta) concentration:

$$(\text{pCi/g wet}) = \frac{A}{B \times C \times D \times F \times 2.22} \pm \frac{2\sqrt{E_{sb}^2 + E_b^2}}{B \times C \times D \times F \times 2.22}$$

Where:

A = Net alpha (beta) count (cpm)

B = Efficiency for counting alpha (beta) activity (cpm/dpm)

C = Weight of sample (grams), ash

D = Correction factor for self-absorption in the sample

E_{sb} = Counting error of sample plus background

E_b = Counting error of background

F = Ratio of wet weight to ashed weight

REFERENCE: Radioassay Procedures for Environmental Samples, U. S. Department of Health, Education and Welfare. Environmental Health Series, January 1967.

C. Gross Alpha and/or Gross Beta in Soil and Bottom Sediments

Procedure

1. Weigh out accurately in a planchet no more than 100 mg of a pulverized sample for gross alpha assay and no more than 200 mg for a gross beta assay.

   NOTE: If both gross alpha and gross beta analyses are required, do not use more than 100 mg.

2. Add a few drops of water and spread uniformly over the area of the planchet. Dry under the infrared lamp.

3. Add 2 - 3 drops of lucite solution in acetone and dry again under the infrared lamp.

4. Store the planchets in a desiccator until counting.

5. Count the gross alpha and gross beta activity in a low background proportional counter.

Calculations

Gross alpha (beta) concentration:

$$(\text{pCi/g dry}) = \frac{A}{B \times C \times D \times 2.22} \pm \frac{2\sqrt{E_{sb}^2 + E_b^2}}{B \times C \times D \times 2.22}$$

Where:

A = Net alpha (beta) count (cpm)

B = Efficiency for counting alpha (beta) activity (cpm/dpm)

C = Weight of sample (grams)

D = Correction factor for self-absorption in the sample

E_{sb} = Counting error of sample plus background

E_b = Counting error of background

REFERENCE: Radioassay Procedures for Environmental Samples, U. S. Department of Health, Education and Welfare. Environmental Health Series, January 1967.

TELEDYNE ISOTOPES

MIDWEST LABORATORY

700 LANDWEHR ROAD

NORTHBROOK, ILLINOIS 60062 2310

(312) 564-0700 FAX (312) 564-4517

DETERMINATION OF GAMMA EMITTERS BY GAMMA SPECTROSCOPY (GERMANIUM DETECTORS)

PROCEDURE NO. TIML-GS-01

Prepared by

Teledyne Isotopes Midwest Laboratory

Copy No. _____

Revision No.	Date	Pages	Prepared by	Approved by
0	07-21-86	5	[signature]	[signature]

DETERMINATION OF GAMMA EMITTERS BY GAMMA SPECTROSCOPY (GERMANIUM DETECTORS)

Principle of Method

The sample is placed in a calibrated container and counted for a length of time required to reach the required LLD. The results are decay corrected to the sampling time, where appropriate, using a dedicated computer and software.

Apparatus

Counting containers
Counting Equipment
Cylinders
Marking Pens
Recording Books

A. Milk and Water

1. Measure accurately 3.5 l or 500 ml of sample and put it in the calibrated counting container. Always use larger volume if sample is in sufficient quantity.

   NOTE: Occasionally the sample size is too large for 500 ml geometry but not sufficient for 3.5 geometry. In such a case, follow the following procedure.

   a. If the sample size is less than 2 l, use 500 ml geometry.

   b. If the sample size is more than 2 l, measure the sample accurately and dilute to 3.5 l with deionized water. Use 3.5 l geometry but use actual sample volume when doing the calculations. Return the diluted sample to the original container and mark the volume of the original sample and deionized water used.

2. Cover and attach a gummed label to the cover; write the sample number, volume, and date and time of collection on the label. Mark "I-131" if analysis for I-131 is required by gamma spectroscopy.

3. Count without delay for estimated time required to meet LLDs. Record file number, sample identification number, date and time counting started, detector number, geometry, sample size, and date and time of collection.

4. Stop counting; transfer specra to the disc and print out the results.

5. Check LLDs before taking the sample off. If LLDs are not met, continue counting until they do.

6. After counting is completed, record the date and time counting ended and counting time.

7. Return the sample to the original container and mark with a red marker.

B. Airborne Particulates

1. Place air filters in a filter cup container.

2. Place on the detector and count long enough to meet the LLD requirements. Record the file number, sample identification number, date and time counting started, detector number, geometry, sample size, and date and time collected.

3. Stop counting and transfer spectra to the disc. Print out the results and check the LLDs before taking the sample off. If LLD levels are not met, continue counting until they do.

