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April 7, 1994

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Ladies/Gentlemen:

Docket 50-305
Operating License DPR-43
Kewaunee Nuclear Power Plant
Annual Radiological Environmental Monitoring Report

Attached is the 1993 Annual Radiological Environmental Monitoring Report for the Kewaunee Nuclear Power Plant (KNPP). This report was prepared by Teledyne Isotopes and satisfies the requirements of KNPP Technical Specification 6.9.b.1.

Also attached are the results of the 1993 Land Use Census, submitted in accordance with KNPP's Offsite Dose Calculation Manual, Section 3/4.7.1.

Sincerely,

C. A. Schrock
Manager - Nuclear Engineering

BJD/cjt

Attach.

cc - US NRC, Region III
US NRC Senior Resident Inspector

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KEWAUNEE NUCLEAR POWER PLANT
1993 LAND USE CENSUS

The 1993 Land Use Census, completed on July 30, 1993, satisfied the requirements of the KNPP Offsite Dose Calculation Manual (ODCM), Section 3.6.2, which states:

> A land use census shall be conducted and shall identify within a distance of 8 km (5 miles) the location in each of the 10 meteorological sectors of the nearest milk animal, the nearest residence and the nearest garden of greater than 50 m^2 (500 ft^2) producing broad leaf vegetation.

The 1993 Land Use Census was conducted by surveying families in the 10 meteorological sectors within 5 miles of the Kewaunee Nuclear Power Plant. This census is conducted annually during the growing season. A combination of a telephone survey and a drive-by observation was used to collect all the necessary information. Of the facilities surveyed, a total of 20 met the ODCM criteria for inclusion in the Land Use Census.

Table 1 lists the results of the 1993 census.

Table 2 describes the changes from 1992 to 1993.

Figure 1 shows the locations of the meteorological sections and the township section numbers.

TABLE 1

LAND USE CENSUS

Inventory of residence, gardens ≥500 sq. feet and milk animals found nearest to the plant in each of the 10 meteorological sections within a five-mile radius of the Kewaunee Nuclear Power Plant.

SECTON	SECTION NO.	RESIDENCE	GARDEN	MILK ANIMALS	DISTANCE FROM PLANT (IN MILES)
J	11	X	(NOTE 1)	(NOTE 1)	2.68
K	35	X	X		0.80
K	11			X	2.50
L	35	X			0.85
L	35		X	X	1.28
M	35	X	X		1.33
M	34			X	1.56
N	35	X			0.95
N	34			X	1.39
N	26		X		1.04
P	26	X	X		1.33
P	22			X	2.01
Q	23	X			1.31
Q	23		X	X	1.33
R	26	X		X	1.00
R	23		X		1.85
A	24	X	X		1.95
A	13			X	2.63
B	24	X			1.20
B	24		X	X	1.27

NOTE 1: There were no milk animals or gardens ≥500 sq. feet located in Sector J within five miles of the Kewaunee Nuclear Power Plant.

TABLE 2

LAND USE CENSUS CHANGES

Sector J

° No Changes

Sector K

° No Changes

Sector L

° No Changes

Sector M

° No Changes

Sector N

° No Changes

Sector P

° No Changes

Sector Q

° No Changes

Sector R

° No Changes

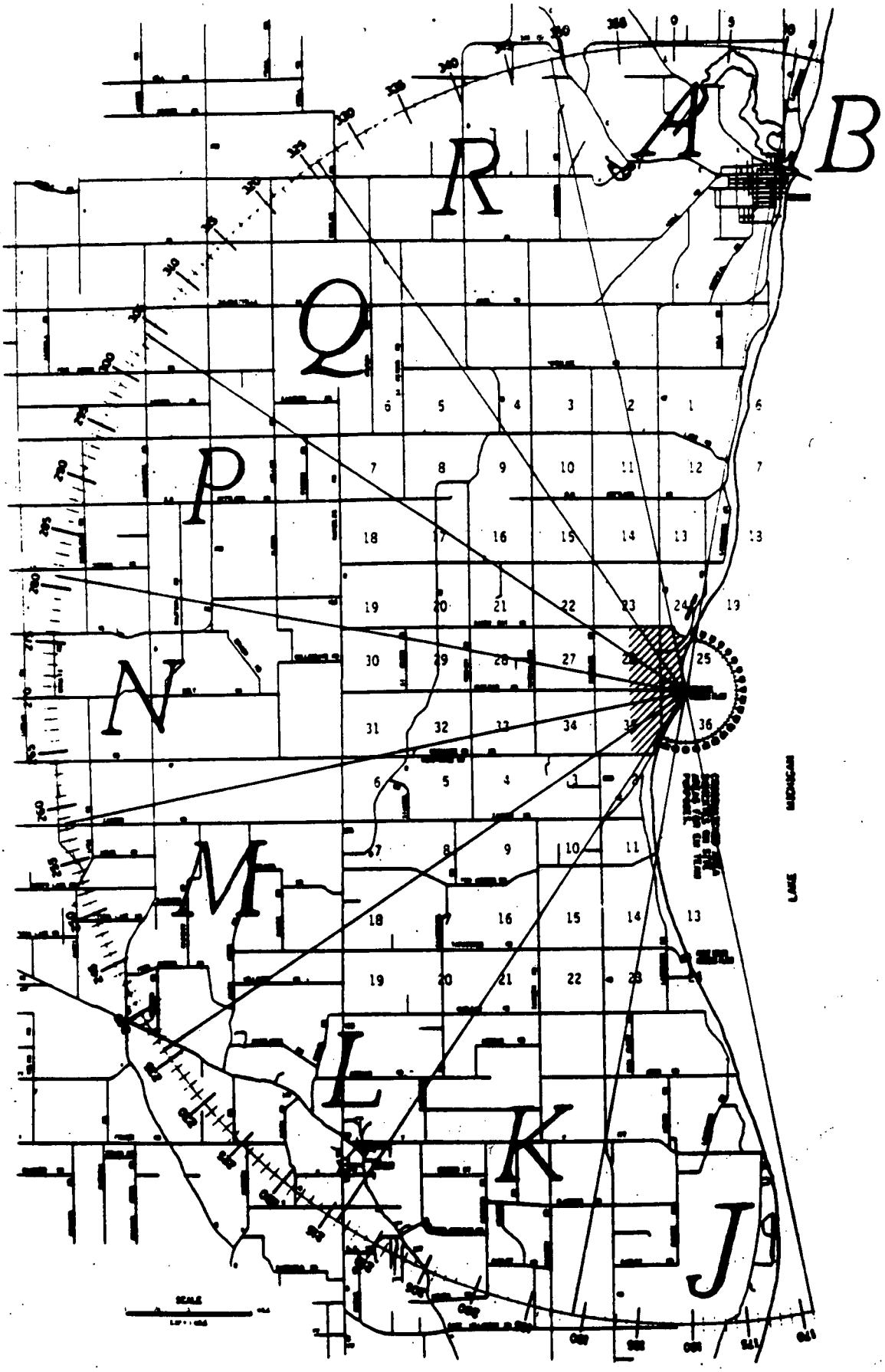
Sector A

° No Changes

Sector B

° The distance of the nearest resident in this sector has changed from 1.27 miles to 1.20 miles (The home at the 1.20 mile distance was vacant last year.).

FIGURE 1



50-305 KEWAUNEE WPSC

1993 ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT - PART I, SUMMARY & INTERPRETATION

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REPORT TO

WISCONSIN PUBLIC SERVICE CORPORATION
WISCONSIN POWER AND LIGHT COMPANY
MADISON GAS AND ELECTRIC COMPANY

RADIOLOGICAL MONITORING PROGRAM FOR THE KEWAUNEE NUCLEAR POWER PLANT KEWAUNEE, WISCONSIN

ANNUAL REPORT - PART I
SUMMARY AND INTERPRETATION
January - December 1993

PREPARED AND SUBMITTED
BY
TELEDYNE ISOTOPES MIDWEST LABORATORY
PROJECT NO. 8002

Approved by: L. G. Huebner

L. G. Huebner
General Manager

22 March 1994

PREFACE

The staff members of the Teledyne Isotopes Midwest Laboratory (TIML) were responsible for the acquisition of data presented in this report. Assistance in sample collection was provided by Wisconsin Public Service Corporation personnel.

The report was prepared by L. G. Huebner, General Manager. He was assisted in report preparation by other staff members of the laboratory.

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1.0 INTRODUCTION

The Kewaunee Nuclear Power Plant is a 535 megawatt pressurized water reactor located on the Wisconsin shore of Lake Michigan in Kewaunee County. The Kewaunee Nuclear Power Plant became critical on March 7, 1974. Initial Power generation was achieved on April 8, 1974, and the Plant was declared commercial on June 16, 1974. This report summarizes the environmental operation data collected during the period January - December 1993.

Wisconsin Public Service Corporation, an operating company for the Kewaunee Nuclear Power Plant, assumes the responsibility for the environmental program at the Plant and any questions relating to this subject should be directed to them.

2.0 SUMMARY

Results of sample analyses during the period January - December 1993 are summarized in Table 4.5. Radionuclide concentrations measured at indicator locations are compared with levels measured at control locations and in preoperational studies. The comparisons indicate background-level radioactivities in all samples collected.

3.0 RADIOLOGICAL SURVEILLANCE PROGRAM

Following is a description of the Radiological Surveillance Program and its execution.

3.1 Methodology

The sampling locations are shown in Figure 4-1. Table 4.1 describes the locations, lists for each direction and distance from the reactor, and indicates which are indicators and which are control locations.

The sampling program monitors the air, terrestrial, and aquatic environments. The types of samples collected at each location and the frequency of collections are presented in Table 4.2, using sample codes defined in Table 4.3. The collections and analyses that comprise the program are described below. Finally, the execution of the program in the current reporting year is discussed.

3.1.1 The Air Program

Airborne Particulates

The airborne particulate samples are collected on 47 mm diameter glass fiber filters at a volumetric rate of approximately one cubic foot per minute. The filters are collected weekly from six locations (K-1f, K-2, K-7, K-8, K-15 and K-16), and dispatched by mail to TIML for radiometric analysis. The material on the filter is counted for gross beta activity approximately five days after receipt to allow for decay of naturally-occurring short-lived radionuclides.

Quarterly composites from each sampling location are analyzed for gamma-emitting isotopes by a germanium detector.

Airborne Iodine

Charcoal filters are located at locations K-1f, K-2, K-7, K-8, K-15 and K-16. The filters are changed bi-weekly and analyzed for iodine-131 immediately after arrival at the laboratory.

Ambient Gamma Radiation - TLDs

The integrated gamma-ray background is measured at six air sampling locations (K-1f, K-2, K-7, K-8, K-15 and K-16), at four milk sampling locations (K-3, K-4, K-5 and K-6), and at two additional locations (K-17, located 4.25 miles west of the plant; and K-27, located 1.5 miles northwest of the plant) with thermoluminescent dosimeters (TLDs). Two TLD cards, each having four main readout areas containing

Ambient Gamma Radiation - TLDs (continued)
phosphor, are placed at each location (eight TLDs at each location). One card is exchanged quarterly, the other card is exchanged annually and read only on an emergency basis.

Precipitation
Monthly composites of precipitation samples collected at K-11 are analyzed for tritium activity by liquid scintillation technique.

3.1.2 The Terrestrial Program

Milk
Milk samples are collected semimonthly (one gallon from each location) from May through October, and monthly (two gallons from each location) during the rest of the year from four herds that graze within four miles of the reactor site (K-4, K-5, K-12 and K-19), from two herds that graze between four and ten miles from the reactor site (K-3 and K-6), and from a dairy in Green Bay (K-28). The milk samples are analyzed for iodine-131, strontium-89 and-90, cesium-137, barium-140, potassium-40, calcium and stable potassium.

Well Water
One gallon water samples are collected quarterly from four off-site wells located at K-10, K-11, K-12, and K-13, and from two on-site wells located at K-1g and K-1h.

Gross beta and gamma spectroscopic analyses are performed on the total residue of each water sample. The concentration of potassium-40 is calculated from total potassium, which is determined by flame photometry on all samples.

Additionally, samples of water from two on-site wells (K-1g and K-1h) are also analyzed for gross alpha. Water from one on-site well (K-1g) is also analyzed for tritium, strontium-89, and strontium-90.

Domestic Meat
Domestic meat samples (chickens) are obtained annually (in the third quarter) at locations K-20, K-24, K-27, and K-29. The flesh is separated from the bones, gamma scanned, and analyzed for gross alpha and gross beta activities.

Eggs
Eggs are collected quarterly at Location K-27. The samples are gamma scanned and analyzed for gross beta, strontium-89, and strontium-90 activities.

Vegetables

Vegetable samples (5 varieties) are collected at locations K-17 and K-26, and two varieties of grain, if available, at location K-23. The samples are gamma scanned and analyzed for gross beta, strontium-89 and strontium-90 activities.

Grass and Cattle Feed

Grass samples are collected during the second, third, and fourth quarters from two on-site locations (K-1b and K-1f) and from six dairy farms (K-3, K-4, K-5, K-6, K-12 and K-19). The samples are gamma scanned and analyzed for gross beta, strontium-89, and strontium-90 activities. During the first quarter, cattle feed is collected from the same six dairy farms, and the same analyses are performed.

Soil

Soil samples are collected twice a year on-site at K-1f and from the six dairy farms (K-3, K-4, K-5, K-6, K-12, and K-19). The samples are gamma scanned and analyzed for gross alpha, gross beta, strontium-89 and strontium-90 activities.

3.1.3 The Aquatic Program

Surface Water

One-gallon water samples are taken monthly from three locations on Lake Michigan: 1) at the point where the condenser water is discharged into Lake Michigan (K-1d); 2) Two Creeks Park (K-14) located 2.5 miles south of the reactor site; and 3) at main pumping station located approximately equidistant from Kewaunee and Green Bay, that pumps water from the Rostok water intake (K-9) located 11.5 miles north of the reactor site. Additionally, one-gallon water samples are taken monthly from three creeks that pass through the site (K-1a, K-1b, and K-1e). Samples from North and Middle Creeks (K-1a, K-1b) are collected near the mouth of each creek. Samples from the South Creek (K-1e) are collected about ten feet downstream from the point where the outflow from the two drain pipes meet. Water samples at K-14 are collected and analyzed in duplicate.

The water samples are gamma scanned and analyzed for gross beta activity in the total residue, dissolved solids, and suspended solids, and potassium-40. The concentration of potassium-40 is calculated from total potassium, which is determined by flame photometry. The tritium activity is determined by liquid scintillation technique. Quarterly composites of monthly grab samples are also analyzed for tritium, strontium-89 and strontium-90.

Fish

Fish samples are collected in the second, third and fourth quarters at Location K-1d. The flesh is separated from the bones, gamma scanned and analyzed for gross beta activity. Ashed bone samples are analyzed for gross beta, strontium-89 and strontium-90 activities.

Slime

Slime samples are collected during the second and third quarters from three Lake Michigan locations (K-1d, K-9 and K-14), and from three creek locations (K-1a, K-1b, and K-1e), if available. The samples are analyzed for gross beta activity. If the quantity is sufficient, they are also gamma scanned and analyzed for strontium-89 and strontium-90 activities.

Bottom Sediments

Bottom sediments are collected in May and November from five locations (K-1c, K-1d, K-1j, K-9 and K-14). The samples are analyzed for gross beta activity and for strontium-89 and strontium-90. Each sample is also gamma scanned. Since it is known that the measured radioactivity per unit mass of sediment increases with decreasing particle size, the sampling procedure is designed to assure collection of very fine particles.

3.1.4 Program Execution

Program execution is summarized in Table 4.4. The program was executed as described in the preceding sections, with the following exceptions:

> No air particulate/air iodine data was available at location K-1f for the week of July 27, 1993. The air sampler pump was exchanged and the previous week's samples were not kept.

3.1.5 Program Modifications

There were no program modifications in 1993.

3.2 Results and Discussion

The results for the reporting period January to December 1993 are presented in summary form in Table 4.5. For each type of analysis of each sampled medium, this table shows the annual mean and range for all indicator locations and for all control locations. The location with the highest annual mean and the results for this location are also given.

The discussion of the results has been divided into three broad categories: the air, terrestrial, and aquatic environments. Within each category, samples will be discussed in the order listed in Table 4.4. Any discussion of previous environmental data for the Kewaunee Nuclear Power Plant refers to data collected by Teledyne Isotopes Midwest Laboratory or its predecessor, Hazleton Environmental Sciences.

The tabulated results of all measurements made in 1993 are not included in this section, although references to these results will be made in the discussion. The complete tabulation of the 1993 results is contained in Part II of the 1993 annual report on the Radiological Monitoring Program for the Kewaunee Nuclear Power Plant.

3.2.1 Atmospheric Nuclear Detonations and Nuclear Accidents

There were no reported atmospheric nuclear tests in 1993. The last reported test was conducted by the People's Republic of China on October 16, 1980. The reported yield was in the 200 kiloton to 1 megaton range.

There were no reported accidents at nuclear facilities in 1993.

3.2.2 The Air Environment

Airborne Particulates

In air particulates, the annual gross beta concentration was identical at both indicator and control locations (0.020 pCi/m^3. The concentration was slightly lower than in 1988 (0.025 and 0.023 pCi/m^3, respectively), in 1989 (0.025 and 0.024 pCi/m^3, respectively), in 1990 (0.024 pCi/m^3 at both locations), and was nearly identical to that in 1991 and in 1992 (0.018 and 0.019 pCi/m^3, respectively).

Gamma spectroscopic analyses of quarterly composites of air particulate filters yielded similar results for indicator and control locations. Beryllium-7, which is produced continuously in the upper atmosphere by cosmic radiation (Arnold and Al-Salih, 1955), was detected in all samples. All other gamma-emitting isotopes were below their respective LLD limits.

Airborne Iodine

Bi-monthly levels of airborne iodine-131 were below the lower limit of detection (LLD) of 0.03 pCi/m^3 at all locations. Thus, there is no indication of an effect of the plant operation on the local air environment.

Ambient Gamma Radiation - TLDs

Ambient gamma radiation was monitored by TLDs at twelve locations: six indicator and six control.

The quarterly TLDs at the indicator locations measured a mean dose equivalent of (15.0±2.2 mR/91 days)*, in agreement with the mean at the control locations of (13.4±2.7 mR/91 days)*, and were similar to the means obtained in 1985 (16.1 and 15.5 mR/91 days, respectively), in 1986 (16.0 and 14.8 mR/91 days, respectively) and in 1987 (15.8 and 15.7 mR/91 days, respectively), in 1988 (18.0 and 17.4 mR/91 days, respectively), in 1989 (17.5 and 16.9 mR/91 days, respectively), in 1990 (14.4 mR/91 days at both indicator and control locations), in 1991 (13.7 and 12.5 mR/91 days, respectively), and identical to 1992 (15.0 and 13.4 mR/91 days, respectively. All these values are slightly lower than the United States average value of 19.5 mR/91 days due to natural background radiation (National Council on Radiation Protection and Measurements, 1975). The highest annual mean was 18.2 mR/91 days at indicator location K-7.

Precipitation

Precipitation was monitored only at an indicator location, K-11. The tritium concentration was below the LLD level of 330 pCi/l in all samples.

3.2.3 The Terrestrial Environment

Milk

Of the 126 analyses for iodine-131 in milk, all were below the LLD level of 0.5 pCi/L.

Strontium-89 concentration was below the LLD level of 1.2 pCi/L in all samples.

* Unless otherwise indicated, uncertainties of average values are standard deviations of the individual measurements over the period averaged. Uncertainties of individual measurements represent probable counting errors at the 95% confidence level.

Milk (continued)
Low levels of Strontium-90 were found in all samples tested. The mean values were nearly identical for indicator and control locations (1.7 and 1.4 pCi/L, respectively) and were nearly identical to those in 1989 (1.6 and 1.7 pCi/L, respectively), in 1990 (1.7 and 1.6 pCi/L, respectively), in 1991 (1.6 and 1.7 pCi/L, respectively), and in 1992 (1.7 and 1.6 pCi/L, respectively).

Barium-140-Lanthanum-140 concentration was below the LLD of 15 pCi/L in all samples. Cesium-137 concentration was also below the LLD of 10 pCi/L in all samples.

Potassium-40 results were similar at both the indicator and control locations (1390 and 1360 pCi/L, respectively), and were essentially identical to the levels observed in 1978 through 1992.

Due to the chemical similarities between strontium and calcium, and cesium and potassium, organisms tend to deposit cesium-137 in the soft tissue and muscle and strontium-89 and-90 in the bones. Consequently, the ratios of strontium-90 activity to the weight of calcium in milk and cesium-137 activity to the weight of potassium in milk were monitored in order to detect potential environmental accumulation of these radionuclides. No statistically significant variations in the ratios were observed. The measured concentrations of stable potassium and calcium are in agreement with previously determined values of 1.50±0.21 g/L and 1.16±0.08 g/L, respectively (National Center for Radiological Health, 1968).

Well Water
Gross alpha concentration was measured at the two on-site wells, (K-1g and K-1h) and averaged 3.3 pCi/L.

Gross beta concentration in well water averaged 1.2 pCi/L in samples from the control location. The mean value for all indicator locations was 2.2 pCi/L and was nearly identical to the values observed in 1977 through 1992 (3.3, 3.4, 3.0, 3.0, 3.6, 3.2, 2.9, 2.3, 2.6, 2.5, 2.1, 3.3, 2.5, 2.0, 2.2, and 2.6 pCi/L respectively). The difference of 1.0 pCi/L in mean gross beta concentrations is not statistically significant because the counting uncertainties of the individual measurements are typically 0.3 to 1.3 pCi/L in all samples.

Tritium concentration in the on-site well (K-1g) was below the LLD of 330 pCi/L in all samples.

All gamma-emittmg isotopes were below their respective LLDs in all samples.

Well Water (continued)
The concentrations of strontium-89 and strontium-90 in well water were below their respective detection limits of 0.9 and 0.5 pCi/L. Potassium-40 levels were quite low (under 1.9 pCi/L), in agreement with the previously measured values.

Domestic Meat
In meat (chickens), gross alpha concentration was below the LLD level of 0.089 pCi/g wet weight in all samples. Gross beta concentration averaged 2.97 pCi/g wet weight for indicator locations and 2.17 pCi/g wet weight for control locations. The difference is not significant. Gamma-spectroscopic analyses showed that most of the beta activity was due to naturally occurring potassium-40. All other gamma-emitting isotopes were below their respective LLD limits.

Eggs
In egg samples, gross beta concentration averaged 0.99 pCi/g wet weight, siinilar to the concentration of the naturally-occurring potassium-40 observed in the samples (1.28 pCi/g). All other gamma-emitting isotopes were below their respective LLDs. The level of strontium-89 was below the LLD of 0.005 pCi/g wet weight in all samples. Strontium-90 was below the LLD level of 0.001 pCi/g wet weight in all samples.

Vegetables
In vegetables, gross beta concentrations were similar at both the indicator location (1.87 pCi/g wet weight) and at the control location (2.22 pCi/g wet weight) and was due primarily to the potassium-40 activity. Strontium-89 was below the LLD level of 0.003 pCi/g wet weight in all samples. Strontium-90 activity was below the LLD level of 0.001 pCi/g wet weight in all samples but two, (0.002 pCi/g wet weight).

All other gamma-emitting isotopes were below their respective LLD levels.

The samples of oats and clover were of similar radioisotope composition to the vegetables but the concentration of radionuclides was slightly higher due to the lower water content of oats and clover in comparison with the vegetables.

Grass and Cattle Feed
In grass, gross beta concentration was similar at both indicator and control locations (6.60 and 7.67 pCi/g wet weight, respectively) and in both cases was predominantly due to naturally occurring potassium-40 and beryllium-7. All other gamma-emitting isotopes were below their

Grass and Cattle Feed (continued)
respective LLD's. Strontium-89 was below the LLD of 0.018 pCi/g wet weight in all samples. Strontium-90 activity was below the LLD of 0.010 pCi/g wet weight in all but two samples (0.012 pCi/g wet weight).

For cattlefeed, the mean gross beta concentration was lower at the control locations (8.56 pCi/g wet weight) than at indicator locations (11.29 pCi/g wet weight). The highest average gross beta level was in the samples from the indicator location K-19 (13.02 pCi/g wet weight), and reflected the high potassium-40 level (13.55 pCi/g wet weight) observed in the samples. The pattern was similar to that observed in 1978 through 1992. Strontium-89 levels were below the LLD level of 0.021 pCi/g wet weight in all samples. Strontium-90 activity measured 0.022 pCi/g wet at the indicator locations, and was similar to that observed in 1992 (0.020 pCi/g wet weight). Measured activity at the control locations was 0.013 pCi/g wet weight, (0.020 pCi/g wet in 1992). The presence of the radiostrontium is attributable to the fallout from the previous nuclear tests. All other gamma-emitting isotopes were below their respective LLD levels.

Soil
No significant differences were found in gross alpha concentrations between indicator (7.1 pCi/g dry weight) and control (6.6 pCi/g dry weight values) in soil samples. The difference of 0.9 pCi/g dry weight in mean gross alpha concentration between indicator locations and control locations is not statistically significant because the counting uncertainties of the individual measurements are typically 3-5 pCi/g dry weight. Mean gross beta levels were nearly identical at indicator and control locations (23.0 and 25.7 pCi/g dry weight, respectively), and is primarily due to the potassium-40 activity. Strontium-89 was below the LLD level of 0.046 pCi/g dry weight in all samples. Strontium-90 was detected in ten of fourteen samples and the level was slightly lower at indicator than at the control locations (0.050 and 0.064 pCi/g dry weight, respectively). Cesium-137 was detected in all samples and was similar at both control and indicator locations (0.29 and 0.20 pCi/g dry weight, respectively). Beryllium-7 was detected above the LLD level of 0.41 pCi/g dry weight in four of the sixteen samples tested. The measured levels were nearly identical at both indicator and control locations (1.12 and 1.01 pCi/g dry weight, respectively). Potassium-40 was detected in all samples and averaged 19.72 and 19.42 pCi/g dry weight at indicator and control locations, respectively. All other gamma-emitting isotopes were below their respective LLD's. The levels of detected activities were similar to those observed in 1979 through 1992.

3.2.4 The Aquatic Environment

Surface Water

In surface water, mean gross beta activity in suspended solids was below the LLD level of 1.6 pCi/L in all samples. Mean gross beta concentration in dissolved solids was higher at indicator locations (5.0 pCi/L) as compared to the control locations (2.3 pCi/L) and was nearly identical to the activities observed in 1978 (5.4 and 2.7 pCi/L), 1979 (5.7 and 2.7 pCi/L), 1980 (5.1 and 2.7 pCi/L), 1981 (4.3 and 2.7 pCi/L), 1982 (4.9 and 2.4 pCi/L), 1983 (5.1 and 2.6 pCi/L), 1984 (5.0 and 2.7 pCi/L), 1985 (5.6 and 2.7 pCi/L), 1986 (4.1 and 2.5 pCi/L), 1987 (5.3 and 2.5 pCi/L) in 1988 (4.8 and 3.6 pCi/L), in 1989 (5.7 and 3.0 pCi/L), in 1990 (4.1 and 2.6 pCi/L), in 1991 (5.1 and 2.2 pCi/L), and in 1992 (4.5 and 2.2 pCi/L). The control sample is Lake Michigan water, which varies very little in gross beta concentration during the year, while indicator samples include two creek locations (K-1a and K-1e) which are much higher in gross beta concentration and exhibit large month-to-month variations. The K-1a creek draws its water from the surrounding fields which are heavily fertilized; and the K-1e creek draws its water mainly from the Sewage Treatment Plant. In general, gross beta concentration levels were high when potassium-40 levels were high and low when potassium-40 levels were low, indicating that the fluctuations in beta concentration were due to variations in potassium-40 concentrations and not to plant operations. The fact that similar fluctuations at these locations were observed in the pre-operational studies conducted prior to 1974 supports this assessment.

Tritium concentration was below the LLD level of 300 pCi/L in all samples.

Strontium-89 and Strontium-90 concentrations were below their respective LLDs of 1.4 and 0.9 pCi/L in all samples.

All gamma-emitting isotopes were below their respective LLDs in all samples.

Fish

In fish samples, the gross beta concentration averaged 2.74 pCi/g wet weight in muscles and 1.09 pCi/g wet weight in bone fractions. In muscle, the gross beta concentration was primarily due to potassium-40 activity. The average beta concentration of 2.12 pCi/g wet weight was about three quarters the average of the 1973 range of 3.34 to 3.62 pCi/g wet weight. The cesium-137 concentration in muscle averaged 0.068 pCi/g wet weight and was slightly lower than the levels observed in 1979 and 1980 (0.12 pCi/g wet weight in both years), 1981 (0.15 pCi/g wet weight), 1982 (0.17 pCi/g wet weight), 1983 (0.14 pCi/g wet weight), 1984

Fish (continued)
(0.10 pCi/g wet weight), 1985 (0.11 pCi/g wet weight), 1986 (0.11 pCi/g wet weight), 1987 (0.11 pCi/g wet weight), 1988 (0.12 pCi/g wet weight), 1989 (0.11 pCi/g wet weight), 1990 (0.075 pCi/g wet weight), and 1991 (0.11 pCi/g wet weight). The levels were almost identical to those seen in 1992 (0.066 pCi/g wet weight). The strontium-89 concentrations were below the LLD of 0.11 pCi/g wet weight in all samples. Strontium-90 was detected in all bone samples and averaged 0.081 pCi/g wet weight.