4. After counting is completed, record the date and time counting ended and counting time.

5. Replace air filters in the original envelopes for storage or further analyses.

C. Other Samples

NOTE: Samples, e.g., soil, vegetation, fish, etc., are prepared in the prep lab and delivered to the counting room.

1. Place the sample on the detector and count long enough to meet LLD requirements. Record the file number, sample identification number, date and time counting started, detector number, geometry, sample size, and date and time of collection.

2. Stop counting and transfer spectra to the disc. Print out the results and check the LLDs before taking the sample off. If LLD levels are not met, continue counting until they are.

3. After counting is completed, record date and time counting ended and counting time. Mark the container with red marker and return to the prep lab for transfer to the plastic bag for storage or further analyses.

TELEDYNE ISOTOPES

MIDWEST LABORATORY

700 LANDWEHR ROAD

NORTHBROOK, ILLINOIS 60062-2310

(708) 564-0700 FAX (708) 564-4517

DETERMINATION OF TRITIUM IN WATER

(DIRECT METHOD)

PROCEDURE NO. TIML-T-02

Prepared by

Teledyne Isotopes Midwest Laboratory

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Revised Pages	Revision No.	Date	Pages	Prepared by	Approved by
	0	11-22-85	5	L. G. Huebner	L G Huebner
2,3	1	09-27-91	4	S. Grab	L G Huebner

DETERMINATION OF TRITIUM IN WATER

(DIRECT METHOD)

Principle of Method

The water sample is purified by distillation, a portion of the distillate is transferred to a counting vial and the scintillation fluid added. The contents of the vial are thoroughy mixed and counted in a liquid scintillation counter.

Reagents

Scintillation medium, Insta-Gel scintillator
Tritium standard solution
Dead water
Ethyl alcohol

Apparatus

Condenser
Distillation flask, 250-ml capacity
Liquid scintillation counter
Liquid scintillation counting vials
Kimwipes

Procedure

NOTE: All glassware must be dry. Dry it in the drying oven at 100-125°C. |1

1. Place 60-70 ml of the sample in a 250-ml distillation flask. Add a boiling chip to the flask. Add one NaOH pellet and ca. 0.02g $KMnO_4$. Connect a side arm adapter and a condenser to the outlet of the flask. Place a receptacle at the outlet of the condenser. Set variac at 70 mark. Heat to boiling to distill. Discard the first 5-10 ml of distillate. Collect next 20-25 ml of distillate for analysis. Do not distill to dryness. |1

2. Mark the vial caps with the sample number and date.

   Note: Use the same type of vial for the whole batch (samples, background, and standard.

3. Mark three (3) vial caps "Bkg 1", "Bkg 2", "Bkg 3", and .

4. Mark three (3) vial caps "St-1", "St-2", "St-3"; standard number, and date.

5. Dispense 13 ml of sample into marked vials and "dead" water into vials marked Bkg-1,2, and 3.

   Note 1: Pipetter is set (and calibrated) to deliver 6.5 ml, so pipette twice into each vial. Use new tip for each sample and new tip (one) for three background samples.

   Note 2: Make sure the pipetter has not been reset. If it has been reset, or if you are not sure, do not use it; check with your supervisor.

   Note 3: Make sure the plastic tip is pushed all the way on to the pipetter and is tight. If it is not, the air will be drawn in and the volume withdrawn will not be correct (it will be smaller).

6. Dispense 13 ml (see Notes 1,2, and 3, above) of "dead" water into each vial marked "St-1", "St-2", and "St-3."

7. Take a 0.1 ml (100) pipetter and withdraw 0.1 ml of water from each of the three standard vials. Discard this 0.1 ml of water.

8. Take a new 0.1 ml tip. Dispense 0.1 ml of standard into each of the three vials marked "St-1", "St-2", and "St-3."

9. Take all vials containing samples, background, and standard to the counting room.

   Note: To avoid spurious counts, scintillator should not be added under flourescent light.

10. Dispense 10 ml of Insta-Gel into each vial (one at a time), cap tightly, and shake VIGOROUSLY for at least 0.5 minutes. Recheck the cap for tightness.

11. Wet a Kimwipe with alcohol and wipe off each vial in the following order:

    Background
    Samples
    Standard

12. Load the vials in the following order:

    Bkg 1
    St-1
    Samples
    Bkg-2*
    St-2*
    Samples
    Bkg-3
    St-3

    * Bkg 2 and St-2 should be approximately in the middle of the batch.

13. Let the vials dark- and temperature-adapt for about one hour.

    Note 1: To check if vials reached counter temperature, inspect one vial (Bkg). The liquid should be transparent. If the temperature is too high (or too low), the liquid will be white and very viscous.