Periphyton (Slime)
In periphyton (slime) samples, mean gross beta concentration was slightly higher at indicator than at control locations (5.22 and 3.29 pCi/g wet weight, respectively). Strontium-89 concentration was below the LLD level of 0.037 pCi/g wet weight in all samples. Strontium-90 concentrations were below the LLD level of 0.015 pCi/g wet weight in all samples. Cs-137 was detected in one of twelve samples and measured 0.066 pCi/g wet weight. All other gamma-emitting isotopes, except naturally-occurring beryllium-7 and potassium-40, were below their respective LLDs.

Bottom Sediments
In bottom sediment samples, the mean gross beta concentration was similar at indicator locations and at the control location (7.6 and 8.3 pCi/g dry weight, respectively) and was due mostly to potassium-40. The difference is not statistically significant.

Cesium-137 was detected in five of eleven samples and averaged 0.034 pCi/g dry weight at indicator locations and less than 0.013 pCi/g dry weight at control locations. Cs-134 was below the LLD level of 0.023 pCi/g dry weight in all samples. The cesium-137 level was slightly lower than the levels observed in 1979 (0.12 pCi/g dry weight), in 1980 (0.19 pCi/g dry weight), in 1981 (0.18 pCi/g dry weight), in 1982 (0.13 pCi/g dry weight), in 1983 (0.16 pCi/g dry weight), and in 1984 (0.07 pCi/g dry weight), and was about the same as observed in 1985 (0.05 pCi/g dry weight), in 1986 (0.037 pCi/g dry weight), in 1987 (0.038 pCi/g dry weight) and in 1988 (0.049 pCi/g dry weight), in 1989 (0.056 pCi/g dry weight), in 1990 (0.058 pCi/g dry weight), in 1991 (0.057 pCi/g dry weight), and in 1992 (0.047 pCi/g dry weight). Levels of Strontium-89 and Strontium-90 were below their respective LLDs of 0.026 and 0.012 pCi/g dry weight in all samples.

4.0 FIGURES AND TABLES

KEWAUNEE
NUCLEAR POWER PLANT

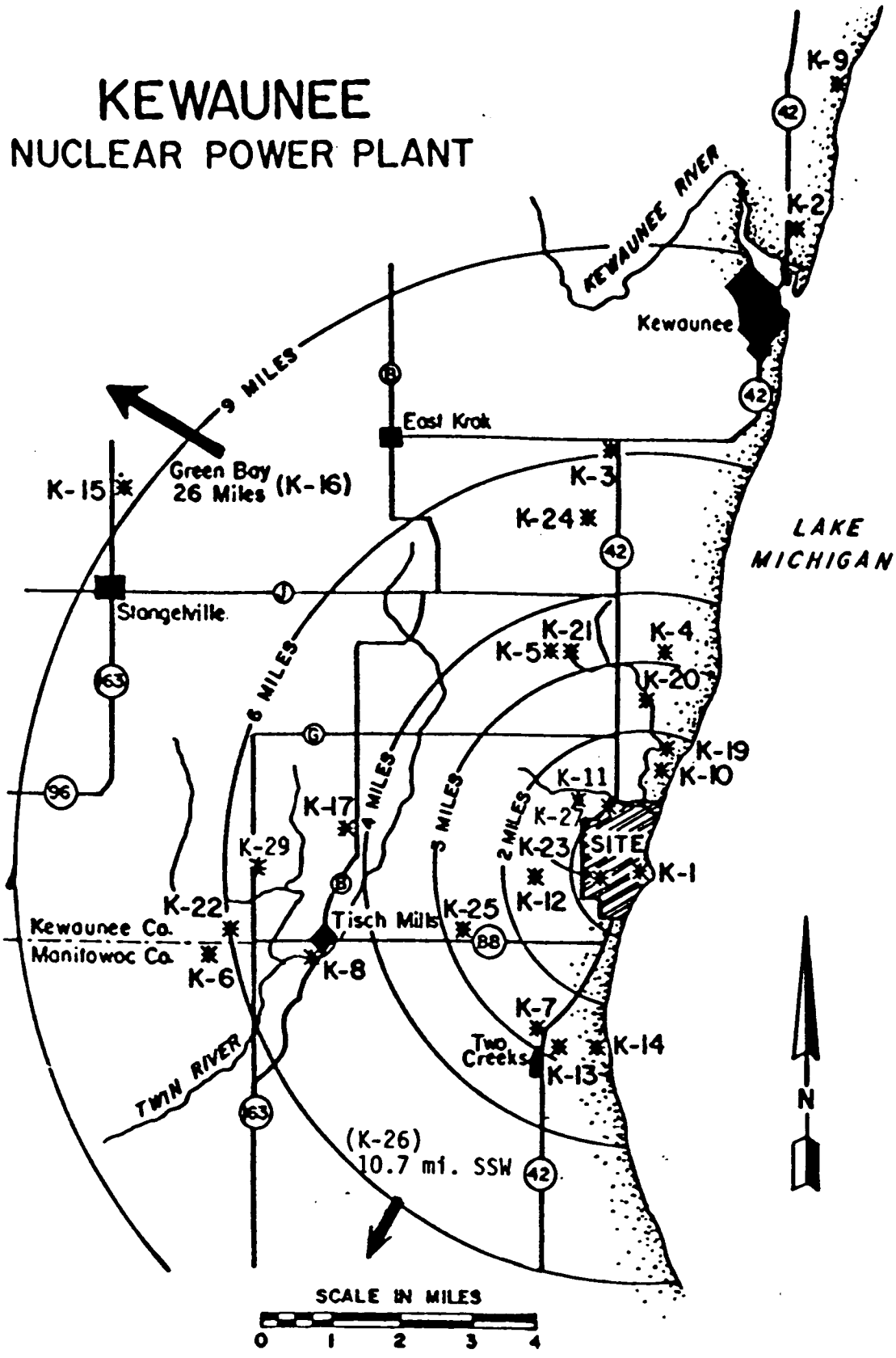

Table 4.1. Sampling locations, Kewaunee Nuclear Power Plant.

Code	Type[a]	Distance (miles)[b] and Sector	Location
K-1			Onsite
K-1a	I	0.62 N	North Creeek
K-1b	I	0.12 N	Middle Creek
K-1c	I	0.10 N	500' north of condenser discharge
K-1d	I	0.10 E	Condenser discharge
K-1e	I	0.12 S	South Creek
K-1f	I	0.12 S	Meteorological Tower
K-1g	I	0.06 W	South Well
K-1h	I	0.12 NW	North Well
K-1j	I	0.10 S	500' south of condenser discharge
K-2	C	9.5 NNE	WPS Operations Building in Kewaunee
K-3	C	6.0 N	Lyle and John Siegmund Farm, Route 1, Kewaunee
K-4	I	3.0 N	Tom Stangel Farm, Route 1, Kewaunee
K-5	I	3.5 NNW	Ed Paplham Farm, Route 1, Kewaunee
K-6	C	6.7 WSW	Novitsky Farm
K-7	I	2.75 SSW	Ron Zimmerman Farm, Route 3, Two Rivers
K-8	C	5.0 WSW	Saint Mary's Church, Tisch Mills
K-9	C	11.5 NNE	Rostok Water Intake for Green Bay, Wisconsin, two miles north of Kewaunee
K-10	I	1.5 NNE	Turner Farm, Kewaunee site
K-11	I	1.0 NW	Harlan Ihlenfeld Farm
K-12	I	1.5 WSW	Lecaptain Farm, one mile west of site
K-13	C	3.0 SSW	Rand's General Store
K-14	I	2.5 S	Two Creeks Park, 2.5 miles south of site
K-15	C	9.25 NW	Gas Substation, 1.5 miles north of Stangelville
K-16	C	26 NW	WPS Division Office Building, Green Bay, Wisconsin
K-17	I	4.25 W	Jansky's Farm, Route 1, Kewaunee
K-19	I	1.75 NNE	Wayne Paral Farm, Route 1, Kewaunee
K-20	I	2.5 N	Carl Struck Farm, Route 1, Kewaunee
K-23	I	0.5 W	0.5 miles west of plant, Kewaunee site
K-24	I	5.45 N	Fectum Farm, Route 1, Kewaunee
K-25[c]	C	2.75 WSW	Wotachek Farm, Route 1, Denmark
K-26	C	10.7 SSW	Bertler's Fruit Stand (8.0 miles south of "BB")
K-27	I	1.5 NW	Schlies Farm, 0.5 miles west of K-11
K-28	C	26 NW	Hansen Dairy, Green Bay, Wisconsin
K-29	I	5.75 W	Kunesh Farm, Route 1, Kewaunee

[a] I= indicator; C = control.

[b] Distances are measured from reactor stack.

[c] Replaced by K-29 in summer 1990 because Wotachek Farm no longer had chickens.

Table 4.2. Type and frequency of collection.

Location	Frequency					
	Weekly	Biweekly	Monthly	Quarterly	Semiannually	Annually
K-1a			SW		SL	
K-1b			SW	GR[a]	SL	
K-1c					BS[b]	
K-1d			SW	FI	BS[b], SL	
K-1e			SW		SL	
K-1f	AP	AI		GR[a], TLD	SO	
K-1g				WW		
K-1h				WW		
K-1j					BS[b]	
K-2	AP	AI		TLD		
K-3			MI[c]	GR[a], TLD, CF[d]	SO	
K-4			MI[c]	GR[a], TLD, CF[d]	SO	
K-5			MI[c]	GR[a], TLD, CF[d]	SO	
K-6			MI[c]	GR[a], TLD, CF[d]	SO	
K-7	AP	AI		TLD		
K-8	AP	AI		TLD		
K-9			SW		BS[b], SL	
K-10				WW		
K-11			PR	WW		
K-12			MI[c]	GR[a], CF[d], WW	SO	
K-13				WW		
K-14			SW		BS[b], SL	
K-15	AP	AI		TLD		
K-16	AP	AI		TLD		
K-17				TLD		VE
K-19			MI[c]	GR[a], CF[d]	SO	
K-20						DM
K-23						GRN
K-24						DM
K-25[e]						DM
K-26						VE
K-27				TLD, EG		DM
K-28			MI[c]			
K-29						DM

[a]Three times a year, second (April, May, June), third (July, August, September), and fourth (October, November, December) quarters.
[b]To be collected in May and November.
[c]Monthly from November through April; semimonthly May through October.
[d]First quarter (January, February, March) only.
[e]Replaced by K-29 in summer of 1990.

Table 4.3. Sample codes used in Table 4.2.

Code	Description
AP	Airborne Particulate
AI	Airborne Iodine
TLD	Thermoluminescent Dosimeter
PR	Precipitation
MI	Milk
WW	Well Water
DM	Domestic Meat
EG	Eggs
VE	Vegetables
GRN	Grain
GR	Grass
CF	Cattlefeed
SO	Soil
SW	Surface Water
FI	Fish
SL	Slime
BS	Bottom Sediments

Table 4.4. Sampling Summary, January - December 1993.

Sample Type	Collection Type and Frequency[a]	Number of Locations	Number of Samples Collected	Number of Samples Missed
Air Environment				
Airborne particulates	C/W	6	311	1
Airborne Iodine	C/BW	6	155	1
TLD's	C/Q	12	48	0
Precipitation	C/M	1	12	0
Terrestrial Environment				
Milk (May-Oct)	G/SM	7	84	0
(Nov-Apr)	G/M	7	42	0
Well water	G/Q	6	24	0
Domestic meat	G/A	4	4	0
Eggs	G/Q	1	4	0
Vegetables - 6 varieties	G/A	2	8	0
Grain - oats	G/A	1	1	0
- clover	G/A	1	1	0
Grass	G/TA	8	24	0
Cattle feed	G/A	6	12	0
Soil	G/SA	7	14	0
Aquatic Environment				
Surface water	G/M	7	96	0
Fish	G/TA	1	7	0
Slime	G/SA	6	12	0
Bottom sediments	G/SA	5	11	0

[a] Type of collection is coded as follows: C = continuous; G = grab.
Frequency is coded as follows: W = weekly; SM = semimonthly; M = monthly; Q=quarterly; SA = semiannually; TA = three times per year; FA = four times per year; A = annually; BW = bi-weekly.

Table 4.5 Environmental Radiological Monitoring Program Summary.

Name of Facility Kewaunee Nuclear Power Plant — Docket No. 50-305
Location of Facility Kewaunee County, Wisconsin (County, State) — Reporting Period January - December 1993

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Quarterly Mean: Location[d]	Location with Highest Quarterly Mean: Mean (F)[c] Range[c]	Control Locations Mean (F)[c] Range	Number Non-Routine Results[e]
Airborne particulates (pCi/m^3)	GB 311	0.003	0.020 (103/104) (0.005-0.040)	K-2, WPS Operations Bldg., 9.5 mi. NNE	0.020[f] (51/52) (0.006-0.041)	0.020 (208/208) (0.005-0.044)	0
	GS 24						
	Be-7	0.010	0.062 (8/8) (0.048-0.084	K-7, Ron Zimmerman Farm, 2.75 mi. SSW	0.070 (4/4) (0.050-0.084	0.061 (16/16) (0.043-0.077)	0
	Nb-95	0.0021	<LLD	-	-	<LLD	0
	Zr-95	0.0028	<LLD	-	-	<LLD	0
	Ru-103	0.0018	<LLD	-	-	<LLD	0
	Ru-106	0.0098	<LLD	-	-	<LLD	0
	Cs-134	0.0011	<LLD	-	-	<LLD	0
	Cs-137	0.0013	<LLD	-	-	<LLD	0
	Ce-141	0.0028	<LLD	-	-	<LLD	0
	Ce-144	0.0072	<LLD	-	-	<LLD	0
Airborne Iodine (pCi/m^3)	I-131 155	0.03	<LLD	-	-	<LLD	0
TLD-Quarterly (mR/91 days)	Gamma 48	1	15.0 (24/24) (11.9-18.9)	K-7, Ron Zimmerman Farm, 2.75 mi SSW	18.2 (4/4) (17.6-18.9)	13.8 (24/24) (9.9-17.6)	0
Precipitation (pCi/L)	H-3 12	330	<LLD	-	-	None	0
Milk (pCi/L)	I-131 126	0.5	<LLD	-	-	<LLD	0
	Sr-89 84	1.2	<LLD	-	-	<LLD	0
	Sr-90 84	0.9	1.7 (48/48) (0.7-4.0)	K-12, Lecaptain Farm 1.5 mi WSW	2.4 (12/12) (1.4-4.0)	1.4 (36/36) (0.9-2.1)	0
	GS 126						
	K-40	50	1390 (72/72) (1120-1660)	K-5, Paplham Farm 3.5 mi NNW	1450 (18/18) (1270-1660)	1360 (54/54) (1120-1540)	0
	Cs-134	10	<LLD	-	-	<LLD	0
	Cs-137	10	<LLD	-	-	<LLD	0
	Ba-La-140	15	<LLD	-	-	<LLD	0
(g/L)	K-stable 84	1.0	1.61 (48/48) (1.35-1.92)	K-5, Paplham Farm 3.5 mi NNW	1.69 (12/12) (1.56-1.92)	1.57 (36/36) (1.32-1.78)	0
(g/L)	Ca 84	0.4	0.91 (48/48) (0.68-1.10)	K-6, Novitsky Farm 6.7 mi WSW	1.03 (12/12) (0.90-1.12)	0.93 (36/36) (0.56-1.12)	0
Well Water (pCi/L)	GA 8	1.8	3.3 (7/8) (2.0-4.7)	K-1g, South Well Onsite, 0.06 mi W	3.8 (3/4) (3.0-4.7)	None	0
	GB 24	1.0	2.2 (19/20) (1.1-4.4)	K-1g, South Well Onsite, 0.06 mi W	3.9 (3/4) (3.3-4.4)	1.2 (4/4) (1.1-1.4)	0
	H-3 4	330	<LLD	-	-	None	0
	K-40 (flame) 24	0.10	1.85 (20/20) (0.86-3.33)	K-1g South Well Onsite, 0.06 mi W	2.93 (4/4) (3.3-4.4)	1.09 (4/4) (0.95-1.33)	0
	Sr-89 4	1.0	<LLD	-	-	None	0
	Sr-90 4	0.5	<LLD	-	-	None	0
	GS 24						0
	Mn-54	15	<LLD	-	-	<LLD	0
	Fe-59	30	<LLD	-	-	<LLD	0
	Co-58	15	<LLD	-	-	<LLD	0
	Co-60	15	<LLD	-	-	<LLD	0
	Zr-Nb-95	15	<LLD	-	-	<LLD	0
	Cs-134	10	<LLD	-	-	<LLD	0
	Cs-137	10	<LLD	-	-	<LLD	0
	Ba-La-140	15	<LLD	-	-	<LLD	0

Table 4.5 Environmental Radiological Monitoring Program Summary.

Name of Facility Kewaunee Nuclear Power Plant — Docket No. 50-305
Location of Facility Kewaunee County, Wisconsin (County, State) — Reporting Period January - December 1993

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Quarterly Mean Location[d]	Location with Highest Quarterly Mean Mean (F)[c] Range[c]	Control Locations Mean (F)[c] Range	Number Non-Routine Results[e]
Domestic Meat (Chickens) (pCi/g wet)	GA 4	0.089	<LLD	-	-	<LLD	0
	GB 4	0.03	2.97 (3/3) (2.75-3.15)	K-20, Struck Farm 2.5 mi N	3.15 (1/1)	2.17 (1/1)	
	GS 4						0
	Be-7	0.40	<LLD	-	-	<LLD	0
	K-40	0.5	2.94 (3/3) (2.53-3.41)	K-27, Schlies Farm 1.5 mi NW	3.41 (1/1)	3.02 (1/1)	0
	Nb-95	0.18	<LLD	-	-	<LLD	0
	Zr-95	0.26	<LLD	-	-	<LLD	0
	Ru-103	0.14	<LLD	-	-	<LLD	0
	Ru-105	0.18	<LLD	-	-	<LLD	0
	Cs-134	0.048	<LLD	-	-	<LLD	0
	Cs-137	0.034	<LLD	-	-	<LLD	0
	Ce-141	0.12	<LLD	-	-	<LLD	0
	Ce-144	0.14	<LLD	-	-	<LLD	0
Eggs (pCi/g wet)	GB 4	0.01	0.99 (4/4) (0.64-1.16)	K-27, Schlies Farm 1.5 mi NW	0.99 (4/4) (0.64-1.16)	None	0
	Sr-89 4	0.005	<LLD	-	-	None	0
	Sr-90 4	0.001	<LLD	-	-	None	0
	GS						
	Be-7	0.063	<LLD	-	-	None	0
	K-40	0.01	1.28 (4/4) (1.12-1.46)	K-27, Schlies Farm 1.5 mi NW	1.28 (4/4) (1.12-1.46)	None	0
	Nb-95	0.009	<LLD	-	-	None	0
	Zr-95	0.016	<LLD	-	-	None	0
	Ru-103	0.008	<LLD	-	-	None	0
	Ru-106	0.067	<LLD	-	-	None	0
	Cs-134	0.007	<LLD	-	-	None	0
	Cs-137	0.009	<LLD	-	-	None	0
	Ce-141	0.010	<LLD	-	-	None	0
	Ce-144	0.044	<LLD	-	-	None	0
Vegetables (pCi/g wet)	GB 8	0.1	1.87 (3/3) (1.37-2.40)	K-26, Bertler's Fruit Stand 10.7 mi SSW	2.22 (5/5) (1.64-3.05)	2.22 (5/5) (1.64-3.05)	0
	Sr-89 8	0.003	<LLD	-	-	<LLD	0
	Sr-90 8	0.001	0.002 (1/3)	Both locations had identical means	0.002 (2/8)	0.002 (1/5)	0
	GS 8						
	Be-7	0.10	<LLD				
	K-40	0.75	2.66 (3/3) (2.14-2.94)	K-17, Jansky's Farm 4.25 mi W	2.66 (3/3) (2.14-2.94)	2.31 (5/5) (1.93-3.02)	0
	Nb-95	0.014	<LLD	-	-	<LLD	0
	Zr-95	0.026	<LLD	-	-	<LLD	0
	Ru-103	0.018	<LLD	-	-	<LLD	0
	Ru-106	0.11	<LLD	-	-	<LLD	0
	Cs-134	0.009	<LLD	-	-	<LLD	0
	Cs-137	0.015	<LLD	-	-	<LLD	0
	Ce-141	0.030	<LLD	-	-	<LLD	0
	Ce-144	0.11	<LLD	-	-	<LLD	0

Table 4.5 Environmental Radiological Monitoring Program Summary.

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Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Quarterly Mean Location[d]	Location with Highest Quarterly Mean Mean (F)[c] Range[c]	Control Locations Mean (F)[c] Range	Number Non-Routine Results[e]
Grain - Oats & Clover (pCi/g wet)	GB 2	0.10	5.49 (2/2) (5.28-5.70)	K-23, Kewaunee Site 0.5 mi W	5.49 (2/2) (5.28-5.70)	None	0
	Sr-89 2	0.009	<LLD	-	-	None	0
	Sr-90 2	0.006	<LLD	-	-	None	0
	GS 2						
	Be-7	0.27	1.22 (2/2) (0.87-1.58)	K-23, Kewaunee Site 0.5 mi	1.22 (2/2) (0.87-1.58)	None	0
	K-40	0.10	5.14 (2/2) (4.19-6.09)	K-23, Kewaunee Site 0.5 mi W	5.14 (2/2) (4.19-6.09)	None	0
	Nb-95	0.037	<LLD	-	-	None	0
	Zr-95	0.072	<LLD	-	-	None	0
	Ru-103	0.032	<LLD	-	-	None	0
	Ru-106	0.26	<LLD	-	-	None	0
	Cs-134	0.024	<LLD	-	-	None	0
	Cs-137	0.033	<LLD	-	-	None	0
	Ce-141	0.055	<LLD	-	-	None	0
	Ce-144	0.26	<LLD	-	-	None	0
Cattlefeed (pCi/g wet)	GB 12	0.1	11.29 (8/8) (2.96-22.40)	K-19, Paral Farm 1.75 mi NNE	13.02 (2/2) (3.64-22.40)	8.56 (4/4) (4.16-11.50)	0
	Sr-89 12	0.021	<LLD	-	-	<LLD	0
	Sr-90 12	0.005	0.022 (8/8) (0.003-0.046)	K-19. Paral Farm 1.75 mi NNE	0.025 (2/2) (0.004-0.046)	0.013 (4/4) (0.004-0.020)	0
	GS 12						
	Be-7	0.49	<LLD	Novitsky Farm, 6.7 mi WSW	1.92 (1/2)	1.92 (1/2)	0
	K-40	1.0	10.60 (8/8) (1.59-23.70)	K-19, Paral Farm 1.75 mi NNE	13.55 (2/2) (3.40-23.70)	8.44 (4/4) (4.55-11.60)	0
	Nb-95	0.060	<LLD	-	-	<LLD	0
	Zr-95	0.11	<LLD	-	-	<LLD	0
	Ru-103	0.053	<LLD	-	-	<LLD	0
	Ru-106	0.51	<LLD	-	-	<LLD	0
	Cs-134	0.057	<LLD	-	-	<LLD	0
	Cs-137	0.056	<LLD	-	-	<LLD	0
	Ce-141	0.081	<LLD	-	-	<LLD	0
	Ce-144	0.32	<LLD	-	-	<LLD	0
Grass (pCi/g wet)	GB 24	0.1	6.60 (18/18) (4.87-9.34)	K-12, Lecaptain Farm, 1.5 mi WSW	7.67 (3/3) (6.10-8.76)	7.04 (6/6) (6.13-9.52)	0
	Sr-89 24	0.018	<LLD	-	-	<LLD	0
	Sr-90 24	0.010	0.012 (2/16)	K-1b, Middle Creek Onsite 0.12 mi N	0.012 (1/3)	<LLD	0
	GS 24						
	Be-7	0.10	2.27 (18/18) (0.45-5.78)	K-1b, Middle Creek Onsite 0.12 mi N	3.04 (3/3) (0.88-5.78)	1.25 (6/6) (0.71-2.03)	0
	K-40	0.1	6.65 (18/18) (4.48-10.12)	K-3, Siegmund Farm 6.0 mi N	7.51 (3/3) (6.16-8.81)	6.97 (6/6) (5.31-8.81)	0
	Nb-95	0.051	<LLD	-	-	<LLD	0
	Zr-95	0.072	<LLD	-	-	<LLD	0
	Ru-103	0.044	<LLD	-	-	<LLD	0
	Ru-106	0.40	<LLD	-	-	<LLD	0
	Cs-134	0.051	<LLD	-	-	<LLD	0
	Cs-137	0.036	<LLD	-	-	<LLD	0
	Ce-141	0.078	<LLD	-	-	<LLD	0
	Ce-144	0.27	<LLD	-	-	<LLD	0

Table 4.5 Environmental Radiological Monitoring Program Summary.

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Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Quarterly Mean Location[d]	Location with Highest Quarterly Mean Mean (F)[c] Range[c]	Control Locations Mean (F)[c] Range	Number Non-Routine Results[e]
Soil (pCi/g dry)	GA 14	5.0	7.1 (7/10) (5.9-10.8)	K-12, Lecaptain Farm 1.5 mi WSW	9.0 (2/2) (7.1-10.8)	6.6 (3/4) (6.5-6.7)	0
	GB 14	2.0	23.0 (10/10) (14.8-32.5)	K-12, Lecaptain Farm 1.5 mi WSW	26.7 (2/2) (20.9-32.5)	25.7 (4/4) (23.6-27.3)	0
	Sr-89 14	0.046	<LLD	-	-	<LLD	0
	Sr-90 14	0.022	0.050 (6/10) (0.022-0.092)	K-6, Novitsky Farm 6.7 mi WSW	0.092 (2/2) (0.080-0.104)	0.064 (4/4) (0.026-0.104)	0
	GS 16						
	Be-7	0.41	1.12 (2/12) (0.60-1.63)	K-5, Paplham Farm, 3.5 mi NNW	1.63 (1/2)	1.01 (2/4) (0.51-1.51)	0
	K-40	1.4	19.72 (12/12) (11.48-23.92)	K-12. Lecaptain Farm 1.5 mi WSW	22.30 (2/2) (20.68-23.92)	19.42 (4/4) (17.86-21.67)	0
	Nb-95	0.059	<LLD	-	-	<LLD	0
	Zr-95	0.074	<LLD	-	-	<LLD	0
	Ru-103	0.045	<LLD	-	-	<LLD	0
	Ru-106	0.29	<LLD	-	-	<LLD	0
	Cs-137	0.041	0.14 (9/12) (0.048-0.35)	K-12, Lecaptain Farm 1.5 mi WSW	0.25 (2/2) (0.15-0.35)	0.18 (2/4) (0.10-0.26)	0
	Ce-141	0.082	<LLD	-	-	<LLD	0
	Ce-144	0.20	<LLD	-	-	<LLD	0
Surface Water (pCi/L)	GB (SS) 96	1.6	<LLD	-	-	<LLD	0
	GB (DS) 96	1.0	5.0 (72/72) (1.3-42.6)	K-1a, North Creek Onsite 0.62 mi N	12.7 (12/12) (6.5-42.6)	2.3 (24/24) (1.8-3.2)	0
	GB (TR) 96	1.0	5.1 (72/72) (1.3-42.6)	K-1a, North Creek Onsite 0.62 mi N	12.9 (12/12) (6.8-42.6)	2.4 (24/24) (1.8-3.8)	0
	GS 96						
	Mn-54	15	<LLD	-	-	<LLD	0
	Fe-59	30	<LLD	-	-	<LLD	0
	Co-58	15	<LLD	-	-	<LLD	0
	Co-60	15	<LLD	-	-	<LLD	0
	Zr-Nb-95	15	<LLD	-	-	<LLD	0
	Cs-134	10	<LLD	-	-	<LLD	0
	Cs-137	10	<LLD	-	-	<LLD	0
	Ba-La-140	15	<LLD	-	-	<LLD	0
	H-3 32	330	<LLD	-	-	<LLD	0
	Sr-89 32	1.4	<LLD	-	-	<LLD	0
	Sr-90 32	0.9	<LLD	-	-	<LLD	0
	K-40 (flame) 96	0.5	3.88 (72/72) (0.87-41.52)	K-1a, North Creek Onsite 0.62 mi N	11.83 (12/12) (4.33-41.52)	1.15 (24/24) (0.87-1.51)	0
Fish - Muscle (pCi/g wet)	GB 7	1.0	2.74 (7/7) (2.34-3.27)	K-1d, Condenser Discharge Onsite 0.10 mi E	2.74 (7/7) (2.34-3.27)	None	0
	GS 7						
	K-40	0.1	2.87 (7/7) (2.37-3.21)	K-1d, Condenser Discharge Onsite 0.10 mi E	2.87 (7/7) (2.37-3.21)	None	0
	Mn-54	0.022	<LLD	-	-	None	0
	Fe-59	0.16	<LLD	-	-	None	0
	Co-58	0.034	<LLD	-	-	None	0
	Co-60	0.022	<LLD	-	-	None	0
	Cs-134	0.021	<LLD	-	-	None	0
	Cs-137	0.028	0.068 (3/7) (0.035-0.097)	K-1d, Condenser Discharge Onsite 0.10 mi E	0.068 (3/7) (0.035-0.097)	None	0

Table 4.5 Environmental Radiological Monitoring Program Summary.