    Note 2: The temperature inside the counter should be between 10° and 14° C (check thermometer). In this temperature range, the liquid is transparent.

14. Set the counter for 100 min counting time and infinite cycles. (Follow manufacturer's procedure for setting the counter.)

15. Fill out the loading sheet, being sure to indicate the date and time counting started, and your initials.

    Note: Do not count prepared background and standard sets with another batch of samples if plastic vials are used. Prepare new backgrounds and standards for each batch.

    If glass vials are used, the prepared background and standard sets can be counted with other batches up to one (1) month after preparation provided they are not taken out of the counter (not warmed up) and the same vial type from the same manufacturing batch (the same carton) is used. After one month prepare new sets of backgrounds and standards.

Calculations

$$pCi/l = \frac{\frac{A}{t_1} - \frac{B}{t_2}}{2.22 \times E \times V \times e^{-\lambda t_3}} \pm \frac{2\sqrt{\frac{A}{t_1^2} + \frac{B}{t_2^2}}}{2.22 \times E \times V \times e^{-\lambda t_3}}$$

Where:

A = Total counts, sample
B = Total counts, background
E = Efficiency (cpm/dpm)
V = Volume (liter)
e = Base of the natural logorithm = 2.71828
$\lambda = \frac{0.693}{12.26} = 0.05652$
t_1 = Counting time, sample
t_2 = Counting time, background
t_3 = Elapsed time from the time of collection to the time of counting (in years)

TELEDYNE ISOTOPES

MIDWEST LABORATORY

700 LANDWEHR ROAD

NORTHBROOK, ILLINOIS 60062-2310

(708) 564-0700 FAX (708) 564-4517

DETERMINATION OF I-131 IN MILK BY ANION EXCHANGE

(BATCH METHOD)

PROCEDURE NO. TIML-I-131-01

Prepared by

Teledyne Isotopes Midwest Laboratory

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_____	0	06-12-85	6	[signature]	L J Huebner
5	1	11-25-85	6	[signature]	L J Huebner
2,3,4,5	2	03-24-89	6	[signature]	L J Huebner
2,3,5	3	04-10-91	6	[signature]	L J Huebner

Determination of I-131 in Milk by Ion Exchange

(Batch Method)

Principle of Method

After samples have been treated to convert all iodine in the sample to a common oxidation state, the iodine is isolated by solvent extraction or a combination of ion exchange and solvent extraction steps.

Iodine, as the iodide, is concentrated by adsorption on an anion resin. Following a NaCl wash, the iodine is eluted with sodium hypochlorite. Iodine in the iodate form is reduced to I_2 and the elemental iodine extracted into $CHCl_3$, back-extracted into water then finally precipitated as palladium iodide.

Chemical recovery of the added carrier is determined gravimetrically from the PdI_2 precipitate. I-131 is determined by beta counting the PdI_2.

Reagents

Anion Exchange Resin, Dowex 1-X8 (20-50 mesh) chloride form | 3

Chloroform, $CHCl_3$ - reagent grade

Hydrochloric Acid, HCl, 1N

Hydrochloric Acid, HCl, 3N

Wash Solution: H_2O - HNO_3 - NH_2OH HCL, 50 mL H_2O; 10 mL 1M - NH_2OH-HCl; 10 mL conc. HNO_3

Hydroxylamine Hydrochloride, NH_2OH HCl - 1 M

Nitric Acid, HNO_3 - concentrated

Palladium Chloride, $PdCl_2$, 7.2 mg Pd^{++}/mL (1.2 g $PdCl_2$/100 mL of 6N HCl) | 3

Sodium Bisulfite, $NaHSO_3$ - 1 M

Sodium Chloride, NaCl - 2M

Sodium Hypochlorite, NaOCl - 5% (Clorox)

Special Apparatus

Chromatographic Column, 20 mm x 150 mm (Reliance Glass Cat. #R2725T)

Vacuum Filter Holder, 2.5 cm^2 filter area

Filter Paper, Whatman #42, 21 mm

Mylar

Polyester Gummed Tape, [illegible]2", Scotch #853

Heat Lamp

Part A

Ion Exchange Procedure

1. Transfer 2 liters (if available) of sample to the beaker. Add 1.00 mL of standardized iodide carrier to each sample. | 3

2. Add a clean magnetic stirring bar to each sample beaker. Stir each sample for 5 minutes or longer on a magnetic stirrer. Allow sample to equilibrate at least 1/2 hour. If a milk sample is curdled or lumpy, vacuum filter the sample through a Buchner funnel using a cheesecloth filter. Wash the curd thoroughly with deionized water, collecting the washings with the filtrate. Pour the filtrate back into the original washed and labeled 4 liter beaker and discard the curd.