Name of Facility Kewaunee Nuclear Power Plant — Docket No. 50-305
Location of Facility Kewaunee County, Wisconsin (County, State) — Reporting Period January - December 1993

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Quarterly Mean Location[d]	Location with Highest Quarterly Mean Mean (F)[c] Range[c]	Control Locations Mean (F)[c] Range	Number Non-Routine Results[e]
Fish - Bones (pCi/g wet)	GB 7	0.1	1.09 (7/7) (0.81-1.81)	K-1d, Condenser Discharge Onsite 0.10 mi E	1.09 (7/7) (0.81-1.81)	None	0
	Sr-89 7	0.11	<LLD	-	-	None	0
	Sr-90 7	0.005	0.081 (7/7) (0.031-0.143)	K-1d, Condenser Discharge Onsite 0.10 mi E	0.081 (7/7) (0.031-0.143)	None	0
Periphyton (Slime) (pCi/g wet)	GB 12	0.1	5.22 (10/10) (1.68-8.23)	K-1d, Condenser Discharge Onsite 0.10 mi E	7.18 (2/2) (6.14-8.23)	3.29 (2/2) (1.99-4.59)	0
	Sr-89 12	0.037	<LLD	-	-	<LLD	0
	Sr-90 12	0.015	<LLD	-	-	<LLD	0
	GS 12						
	Be-7	0.44	1.06 (6/10) (0.59-1.58)	K-1d, Condenser Discharge Onsite 0.10 mi E	1.34 (2/2) (1.09-1.58)	<LLD	0
	K-40	0.2	3.39 (10/10) (2.23-5.74)	K-1a, North Creek Onsite 0.62 mi N	4.78 (2/2) (3.81-5.74)	3.13 (2/2) (2.65-3.61)	0
	Mn-54	0.036	<LLD	-	-	<LLD	0
	Co-58	0.030	<LLD	-	-	<LLD	0
	Co-60	0.050	<LLD	-	-	<LLD	0
	Nb-95	0.044	<LLD	-	-	<LLD	0
	Zr-95	0.056	<LLD	-	-	<LLD	0
	Ru-103	0.045	<LLD	-	-	<LLD	0
	Ru-106	0.26	<LLD	-	-	<LLD	0
	Cs-134	0.046	<LLD	-	-	<LLD	0
	Cs-137	0.051	0.066 (1/10)	K-14, Two Creeks Park, 2.5 mi S	0.066 (1/2)	<LLD	0
	Ce-141	0.069	<LLD	-	-	<LLD	0
	Ce-144	0.26	<LLD	-	-	<LLD	0
Bottom Sediments (pCi/g dry)	GB 11	1.0	7.6 (9/9) (5.8-9.6)	K-1j, 500' S of Condenser Discharge, 0.10 mi S	8.9 (2/2) (8.3-9.6)	8.3 (2/2) (7.1-9.4)	0
	Sr-89 11	0.026	<LLD	-	-	<LLD	0
	Sr-90 11	0.012	<LLD	-	-	<LLD	0
	GS 11						
	K-40	1.0	7.12 (9/9) (5.91-8.04)	K-9, Rostok Water Intake 11.5 mi NNE	8.05 (2/2) (7.16-8.94)	8.05 (2/2) (7.16-8.94)	0
	Co-58	0.023	<LLD	-	-	<LLD	0
	Co-60	0.034	<LLD	-	-	<LLD	0
	Cs-134	0.023	<LLD	-	-	<LLD	0
	Cs-137	0.018	0.034 (5/9) (0.024-0.042)	K-1c, 500' N of Condenser Discharge 0.10 mi N	0.038 (2/2) (0.035-0.042)	<LLD	0

a GA = gross alpha, GB = gross beta, GS = gamma spectroscopy, SS = suspended solids, DS = dissolved solids, TR = total residue.

b LLD = nominal lower limit of detection based on 4.66 sigma counting error for background sample.

c Mean based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (F).

d Locations are specified by station code (Table 4.1), distance (miles) and direction relative to reactor site.

e Non-routine results are those which exceed ten times the control station value. If no control station value is available, the result is considered non-routine if it exceeds ten times the pre-operational value for the location.

f Three locations (K-2, K-7, and K-8) had identical means of 0.020 pCi/m^3. Only K-2 is detailed in this summary.

5.0 REFERENCES

Arnold. J. R. and H. A. Al-Salih. 1955. Beryllium-7 Produced by Cosmic Rays. Science 121: 451-453.

Eisenbud, M. 1963. Environmental Radioactivity, McGraw-Hill, New York, New York, pp. 213, 275, and 276.

Gold, S., H. W. Barkhau, B. Shlein, and B. Kahn, 1964 Measurement of Naturally Occurring Radionuclides in Air, in the Natural Radiation Environment, University of Chicago Press, Chicago, Illinois, 369-382.

Hazelton Environmental Sciences, 1979. Annual Report. Radiological Monitoring for the Kewaunee Nuclear Power Plant, Kewaunee, Wisconsin, Final Report - Part II, Data Tabulations and Analysis, January - December 1978.

Hazelton Environmental Sciences, 1980. Annual Report. Radiological Monitoring Program for the Kewaunee Nuclear Power Plant, Kewaunee, Wisconsin, Final Report - Part II, Data Tabulations and Analysis, January - December 1979.

Hazelton Environmental Sciences, 1981 Annual Report. Radiological Monitoring Program for the Kewaunee Nuclear Power Plant, Kewaunee, Wisconsin, Final Report - Part II, Data Tabulations and Analysis, January - December 1980.

Hazelton Environmental Sciences, 1982. Annual Report. Radiological Monitoring Program for the Kewaunee Nuclear Power Plant, Kewaunee, Wisconsin, Final Report - Part II, Data Tabulations and Analysis, January - December 1981.

Hazelton Environmental Sciences, 1983. Annual Report. Radiological Monitoring Program for the Kewaunee Nuclear Power Plant, Kewaunee, Wisconsin, Final Report - Part II, Data Tabulations and Analysis, January - December 1982.

Industrial BIO-TEST Laboratories, Inc. 1974. Annual Report. Pre-operational Radiological Monitoring Program for the Kewaunee Nuclear Power Plant. Kewaunee, Wisconsin. January - December 1973.

Industrial BIO-TEST Laboratories, Inc. 1975 Semi-annual Report. Radiological Monitoring Program for the Kewaunee Nuclear Power Plant, Kewaunee, Wisconsin. January - June, 1975.

NALCO Environmental Sciences. 1977. Annual Report. Radiological Monitoring Program for the Kewaunee Nuclear Power Plant, Kewaunee, Wisconsin, January - December 1976.

NALCO Environmental Sciences. 1978. Annual Report. Radiological Monitoring Program for the Kewaunee Nuclear Power Plant, Kewaunee, Wisconsin, Final Report - Part II, Data Tabulations and Analysis, January - December 1977.

National Center for Radiological Health. 1968. Section 1. Milk Surveillance. Radiological Health Data Rep., December 9: 730-746.

National Council on Radiation Protection and Measurements. 1975. Natural Radiation Background in the United States. NCRP Report No. 45.

Solon, L. R., W. M. Lowder, A. Shambron, and H. Blatz. 1960. Investigations of Natural Environmental Radiation. Science. 131: 903-906.

Teledyne Isotopes Midwest Laboratory. 1984. Annual Report. Radiological Monitoring Program for the Kewaunee Nuclear Power Plant, Kewaunee, Wisconsin, Final Report, Part II, Data Tabulations and Analysis, January - December 1983.

Teledyne Isotopes Midwest Laboratory. 1985. Annual Report. Radiological Monitoring Program for the Kewaunee Nuclear Power Plant, Kewaunee, Wisconsin, Final Report - Part II, Data Tabulations and Analysis, January - December 1984.

Teledyne Isotopes Midwest Laboratory. 1986. Annual Report. Radiological Monitoring Program for the Kewaunee Nuclear Power Plant, Kewaunee, Wisconsin, Final Report - Part II, Data Tabulations and Analysis, January - December 1985.

Teledyne Isotopes Midwest Laboratory. 1987. Annual Report. Radiological Monitoring Program for the Kewaunee Nuclear Power Plant, Kewaunee, Wisconsin, Final Report - Part II, Data Tabulations and Analysis, January - December 1986.

Teledyne Isotopes Midwest Laboratory.1988. Annual Report. Radiological Monitoring Program for the Kewaunee Nuclear Power Plant, Kewaunee, Wisconsin, Final Report - Part II, Data Tabulations and Analysis, January - December 1987.

Teledyne Isotopes Midwest Laboratory. 1989. Annual Report. Radiological Monitoring Program for the Kewaunee Nuclear Power Plant, Kewaunee, Wisconsin, Final Report - Part II, Data Tabulations and Analysis, January - December 1988.

Teledyne Isotopes Midwest Laboratory. 1990. Annual Report. Radiological Monitoring Program for the Kewaunee Nuclear Power Plant, Kewaunee, Wisconsin, Final Report - Part II, Data Tabulations and Analysis, January - December 1989.

Teledyne Isotopes Midwest Laboratory. 1991. Annual Report. Radiological Monitoring Program for the Kewaunee Nuclear Power Plant, Kewaunee, Wisconsin, Final Report - Part II, Data Tabulations and Analysis, January - December 1990.

Teledyne Isotopes Midwest Laboratory. 1992. Annual Report. Radiological Monitoring Program for the Kewaunee Nuclear Power Plant, Kewaunee, Wisconsin, Final Report - Part II, Data Tabulations and Analysis, January - December 1991.

Teledyne Isotopes Midwest Laboratory. 1993. Annual Report. Radiological Monitoring Program for the Kewaunee Nuclear Power Plant, Kewaunee, Wisconsin, Final Report - Part II, Data Tabulations and Analysis, January - December 1992.

Teledyne Isotopes Midwest Laboratory. 1994. Annual Report. Radiological Monitoring Program for the Kewaunee Nuclear Power Plant, Kewaunee, Wisconsin, Final Report- Part II, Data Tabulations and Analysis, January - December 1993.

Wilson, D.W., G. M. Ward, and J. E. Johnson, 1969. In Environmental Contamination by Radioactive Materials. International Atomic Energy Agency, p. 125.

APPENDIX A

INTERLABORATORY COMPARISON PROGRAM RESULTS

NOTE: Teledyne's Midwest Laboratory participates in intercomparison studies administered by U.S. EPA Environmental Monitoring Systems Laboratory, Las Vegas, Nevada. The results are reported in Appendix A. Also reported are results of in-house spikes and blanks. Appendix A is updated four times a year; the complete Appendix is included in March, June, September and December monthly progress reports only. Please refer to March, June, September and December progress reports for information.

January, 1990 through December, 1993

Appendix A

Interlaboratory Comparison Program Results

Teledyne's Midwest Laboratory (formerly Hazleton Environmental Sciences) has participated in interlaboratory comparison (crosscheck) programs since the formulation of it's 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 know 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 1990 - 1993. This program is 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 dosimenters (TLDs), since1976 via various International Intercomparisons 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 A lists acceptance criteria for "spiked" samples.

Out-of-limit results are explained directly below the result.

December, 1993

ATTACHMENT A

ACCEPTANCE CRITERIA FOR "SPIKED" SAMPLES

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

Analysis	Level	One Standard Deviation for single determinations
Gamma Emitters	5 to 100 pCi/liter or kg >100 pCi/liter or kg	5.0 pCi/liter 5% of known value
Strontium-89[b]	5 to 50 pCi/liter or kg >50 pCi/liter or kg	5.0 pCi/liter 10% of known value
Strontium-90[b]	2 to 30 pCi/liter or kg >30 pCi/liter or kg	5.0 pCi/liter 10% of known value
Potassium	>0.1 g/liter or kg	5% of known value
Gross alpha	≤20 pCi/liter >20 pCi/liter	5.0 pCi/liter 25% of known value
Gross beta	≤100 pCi/liter >100 pCi/liter	5.0 pCi/liter 5% of known value
Tritium	≤4,000 pCi/liter >4,000 pCi/liter	1s = (pCi/liter) = 169.85 x (known)$^{0.0933}$ 10% of known value
Radium-226,-228	<0.1 pCi/liter	15% of known value
Plutonium	0.1 pCi/liter, gram, or sample	10% of known value
Iodine-131, Iodine-129[b]	≤55 pCi/liter >55 pCi/liter	6.0 pCi/liter 10% of known value
Uranium-238, Nickel-64[b] Technetium-99[b]	≤35 pCi/liter >35 pCi/liter	6.0 pCi/liter 15% of known value
Iron-55[b]	50 to 100 pCi/liter >100 pCi/liter	10 pCi/liter 10% of known value
Others[b]	–	20% of known value

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

[b] Teledyne limit.

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media[a].

Lab Code	Sample Type	Date Collected	Analyses	Concentration in pCi/L[b] Teledyne Results ±2 Sigma[c]	EPA Result[d] 1s, N=1	Control Limits
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
	The sample was reanalyzed in triplicate for Sr-90; results of reanalyses were 18.8±1.5 pCi/L. No further action is planned.					
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
STW-592	WATER	Jan, 1990	Co-60	14.7±2.3	15.0±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	4827.0±83.0	4976.0±498.0	4113.0 - 5839.0
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	Uranium	4.0±0.0	4.0±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	WATER	Apr, 1990	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
STW-598	WATER	Apr, 1990	Gross 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

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media[a].

Lab Code	Sample Type	Date Collected	Analyses	Concentration in pCi/L[b] Teledyne Results ±2 Sigma[c]	EPA Result[d] 1s, N=1	Control Limits
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
	The K analysis was repeated in triplicate; result of reanalysis was 1421.7±95.3 mg/L. No further action is planned.					
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
	Gross Alpha analysis was repeated in triplicate; results of reanalyses were 13.4±1.0 pCi/L. No further action is planned.					
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	2927.0 ± 306.0	2933.0 ± 358.0	2312.0 - 3554.0
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

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media[a].