3. Add approximately 45 grams of Dowex 1X8 (20-50 mesh) anion resin to each sample beaker and stir on a magnetic stirrer for at least 1 hour. Turn off the stirrer and allow the resin to settle for 10 minutes.

4. Gently decant and discard the milk or water sample taking care to retain as much resin as possible in the beaker. Add approximately 1 liter of deionized water to rinse the resin, allow to settle 2 minutes, and pour off the rinse. Repeat rinsing in the case of milk samples until all traces of milk are removed from the resin.

5. Using a deionized water wash bottle, transfer the resin to the column marked with the sample number. Allow resin to settle 2 minutes and drain the standing water. Wash the resin with 100 mL of 2M NaCl.

6. Measure 50 mL 5% sodium hypochlorite in a graduated cylinder. Add sodium hypochlorite to column in 10-20 mL increments, stirring resin as needed to eliminate gas bubbles and maintain flow rate of 2 mL/min. Collect eluate in 250 mL beaker and discard the resin.

Part B

Iodine Extraction Procedure

1. Acidify the eluate from Step 6 using concentrated HNO_3 to make the sample 2-3 N in HNO_3 and transfer to 250 mL separatory funnel. (Add the acid slowly with stirring unt the vigorous reaction subsides.) Volumn of concentrated HNO_3 required will depend on eluate volume as follows:

Eluate Volume (mL)	Concentrated HNO_3 (mL)
50-60	10
60-70	12
70-80	14
80-90	16

2. Add 50 mL of $CHCl_3$ and 10 mL of 1 M hydroxylamine hydrochloride (freshly prepared). Extract iodine into organic phase (about 2 minutes equilibration). Draw off the organic phase (lower phase) into another separatory funnel.

3. Add 25 mL of $CHCl_3$ and 5 mL of 1 M hydroxylamine hydrochloride to the first separatory funnel and again equilibrate for 2 minutes. Combine the organic phases. Discard the aqueous phase (Upper phase) if no other analyses are required. If Pu, U or Sr is required on the same sample aliquot, submit the aqueous phase and data sheet to the approprate laboratory section.

4. Add 20 mL H_2O-HNO_3-NH_2OH HCl wash solution to the separatory funnel containing the $CHCl_4$. Equilibrate 2 minutes. Allow phases to separate and transfer $CHCl_3$ (lower phase) to a clean separatory funnel. Discard the wash solution.

5. Add 25 mL H_2O and 10 drops of 1 M sodium bisulfite (freshly prepared) to the separatory funnel containing the $CHCl_3$. Equilibrate for 2 minutes. Discard the organic phase (lower phase). Drain aqueous phase (upper phase) into a 100 mL beaker. Proceed to the Precipitation of PdI_2.

Part C

Precipitation of Palladium Iodide

CAUTION: AMMONIUM HYDROXIDE INTERFERES WITH THIS PROCEDURE

1. Add 10 mL of 3 N HCl to the aqueous phase from the iodine extraction procedure in Step 5.

2. Place the beaker on a stirrer-hot plate. Using the magnetic stirrer, boil and stir the sample until it evaporates to 30 mL or begins to turn yellow.

3. [illegible] heat off. Remove the magnetic stirrer, rinse with deionized [illegible]

[illegible] wise, to the solution, 2.0 mL of palladium chloride.

[illegible] sample to room temperature. Place the beaker with sample on the [illegible] ess steel tray and put in the refrigerator overnight.

6. Weigh a clean 21 mm Whatman #42 filter which has been dried under a heat lamp.

7. Place the weighed filter in the filter holder. Filter the sample and wash the residue with water and then with absolute alcohol.

8. Remove filter from filter holder and place it in the labeled petri dish.

9. Dry under the lamp for 5-10 minutes. 3

10. Weigh the filter with the precipitate.

11. Cut a 1-1/2" strip of polyester tape and lay it on a clean surface, gummed side up. Place the filter, precipitate side up, in the center of the tape.

12. Cut a 1-1/2" wide piece of mylar. Using a spatula to press it in place, put it directly over the precipitate and seal the edges to the polyester tape. Trim to about 5 mm from the edge of the filter with scissors.

13. Mount the sample on the plastic disc and write the sample number on the back side of the disc.

14. Count the sample on a proportional beta counter.

Calculations

Calculate the sample activity using computer program I131.

Part C

Precipitation of Palladium Iodide (continued)

I-131 concentration:

$$(pCi/l) = \frac{A}{2.22 \times B \times C \times D} \pm \frac{2\sqrt{E_{sb}^2 + E_b^2}}{2.22 \times B \times C \times D}$$

where:

A = Net cpm, sample

B = Efficiency for counting beta I-131 (cpm/dpm)

C = Volume of sample (liters)

D = Correction for decay to the time of collection = $e^{-\lambda t}$ =

$$Exp\left(-\frac{0.693 \times t}{8.04}\right) = e^{-0.0862t}$$

where t = elapsed time from the time of collection to the counting time (in days)

E_{sb} = Counting error of sample plus background

E_b = Counting error of background

Reference: "Determination of 1-131 by Beta-Gamma coincidence Counting of PdI_2". Radiological Science Laboratory. Division of Laboratories and Research, New York State Department of Health, March 1975, Revised February 1977.

TELEDYNE ISOTOPES

MIDWEST LABORATORY

700 LANDWEHR ROAD

NORTHBROOK, ILLINOIS 60062-2310

(312) 564-0700 FAX (312) 564-4517

DETERMINATION OF AIRBORNE I-131 IN CHARCOAL CARTRIDGES BY GAMMA SPECTROSCOPY

PROCEDURE NO. TIML-I-131-02

Prepared by

Teledyne Isotopes Midwest Laboratory

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Revision No.	Date	Pages	Prepared by	Approved by
0	07-04-86	3	P. Gob	L.A. Hueluue

DETERMINATION OF AIRBORNE I-131 IN CHARCOAL CARTRIDGES BY GAMMA SPECTROSCOPY

Principle of Method

Each charcoal cartridge is placed on the detector and counted. A peak of 0.36 MeV is used to calculate the concentration at counting time. The equilibrium concentration at the end of collection is then calculated. Decay correction between the end of collection period and the counting time is then made.

Materials

Charcoal Cartridges

Apparatus

Counting Container
Germanium Detector
Plastic Bags
Plastic Bag Sealer
Paper Tape
Scissors

Procedure

NOTE: Because of the short half-life of I-131, count the samples as soon as possible after receipt and no later than 48 hours.

1. Load the charcoal cartridges in a specially designed holder or transfer charcoal from each cartridge to individual plastic bags. Seal the bags.

2. Label each bag with corresponding project ID, locations ID, and date of collection.

3. Place the bags in a standard geometry container, cap the container and secure the cap with a tape.

4. Place the holder or container on the detector and count for a period of time that will meet the required Lower Limit of Detection (LLD).

Calculation:

A_1 = I-131 activity (pCi/sample) = $\frac{A}{2.22 \times B}$ (at counting time) (1)

Where:

A = Net count rate of I-131 in the 0.36 MeV peak (cpm)

B = Efficiency for the I-131 in 0.36 MeV peak (cpm/dpm)

Correction for Equilibrium (assuming constant concentration over the sampling period) and Decay:

$$C = \frac{\lambda A_1 e^{\lambda t_1}}{F (1-e^{-\lambda t_2})} \quad (2)$$

Where:

C = Equilibrium concentration of I-131 (pCi/m^3)

A_1 = Activity of I-131 at the time of counting (pCi/sample)

e = The base of the natural logarithm = 2.71828

λ = 0.693/half life (days) = 0.693/8.04 = 0.0862/day

t_1 = Elapsed time between the end of sampling and mid-counting point (in days)

t_2 = Duration of collection (in days)

F = m^3/day

Reference: Radiation Safety Technician Training Course, Argonne National Laboratory, Section 14, pp. 361-364, May 1972.

TELEDYNE ISOTOPES

MIDWEST LABORATORY

700 LANDWEHR ROAD

NORTHBROOK, ILLINOIS 60062-2311

(312) 564-0700 FAX (312) 564-4517

PROCEDURE FOR COMPOSITING WATER AND MILK SAMPLES

PROCEDURE NO. TIML-COMP-01

Prepared by

Teledyne Isotopes Midwest Laboratory

Copy No. _____

Revised Pages	Revision No.	Date	Pages	Prepared by	Approved by
	J	11-07-88	2	B. Gob	RJ Heeboer

Procedure for Compositing Water and Milk Samples

1. At the beginning of each composite period, (month, quarter, semi-annual), prepare a one-gallon cubitainer for a specific location and time-period.

2. Remove an equal aliquot of original sample (for example, one liter) and transfer to prepared cubitainer. Do this for each week, month, etc. Mark date of original sample on prepared cubitainer.

3. When prepared container is complete, give the sample to the recording clerk for assigning a number.

4. Analyze according to the client requirement.