Lab Code	Sample Type	Date Collected	Analyses	Concentration in pCi/L[b] Teledyne Results ±2 Sigma[c]	EPA Result[d] 1s, N=1	Control Limits
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-40	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 - 129.0
STW-613	WATER	Oct, 1990	H-3	7167.0 ± 330.0	7203.0 ± 720.0	5954.0 - 8452.0
STW-614	WATER	Oct, 1990	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
STW-615	WATER	Oct, 1990	Gross 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	6.0 - 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-617	WATER	Nov, 1990	U	35.0 ± 0.4	35.5 ± 3.6	29.3 - 41.7
	Sample was analyzed but the results where not submitted to the EPA because the deadline was missed (all data on file).					
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

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media[a].

Lab Code	Sample Type	Date Collected	Analyses	Concentration in pCi/L[b] Teledyne Results ±2 Sigma[c]	EPA Result[d] 1s, N=1	Control Limits
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		21.1 ± 5.3	11.9 - 30.3
	No data for Ra-228 was reported; sample was lost during analysis.					
STW-625	WATER	Mar, 1991	U	6.7 ± 0.4	7.6 ± 3.0	2.4 - 12.8
STAF-626	AIR 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
	The cause of the high Gross Alpha result is the difference in geometry between the standard used in the TIML lab and the EPA filter.					
STW-627	WATER	Apr, 1991	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
STW-628	WATER	Apr, 1991	Gross 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-40	1591.7 ± 180.1	1650.0 ± 83.0	1506.0 - 1794.0

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media[a].

Lab Code	Sample Type	Date Collected	Analyses	Concentration in pCi/L[b] Teledyne Results ±2 Sigma[c]	EPA Result[d] 1s, N=1	Control Limits
STW-630	WATER	May, 1991	Sr-89	40.7 ± 2.3	39.0 ± 5.0	30.3 - 47.7
			Sr-90	23.7 ± 1.2	24.0 ± 5.0	15.3 - 32.7
STW-631	WATER	May, 1991	Gr. Alpha	27.7 ± 5.8	24.0 ± 6.0	13.6 - 34.4
			Gr. Beta	46.0 ± 0.0	46.0 ± 5.0	37.3 - 54.7
STW-632	WATER	Jun, 1991	Co-60	11.3 ± 1.2	10.0 ± 5.0	1.3 - 18.7
			Zn-65	119.3 ± 16.3	108.0 ± 11.0	88.9 - 127.1
			Ru-106	162.3 ± 19.0	149.0 ± 15.0	123.0 - 175.0
			Cs-134	15.3 ± 1.2	15.0 ± 5.0	6.3 - 23.7
			Cs-137	16.3 ± 1.2	14.0 ± 5.0	5.3 - 22.7
			Ba-133	74.0 ± 6.9	62.0 ± 6.0	51.6 - 72.4
	Sample was reanalyzed for Ba-133. Result of the reanalysis was 63.8±6.9 pCi/L; within the EPA control limits.					
STW-633	WATER	Jun, 1991	H-3	13470.0 ± 385.8	12480.0 ± 1248.0	10314.8 - 14645.2
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
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

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media[a].

Lab Code	Sample Type	Date Collected	Analyses	Concentration in pCi/L[b] Teledyne Results ±2 Sigma[c]	EPA Result[d] 1s, N=1	Control Limits
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
	The cause of the high result for the I-131 analysis is unknown. An in-house spike sample was prepared with activity for I-131 of 68.3±6.8 pCi/L. Result of TIML's analysis of the in-house spike was 69.1±9.7 pCi/L.					
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	WATER	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
STW-645	WATER	Oct, 1991	Gross 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
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
STW-648	WATER	Jan, 1992	Sr-89	42.7 ± 6.4	51.0 ± 5.0	42.3 - 59.7
			Sr-90	18.3 ± 3.1	20.0 ± 5.0	11.3 - 28.7
STW-649	WATER	Jan, 1992	Pu-239	16.1 ± 0.8	16.8 ± 1.7	13.9 - 19.7
STW-650	WATER	Jan, 1992	Gr. Alpha	23.7 ± 9.2	30.0 ± 8.0	16.1 - 43.9
			Gr. Beta	27.7 ± 4.2	30.0 ± 5.0	21.3 - 38.7

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media[a].

Lab Code	Sample Type	Date Collected	Analyses	Concentration in pCi/L[b] Teledyne Results ±2 Sigma[c]	EPA Result[d] 1s, N=1	Control Limits
STW-651	WATER	Feb, 1992	I-131	60.3 ± 4.2	59.0 ± 6.0	48.6 - 69.4
STW-652	WATER	Feb, 1992	Co-60	40.3 ± 5.0	40.0 ± 5.0	31.3 - 48.7
			Zn-65	148.0 ± 15.0	150.7 ± 6.1	122.0 - 174.0
			Ru-106	188.7 ± 28.8	203.0 ± 20.0	168.3 - 237.7
			Cs-134	31.7 ± 4.2	31.0 ± 5.0	22.3 - 39.7
			Cs-137	51.0 ± 3.4	49.0 ± 5.0	40.3 - 57.7
			Ba-133	79.0 ± 3.4	76.0 ± 8.0	62.1 - 89.9
STW-653	WATER	Feb, 1992	H-3	7714.0 ± 119.6	7904.0 ± 790.0	6533.4 - 9274.6
STW-654	WATER	Mar, 1992	Ra-226	9.0 ± 0.4	10.1 ± 1.5	7.5 - 12.7
			Ra-228	18.8 ± 0.6	15.5 ± 3.9	8.7 - 22.3
STW-655	WATER	Mar, 1992	Rn-222	0.0	0.0	
	ND = No Data; Special EPA testing.					
STW-656	WATER	Mar, 1992	U	25.1 ± 1.9	25.3 ± 3.0	20.1 - 30.5
STW-657	WATER	Mar, 1992	Rn-222			
	No Data is available; Special EPA testing.					
STAF-658	AIR FILTER	Mar, 1992	Gr. Alpha	7.0 ± 0.0	7.0 ± 5.0	0.0 - 15.7
			Gr. Beta	39.3 ± 1.6	41.0 ± 5.0	32.3 - 49.7
			Sr-90	13.7 ± 1.6	15.0 ± 5.0	6.3 - 23.7
			Cs-137	10.0 ± 0.0	10.0 ± 5.0	1.3 - 18.7
STW-659	WATER	Apr, 1992	Gr. Alpha	35.7 ± 6.1	40.0 ± 10.0	22.7 - 57.3
			Ra-226	12.7 ± 1.2	14.9 ± 2.2	11.1 - 18.7
			Ra-228	14.5 ± 2.1	14.0 ± 3.5	7.9 - 20.1
			U	3.9 ± 0.2	4.0 ± 3.0	0.0 - 9.2
STW-660	WATER	Apr, 1992	Gross Beta	113.0 ± 7.2	140.0 ± 21.0	103.6 - 176.4
			Sr-89	12.3 ± 4.2	15.0 ± 5.0	6.3 - 23.7
			Sr-90	15.0 ± 1.2	17.0 ± 5.0	8.3 - 25.7
			Co-60	61.0 ± 4.0	56.0 ± 5.0	47.3 - 64.7
			Cs-134	24.3 ± 1.2	24.0 ± 5.0	15.3 - 32.7
			Cs-137	24.0 ± 2.0	22.0 ± 5.0	13.3 - 30.7

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media[a].

Lab Code	Sample Type	Date Collected	Analyses	Concentration in pCi/L[b] Teledyne Results ±2 Sigma[c]	EPA Result[d] 1s, N=1	Control Limits
STM-661	MILK	Apr, 1992	Sr-89	25.3 ± 7.6	38.0 ± 5.0	29.3 - 46.7
			Sr-90	24.3 ± 3.1	29.0 ± 5.0	20.3 - 37.7
			I-131	78.7 ± 9.5	78.0 ± 8.0	64.1 - 91.9
			Cs-137	39.3 ± 2.3	39.0 ± 5.0	30.3 - 47.7
			K-40	1610.0 ± 72.1	1710.0 ± 86.0	1560.8 - 1859.2
	The cause of the low Sr-89 results is unknown. Data were checked for errors. An in-house spike sample was prepared with activity for Sr-89 of 41.0±10.0 pCi/L. Result of the analysis of the in-house spike sample for Sr-89 was 37.2±3.6 pCi/L.					
STW-662	WATER	May, 1992	Sr-89	24.0 ± 4.0	29.0 ± 5.0	20.3 - 37.7
			Sr-90	6.7 ± 1.2	8.0 ± 5.0	0.0 - 16.7
STW-663	WATER	May, 1992	Gr. Alpha	12.3 ± 2.1	15.0 ± 5.0	6.3 - 23.7
			Gr. Beta	46.0 ± 5.0	44.0 ± 5.0	35.3 - 52.7
STW-664	WATER	Jun, 1992	Co-60	20.3 ± 1.2	20.0 ± 5.0	11.3 - 28.7
			Zn-65	103.3 ± 10.6	99.0 ± 10.0	81.7 - 116.3
			Ru-106	142.7 ± 23.7	141.0 ± 14.0	116.7 - 165.3
			Cs-134	14.3 ± 2.3	15.0 ± 5.0	6.3 - 23.7
			Cs-137	15.0 ± 2.0	15.0 ± 5.0	6.3 - 23.7
			Ba-133	92.7 ± 11.0	98.0 ± 10.0	80.7 - 115.3
STW-665	WATER	Jun, 1992	H-3	2153.3 ± 144.6	2125.0 ± 347.0	1523.0 - 2727.0
STW-666	WATER	Jul, 1992	Ra-226	22.3 ± 2.2	24.9 ± 3.7	18.5 - 31.3
			Ra-228	16.7 ± 3.1	16.7 ± 4.2	9.4 - 24.0
STW-667	WATER	Jul, 1992	Uranium	3.6 ± 0.3	4.0 ± 3.0	0.0 - 9.2
STW-668	WATER	Aug, 1992	I-131	47.0 ± 3.5	45.0 ± 6.0	34.6 - 55.4
STW-669	WATER	Aug, 1992	Pu-239	8.5 ± 0.9	9.0 ± 0.9	7.4 - 10.6
STAF-670	AIR FILTER	Aug, 1992	Alpha	25.7 ± 1.2	30.0 ± 8.0	16.1 - 43.9
			Beta	69.0 ± 2.0	69.0 ± 10.0	51.7 - 86.3
			Sr-90	26.0 ± 4.0	25.0 ± 5.0	16.3 - 33.7
			Cs-137	16.0 ± 0.0	18.0 ± 5.0	9.3 - 26.7
STW-671	WATER	Sep, 1992	Sr-89	16.0 ± 4.0	20.0 ± 5.0	11.3 - 28.7
			Sr-90	14.3 ± 3.1	15.0 ± 5.0	6.3 - 23.7
STW-672	WATER	Sep, 1992	Alpha	43.0 ± 13.1	45.0 ± 11.0	25.9 - 64.1
			Beta	41.3 ± 18.6	50.0 ± 5.0	14.3 - 58.7

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media[a].

Lab Code	Sample Type	Date Collected	Analyses	Concentration in pCi/L[b] Teledyne Results ±2 Sigma[c]	EPA Result[d] 1s, N=1	Control Limits
STM-673	MILK	Sep, 1992	I-131(gamma	109.7 ± 19.4	100.0 ± 10.0	82.7 - 117.3
			Sr-89	11.0 ± 3.5	15.0 ± 5.0	6.3 - 23.7
			Sr-90	12.7 ± 1.6	15.0 ± 5.0	6.3 - 23.7
			Cs-137	14.0 ± 3.5	15.0 ± 5.0	6.3 - 23.7
			K	1540.0 ± 103.9	1750.0 ± 88.0	1597.3 - 1902.7
	The K activity was calculated using the wrong volume (3.5 L), instead of 3.25 L. Correction for volume resulted in a value of 1660.0±110.1; within EPA control limits.					
STW-674	WATER	Oct, 1992	Co-60	11.3 ± 2.3	10.0 ± 5.0	1.3 - 18.7
			Zn-65	169.7 ± 25.0	148.0 ± 15.0	122.0 - 174.0
			Ru-106	170.7 ± 2.3	175.0 ± 18.0	143.8 - 206.2
			Cs-134	9.7 ± 2.3	8.0 ± 5.0	0.0 - 16.7
			Cs-137	9.7 ± 1.2	8.0 ± 5.0	0.0 - 16.7
			Ba-133	80.3 ± 9.0	74.0 ± 7.0	61.9 - 86.1
STW-675	WATER	Oct, 1992	H-3	5896.7 ± 136.2	5962.0 ± 596.0	4928.0 - 6996.0
STW-676	WATER	Oct, 1992	Gr. Alpha	24.7 ± 5.0	29.0 ± 7.0	16.9 - 41.1
			Ra-226	7.1 ± 0.4	7.4 ± 1.1	5.5 - 9.3
			Ra-228	11.5 ± 1.0	10.0 ± 2.5	5.7 - 14.3
			Uranium	9.7 ± 0.5	10.2 ± 3.0	5.0 - 15.4
STW-677	WATER	Oct, 1992	Gr. Beta	42.7 ± 8.1	53.0 ± 10.0	35.7 - 70.3
			Co-60	15.0 ± 2.0	15.0 ± 5.0	6.3 - 23.7
			Cs-134	5.7 ± 1.2	5.0 ± 5.0	0.0 - 13.7
			Cs-137	8.0 ± 2.0	8.0 ± 5.0	0.0 - 16.7
			Sr-89	6.7 ± 1.2	8.0 ± 5.0	0.0 - 16.7
			Sr-90	10.0 ± 2.0	110.0 ± 5.0	1.3 - 18.7
STW-678	WATER	Oct, 1992	Ra-226	7.5 ± 0.8	7.5 ± 1.1	5.6 - 9.4
			Ra-228	5.8 ± 0.7	5.0 ± 1.3	2.7 - 7.3
STW-679	WATER	Nov, 1992	Uranium	15.5 ± 1.1	15.2 ± 3.3	10.0 - 20.4
STW-680	WATER	Jan, 1993	Sr-89	15.0 ± 2.0	15.0 ± 5.0	6.3 - 23.7
			Sr-90	10.3 ± 1.2	10.0 ± 5.0	1.3 - 18.7
STW-681	WATER	Jan, 1993	Pu-239	17.5 ± 1.6	20.0 ± 2.0	16.5 - 23.5

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media[a].

Lab Code	Sample Type	Date Collected	Analyses	Concentration in pCi/L[b] Teledyne Results ±2 Sigma[c]	EPA Result[d] 1s, N=1	Control Limits
STW-682	WATER	Jan, 1993	Alpha	17.1 ± 1.2	34.0 ± 9.0	18.4 - 49.6
			Beta	46.7 ± 3.2	44.0 ± 5.0	35.3 - 52.7
	Gross Alpha analysis was repeated with similar results. An investigation of possible causes for the deviation from the EPA was conducted with no cause discovered. The sample was spiked with Th-230; so Alpha Spec Analysis for Th-230 was performed in triplicate with results of 15.5±2.1, 13.4±1.4, and 14.8±2.0. It should be noted that 66% of all participants failed this analysis with a grand average of 17.1. This coupled with the support of the Alpha Spec results leaves TIML cause to believe that there may have been a dilution error at the EPA. It should be noted that on the next Gross Alpha EPA check, TIML reported results that where exactly the known value. Since no apparent cause can be found, and TIML had outstanding results on the following sample, it is felt that no further investigation is needed.					
STW-683	WATER	Feb, 1993	I-131	106.0 ± 10.0	100.0 ± 10.0	82.7 - 117.3
STW-684	WATER	Feb, 1993	Uranium	7.2 ± 0.5	7.6 ± 3.0	2.4 - 12.8
STW-685	WATER	Mar, 1993	Ra-226	9.3 ± 1.3	9.8 ± 1.5	7.2 - 12.4
			Ra-228	20.8 ± 2.2	18.5 ± 4.6	10.5 - 26.5
STW-686	WATER	Apr, 1993	Alpha	88.3 ± 8.1	95.0 ± 24.0	53.4 - 136.6
			Ra-226	25.4 ± 1.4	24.9 ± 3.7	18.5 - 31.3
			Ra-228	17.4 ± 1.2	19.0 ± 4.8	10.7 - 27.3
			Uranium	27.8 ± 2.2	28.9 ± 3.0	23.7 - 34.1
STW-687	WATER	Apr, 1993	Beta	141.7 ± 9.0	177.0 ± 27.0	130.2 - 223.8
			Sr-89	28.7 ± 9.4	41.0 ± 5.0	32.3 - 49.7
			Sr-90	28.0 ± 3.5	29.0 ± 5.0	20.3 - 37.7
			Co-60	41.3 ± 1.2	39.0 ± 5.0	30.3 - 47.7
			Cs-134	24.7 ± 1.2	27.0 ± 5.0	18.3 - 35.7
			Cs-137	30.0 ± 0.0	32.0 ± 5.0	23.3 - 40.7
	The EPA report was received 08-16-93. No cause for the Iow result for Sr-89 was found. The analyst has been observed performing this procedure with no noted descrepancies. Teledyne will continue to monitor this procedure in the future. No further action is anticipated unless conditions warrant.					
STW-688	WATER	Jun, 1993	H-3	9613.3 ± 46.2	9844.0 ± 984.0	8136.8 - 11551.2

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media[a].

Lab Code	Sample Type	Date Collected	Analyses	Concentration in pCi/L[b] Teledyne Results ±2 Sigma[c]	EPA Result[d] 1s, N=1	Control Limits
STW-689	WATER	Jun, 1993	Co-60	17.3±4.6	15.0±5.0	6.3 - 23.7
			Zn-65	114.0±13.2	103.0±10.0	85.7 - 120.3
			Ru-106	108.0±8.0	119.0±12.0	98.2 - 139.8
			Cs-134	5.7±1.2	5.0±5.0	0.0 - 13.7
			Cs-137	6.0±2.0	5.0±5.0	0.0 - 13.7
			Ba-133	101.7±10.3	99.0±10.0	81.7 - 116.3
STW-690	WATER	Jul, 1993	Sr-89	28.3±2.3	34.0±5.0	25.3 - 42.7
			Sr-90	25.0±1.0	25.0±5.0	16.3 - 33.7
STW-691	WATER	Jul, 1993	Alpha	15.0±2.7	15.0±5.0	6.3 - 23.7
			Beta	41.3±4.9	43.0±6.9	31.0 - 55.0
STW-692	WATER	Aug, 1993	Uranium	24.9±1.4	25.3±3.0	20.1 - 30.5
STAF-693	AIR FILTER	Aug, 1993	Alpha	17.0±1.0	19.0±5.0	10.3 - 27.7
			Beta	47.3±0.6	47.0±5.0	38.3 - 55.7
			Sr-90	19.3±0.6	19.0±5.0	10.3 - 27.7
			Cs-137	10.0±1.0	9.0±5.0	0.3 - 17.7
STW-694	WATER	Sep, 1993	Ra-226	15.9±0.7	14.9±2.2	11.1 - 18.7
			Ra-228	21.0±1.6	20.4±5.1	11.6 - 29.2
STM-695	MILK	Sep, 1993	I-131	125.3±4.5	120.0±12.0	99.2 - 140.8
			Sr-89	19.3±1.5	30.0±5.0	21.3 - 38.7
			Sr-90	22.0±0.0	25.0±5.0	16.3 - 33.7
			Cs-137	49.0±3.0	49.0±5.0	40.3 - 57.7
			K	1616.7±37.9	1679.0±84.0	1533.3 - 1824.7
	Report was received 01-18-94; an investigation is underway as to the cause of the low Sr-89 results. In house spikes have been prepared and the analysis is in progress (see SPM-4848 and SPM-4849 in future reports). There is no apparent cause of the low Sr-89 results. In-house spikes have been prepared and the analysis is in progress. The analyst has been observed performing this procedure with no discrepancies noted. No further action is planned unless the results of the In-House spikes show a problem.					
STW-696	WATER	Oct, 1993	I-131	116.7±2.3	117.0±12.0	96.2 - 137.8
STW-697	WATER	Oct, 1993	Gr. Alpha	39.7±1.5	40.0±10.0	22.7 - 57.3
			Ra-226	10.6±0.5	9.9±1.5	7.3 - 12.5
			Ra-228	13.2±1.5	12.5±3.1	7.1 - 17.9
			Uranium	15.3±0.6	15.1±3.0	9.9 - 20.3

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne's Midwest Laboratory results for various sample media[a].

Lab Code	Sample Type	Date Collected	Analyses	Concentration in pCi/L[b] Teledyne Results ±2 Sigma[c]	EPA Result[d] 1s, N=1	Control Limits
STW-698	WATER	Oct, 1993	Beta	52.0 ± 1.0	58.0 ± 10.0	40.7 - 75.3
			Sr-89	11.3 ± 0.6	15.0 ± 5.0	6.3 - 23.7
			Sr-90	11.0 ± 0.0	10.0 ± 5.0	1.3 - 18.7
			Co-60	10.7 ± 0.6	10.0 ± 5.0	1.3 - 18.7
			Cs-134	10.0 ± 1.0	12.0 ± 5.0	3.3 - 20.7
			Cs-137	12.3 ± 1.2	10.0 ± 5.0	1.3 - 18.7
STW-699	WATER	Oct, 1993	Alpha	18.3 ± 2.5	20.0 ± 5.0	11.3 - 28.7
			Beta	13.7 ± 0.6	15.0 ± 5.0	6.3 - 23.7
STW-700	WATER	Nov, 1993	H-3	7310.0 ± 175.2	7398.0 ± 740.0	6114.1 - 8681.9
STW-701	WATER	Nov, 1993	Ba-133	75.7 ± 7.6	79.0 ± 8.0	65.1 - 92.9
			Co-60	30.7 ± 2.1	30.0 ± 5.0	21.3 - 38.7
			Cs-134	51.3 ± 5.9	59.0 ± 5.0	50.3 - 67.7
			Cs-137	41.7 ± 1.2	40.0 ± 5.0	31.3 - 48.7
			Ru-106	163.3 ± 3.2	201.0 ± 20.0	166.3 - 235.7
			Zn-65	157.0 ± 8.7	150.0 ± 15.0	124.0 - 176.0

The report was received on 02-14-94; the cause of the low Ru-106 is under investigation. It should be noted that the grand average of all participants in this analysis was 175.2 pCi/L, with 54% of the participants outside of limits.

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

[b] All results are in pCi/L, except for elemental potassium (K) data in milk, which are in mg/L; air filter samples, which are in pCi/Filter; and food products, which are in mg/Kg.

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

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

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

Lab Code	TLD Type	Measurement		mR: Teledyne Results ± 2 Sigma	mR: Known Value ± 2 Sigma	mR: Average ± 2 Sigma (All Participants)
2nd International Intercomparison						
115-2	CaF_2: Mn Bulb	Apr, 1976	Field	17.0 ± 1.9	17.1	16.4 ± 7.7
			Lab	20.8 ± 4.1	21.3	18.8 ± 7.6
	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.					
3rd International Intercomparison						
115-3	CaF_2: Mn Bulb	Jun, 1977	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
	Third International Intercomparison of Environmental Dosimeters conducted in the summer of 1977 by Oak Ridge National Laboratory and the School of Public Health of the University of Texas, Houston, Texas.					
4th International Intercomparison						
115-4	CaF_2: Mn Bulb	Jun, 1979	Field	14.1 ± 1.1	14.1 ± 1.4	16.0 ± 9.0
			Lab, Low	9.8 ± 1.3	12.2 ± 2.4	12.0 ± 7.4
			Lab, High	40.4 ± 1.4	45.8 ± 9.2	43.9 ± 13.2
	Fourth International Intercomparison of Environmental Dosimeters conducted in the summer of 1979 by the School of Public Health of the University of Texas, Houston, Texas.					
5th International Intercomparison						
115-5A	CaF_2: Mn Bulb	Oct, 1980	Field	31.4 ± 1.8	30.0 ± 6.0	30.2 ± 14.6
			Lab, Start	77.4 ± 5.8	75.2 ± 7.6	75.8 ± 40.4
			Lab, End	96.6 ± 5.8	88.4 ± 8.8	90.7 ± 31.2
115-5B	LiF-100 Chips	Oct, 1980	Field	30.3 ± 4.8	30.0 ± 6.0	30.2 ± 14.6
			Lab, Start	81.1 ± 7.4	75.2 ± 7.6	75.8 ± 40.4
			Lab, End	85.4 ± 11.7	88.4 ± 8.8	90.7 ± 31.2
	Fifth International Intercomparison of Environmental Dosimeters conducted in the 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.					

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

Lab Code	TLD Type	Measurement	mR: Teledyne Results ± 2 Sigma	mR: Known Value ± 2 Sigma	mR: Average ± 2 Sigma (All Participants)
7th International Intercomparison					
115-7A	LiF-100 Chips	Jun, 1984 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
115-7B	CaF_2: Mn Bulb	Jun, 1984 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	Jun, 1984 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
	Seventh International Intercomparison of Environmental Dosimeters conducted in the spring and summer of 1984 at Las Vegas, Neveda, and sponsored by the U.S. Department of Energy, The Nuclear Regulatory Commission, and the U.S. Environmental Protection Agency. Teledyne did not participate in the Sixth International Intercomparison of Environmental Dosimeters.				
8th International Intercomparison					
115-8A	LiF-100 Chips	Jan, 1986 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 ± 9.1
		Lab, Cs-137	13.7 ± 0.9	17.2 ± 0.9	16.2 ± 6.8
115-8B	CaF_2: Mn Bulb	Jan, 1986 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	Jan, 1986 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
	Eighth International Intercomparison of Environmental Dosimeters conducted in the fall and winter of 1985-1986 at New York, New York and sponsored by the U.S. Department of Energy.				

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

Lab Code	TLD Type	Measurement		mR: Teledyne Results ± 2 Sigma	mR: Known Value ± 2 Sigma	mR: Average ± 2 Sigma (All Participants)
10th International Intercomparison						
115-10A	LiF-100 Chips	Aug, 1993	Field	25.7 ± 1.4	27.0 ± 1.6	26.4 ± 10.2
			Lab	22.7 ± 1.6	25.9 ± 1.3	25.0 ± 9.4
			Lab	62.7 ± 2.6	72.7 ± 1.9	69.8 ± 20.3
	Tenth International Intercomparison of Environmental Dosimeters conducted in 1993 at Idaho State University and sponsored by the U.S. Department of Energy and the Idaho State University. The Nineth International Intercomparison of Environmental Dosimeters was not available to Teledyne's Midwest Laboratory.					
115-10B	$CaSO_4$:Dy Cards	Aug, 1993	Field	26.0 ± 2.3	27.0 ± 1.6	26.4 ± 10.2
			Lab	24.1 ± 1.7	25.9 ± 1.3	25.0 ± 9.4
			Lab	69.2 ± 3.0	72.7 ± 1.9	69.8 ± 20.3
	Tenth International Intercomparison of Environmental Dosimeters conducted in 1993 at Idaho State University and sponsored by the U.S. Department of Energy and the Idaho State University. The Nineth International Intercomparison of Environmental Dosimeters was not available to Teledyne's Midwest Laboratory.					
Teledyne Testing						
89-1	LiF-100 Chips	Sep, 1989	Lab	21.0 ± 0.4	22.4	ND
	ND = No Data; Teledyne Testing was only performed by Teledyne. Chips were irradiated by Teledyne Isotopes, Inc., Westwood NJ. in September, 1989					
89-2	Teledyne $CaSO_4$:Dy Cards	Nov, 1989	Lab	20.9 ± 1.0	20.3	ND
	ND = No Data; Teledyne Testing was only performed by Teledyne. Cards were irradiated by Teledyne Isotopes, Inc., Westwood NJ. in November, 1989.					
90-1	Teledyne $CaSO_4$:Dy Cards	Jun, 1990	Lab	20.6 ± 1.4	19.6	ND
	ND = No Data; Teledyne Testing was only performed by Teledyne. Cards were irradiated by Teledyne Isotopes, Inc., Westwood NJ. on June 19, 1990.					
90-2	Teledyne $CaSO_4$:Dy Cards	Sep, 1990	Lab	100.8 ± 4.3	100.0	ND
	ND = No Data; Teledyne Testing was only performed by Teledyne. Cards were irradiated by Dosimetry Associates, Inc., Northville, MI on October 30, 1990.					

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

Lab Code	TLD Type	Measurement		mR: Teledyne Results ± 2 Sigma	mR: Known Value ± 2 Sigma	mR: Average ± 2 Sigma (All Participants)
91-1	Teledyne $CaSO_4$:Dy Cards	Oct, 1990	Lab	33.4 ± 2.0	32.0	ND
				55.2 ± 4.7	58.8	ND
				87.8 ± 6.2	85.5	ND
	ND = No Data; Teledyne Testing was only performed by Teledyne. Cards were irradiated by Teledyne Isotopes, Inc., Westwood NJ. on October 8, 1991.					
92-1	LiF-100 Chips	Feb, 1992	Lab	11.1 ± 0.2	10.7	ND
				25.6 ± 0.5	25.4	ND
				46.4 ± 0.5	46.3	ND
	ND = No Data; Teledyne Testing was only performed by Teledyne. Chips were irradiated by Teledyne Isotopes, Inc., Westwood NJ. on February 26, 1992.					
92-2	Teledyne $CaSO_4$:Dy Cards	Apr, 1992	Lab, Reader1	20.1 ± 0.1	20.1	ND
				40.6 ± 0.1	40.0	ND
				60.0 ± 1.3	60.3	ND
			Lab, Reader2	20.3 ± 0.3	20.1	ND
				39.2 ± 0.3	40.0	ND
				60.7 ± 0.4	60.3	ND
	ND = No Data; Teledyne Testing was only performed by Teledyne. Cards were irradiated by Teledyne Isotopes, Inc., Westwood NJ. on April 1, 1992.					
93-1	Teledyne LiF-100 Chips	Mar, 1993	Lab	10.0 ± 1.0	10.2	ND
				25.5 ± 2.2	25.5	ND
				42.7 ± 5.7	45.9	ND
	ND = No Data; Teledyne Testing was only performed by Teledyne. Cards and Chips were irradiated by Teledyne Isotopes, Inc., Westwood NJ. on March 10, 1993. Due to a potential error of 10-12% when cards where irradiated, results of the testing on the cards will not be published. Data is available upon request.					

Table A-3. In-house "spike" samples.

Lab Code	Sample Type	Date Collected	Analyses	Concentration in pCi/L[a] Teledyne Results 2s, n=1[b]	Known Activity	Control[c] Limits
QCMI-26	MILK	Jan, 1990	Cs-134	19.3 ± 1.0	20.8	10.8 - 30.8
			Cs-137	25.2 ± 1.2	22.8	12.8 - 32.8
QCMI-27	MILK	Feb, 1990	Sr-90	18.0 ± 1.6	18.8	8.8 - 28.8
QCMI-28	MILK	Mar, 1990	I-131	63.8 ± 2.2	62.6	50.1 - 75.1
QCMI-29	MILK	Apr, 1990	I-131	90.7 ± 9.2	82.5	66.0 - 99.0
			Cs-134	18.3 ± 1.0	19.7	9.7 - 29.7
			Cs-137	20.3 ± 1.0	18.2	8.2 - 28.2
QCW-61	WATER	Apr, 1990	Sr-89	17.9 ± 5.5	23.1	13.1 - 33.1
			Sr-90	19.4 ± 2.5	23.5	13.5 - 33.5
QCW-62	WATER	Apr, 1990	Co-60	8.7 ± 0.4	9.4	0.0 - 19.4
			Cs-134	20.0 ± 0.2	19.7	9.7 - 29.7
			Cs-137	28.7 ± 1.4	22.7	12.7 - 32.7
QCW-63	WATER	Apr, 1990	I-131	63.5 ± 8.0	66.0	52.8 - 79.2
QCW-64	WATER	Apr, 1990	H-3	1941.0 ± 130.0	1826.0	1141.5 - 2510.5
QCW-65	WATER	Jun, 1990	Ra-226	6.4 ± 0.2	6.9	4.8 - 9.0
QCW-66	WATER	Jun, 1990	Uranium	6.2 ± 0.2	6.0	3.6 - 8.4
QCMI-30	MILK	Jul, 1990	Sr-89	12.8 ± 0.4	18.4	8.4 - 28.4
			Sr-90	18.2 ± 1.4	18.7	8.7 - 28.7
			Cs-134	46.0 ± 1.3	49.0	39.0 - 59.0
			Cs-137	27.6 ± 1.3	25.3	15.3 - 35.3
QCW-68	WATER	Jul, 1990	Gr. Alpha	9.8 ± 0.3	10.6	0.6 - 20.6
			Gr. Beta	11.4 ± 0.6	11.3	1.3 - 21.3
QCMI-31	MILK	Aug, 1990	I-131	68.8 ± 1.6	61.4	49.1 - 73.7
QCW-69	WATER	Sep, 1990	Sr-89	17.7 ± 1.6	19.2	9.2 - 29.2
			Sr-90	13.9 ± 1.6	17.4	7.4 - 27.4
QC MI-32	MILK	Oct, 1990	I-131	34.8 ± 0.2	32.4	20.4 - 44.4
			Cs-134	25.8 ± 1.2	27.3	17.3 - 37.3
			Cs-137	25.3 ± 2.0	22.4	12.4 - 32.4
QCW-70	WATER	Oct, 1990	H-3	2355.0 ± 59.0	2276.0	1577.3 - 2974.7
QCW-71	WATER	Oct, 1990	I-131	55.9 ± 0.9	51.8	39.8 - 63.8
QCW-73	WATER	Oct, 1990	Co-60	18.3 ± 2.7	16.8	6.8 - 26.8
			Cs-134	28.3 ± 2.3	27.0	17.0 - 37.0
			Cs-137	22.7 ± 1.3	22.4	12.4 - 32.4
QCW-74	WATER	Dec, 1990	Gr. Alpha	21.4 ± 1.0	26.1	13.1 - 39.2
			Gr. Beta	25.9 ± 1.0	22.3	12.3 - 32.3

Table A-3. In-house "spike" samples.

Lab Code	Sample Type	Date Collected	Analyses	Concentration in pCi/L[a] Teledyne Results 2s, n=1[b]	Known Activity	Control[c] Limits
QCMI-33	MILK	Jan, 1991	Sr-89	20.7 ± 3.3	21.6	11.6 - 31.6
			Sr-90	19.0 ± 1.4	23.0	13.0 - 33.0
			Cs-134	22.2 ± 1.7	19.6	9.6 - 29.6
			Cs-137	26.1 ± 1.6	22.3	12.3 - 32.3
QCMI-34	MILK	Feb, 1991	I-131	40.7 ± 1.8	40.1	28.1 - 52.1
QCW-75	WATER	Mar, 1991	Sr-89	18.8 ± 1.5	23.3	13.3 - 33.3
			Sr-90	16.0 ± 0.8	17.2	7.2 - 27.2
QCMI-35	MILK	Apr, 1991	I-131	48.0 ± 0.8	49.2	37.2 - 61.2
			Cs-134	19.2 ± 2.0	22.6	12.6 - 32.6
			Cs-137	22.8 ± 2.2	22.1	12.1 - 32.1
QCW-76	WATER	Apr, 1991	I-131	56.5 ± 1.7	59.0	47.2 - 70.8
QCW-77	WATER	Apr, 1991	Co-60	16.4 ± 2.2	15.7	5.7 - 25.7
			Cs-134	23.8 ± 2.5	22.6	12.6 - 32.6
			Cs-137	25.0 ± 2.4	21.1	11.1 - 31.1
QCW-78	WATER	Apr, 1991	H-3	4027.0 ± 188.0	4080.0	3264.0 - 4896.0
QCW-79	WATER	Jun, 1991	Gr. Alpha	7.4 ± 0.7	7.8	0.0 - 17.8
			Gr. Beta	11.0 ± 0.7	11.0	1.0 - 21.0
SPM-36	MILK	Jul, 1991	Sr-89	28.1 ± 2.1	34.0	24.0 - 44.0
			Sr-90	11.6 ± 0.7	11.5	1.5 - 21.5
			I-131	14.4 ± 1.9	18.3	6.3 - 30.3
			Cs-137	34.3 ± 3.0	35.1	25.1 - 45.1
QCMI-37	MILK	Oct, 1991	I-131	23.6 ± 3.2	25.8	13.8 - 37.8
			Cs-134	22.7 ± 2.8	22.1	12.1 - 32.1
			Cs-137	38.3 ± 3.0	35.1	25.1 - 45.1
QCW-80	WATER	Oct, 1991	Sr-89	27.4 ± 6.9	24.4	14.4 - 34.4
			Sr-90	11.7 ± 1.4	14.1	4.1 - 24.1
QCW-81	WATER	Oct, 1991	I-131	19.1 ± 0.7	20.6	8.6 - 32.6
QCW-82	WATER	Oct, 1991	Co-60	22.6 ± 2.7	22.1	12.1 - 32.1
			Cs-134	15.5 ± 1.8	17.6	7.6 - 27.6
			Cs-137	17.5 ± 2.1	17.6	7.6 - 27.6
QCW-83	WATER	Oct, 1991	H-3	4639.0 ± 137.0	4382.0	3505.6 - 5258.4
QCW-84	WATER	Dec, 1991	Gr. Alpha	6.2 ± 6.0	7.8	0.0 - 17.8
			Gr. Beta	11.0 ± 0.7	11.0	1.0 - 21.0

Table A-3. In-house "spike" samples.

Lab Code	Sample Type	Date Collected	Analyses	Concentration in pCi/L[a] Teledyne Results 2s, n=1[b]	Known Activity	Control[c] Limits
QCMI-39	MILK	Jan, 1992	Sr-89	21.6 ± 6.5	31.2	21.2 - 41.2
			Sr-90	38.7 ± 1.8	42.3	33.8 - 50.8
			I-131	76.8 ± 0.9	83.7	67.0 - 100.4
			Cs-134	42.1 ± 5.7	49.4	39.4 - 59.4
			Cs-137	55.2 ± 6.4	53.0	43.0 - 63.0
QCW-85	WATER	Mar, 1992	Sr-89	26.2 ± 3.1	32.0	22.0 - 42.0
			Sr-90	24.4 ± 1.4	28.0	18.0 - 38.0
QCMI-40	MILK	Apr, 1992	Cs-134	58.0 ± 2.6	55.9	45.9 - 65.9
			Cs-137	43.7 ± 3.0	38.9	28.9 - 48.9
QC MI-41	MILK	Apr, 1992	I-131	50.3 ± 0.8	55.9	44.7 - 67.1
QCW-86	WATER	Apr, 1992	H-3	4080.0 ± 190.0	4027.0	3221.6 - 4832.4
QCW-87	WATER	Apr, 1992	I-131	33.5 ± 0.6	33.2	21.2 - 45.2
QCW-88	WATER	Apr, 1992	Co-60	17.5 ± 2.7	19.7	9.7 - 29.7
			Cs-134	28.9 ± 2.5	33.5	23.5 - 43.5
			Cs-137	41.0 ± 3.0	38.9	28.9 - 48.9
QCW-89	WATER	Jun, 1992	Gr. Alpha	15.3 ± 0.8	13.6	3.6 - 23.6
			Gr. Beta	17.2 ± 0.9	17.6	7.6 - 27.6
QCMI-42	MILK	Aug, 1992	Sr-89	41.4 ± 5.9	51.2	41.0 - 61.4
			Sr-90	48.9 ± 2.5	51.9	41.5 - 62.3
			Cs-134	20.1 ± 2.8	20.2	10.2 - 30.2
			Cs-137	26.2 ± 2.7	26.1	16.1 - 36.1
QCW-90	WATER	Sep, 1992	Sr-89	6.7 ± 3.4	12.6	2.6 - 22.6
			Sr-90	16.1 ± 1.4	15.6	5.6 - 25.6
QCMI-43	MILK	Oct, 1992	I-131	19.9 ± 1.0	21.5	9.5 - 33.5
			Cs-134	14.2 ± 3.4	12.7	2.7 - 22.7
			Cs-137	14.1 ± 5.2	17.1	7.1 - 27.1
QCMI-44	MILK	Oct, 1992	I-131	36.1 ± 1.2	43.0	31.0 - 55.0
			Cs-134	28.2 ± 4.0	25.4	15.4 - 35.4
			Cs-137	38.8 ± 5.1	34.2	24.2 - 44.2
QCW-91	WATER	Oct, 1992	I-131	34.9 ± 2.2	34.9	22.9 - 46.9
QCW-92	WATER	Oct, 1992	Co-60	11.4 ± 1.9	9.2	0.0 - 19.2
			Cs-134	18.7 ± 2.3	14.3	4.3 - 24.3
			Cs-137	14.1 ± 1.8	15.0	5.0 - 25.0
QCW-93	WATER	Oct, 1992	H-3	3704.0 ± 186.0	3904.0	3169.2 - 4638.8
QCW-94	WATER	Oct, 1992	H-3	14925.0 ± 339.0	15616.0	12492.8 - 18739.2

Table A-3. In-house "spike" samples.

Lab Code	Sample Type	Date Collected	Analyses	Concentration in pCi/L[a] Teledyne Results 2s, n=1[b]	Known Activity	Control[c] Limits
QCW-95	WATER	Oct, 1992	I-131	64.2 ± 2.7	67.2	53.8 - 80.6
QCW-36	WATER	Dec, 1992	Alpha	11.5 ± 2.3	15.2	9.1 - 21.3
			Beta	26.5 ± 2.0	25.7	15.4 - 36.0
QCW-96	WATER	Dec, 1992	Gr. Alpha	8.3 ± 0.6	10.4	0.4 - 20.4
			Gr. Beta	19.8 ± 1.5	20.6	10.6 - 30.6
SPM-3341	MILK	Jan, 1993	Sr-89	6.7 ± 3.1	8.7	0.0 - 18.7
			Sr-90	20.0 ± 1.2	19.2	9.2 - 29.2
			Cs-134	17.1 ± 2.0	21.3	11.3 - 31.3
			Cs-137	21.4 ± 2.0	23.8	13.8 - 33.8
SPM-3387	MILK	Feb, 1993	I-131	72.5 ± 8.4	71.5	57.2 - 85.8
SPVE-3401	VEGETATION (SAW DUST)	Feb, 1993	I-131	994.5 ± 53.2	953.7	763.0 - 1144.4
SPCH-3402	CHARCOAL	Feb, 1993	I-131	95.2 ± 12.8	95.4	76.3 - 114.5
SPW-3434	WATER	Apr, 1993	Gr. Alpha	10.4 ± 1.8	10.4	0.4 - 20.4
			Gr. Beta	22.0 ± 2.0	20.6	10.6 - 30.6
SPW-3556	WATER	Apr, 1993	Sr-89	18.2 ± 5.0	22.2	12.2 - 32.2
			Sr-90	20.1 ± 1.8	17.0	7.0 - 27.0
SPW-3597	WATER	Apr, 1993	H-3	5464.0 ± 219.0	5428.0	4342.4 - 6513.6
SPW-3599	WATER	Apr, 1993	I-131	149.8 ± 1.9	145.0	116.0 - 174.0
SPW-3606	WATER	Apr, 1993	Co-60	24.8 ± 2.3	21.5	11.5 - 31.5
			Cs-134	26.4 ± 1.9	26.4	16.4 - 36.4
			Cs-137	33.9 ± 2.6	31.7	21.7 - 41.7
SPM-3631	MILK	Apr, 1993	I-131	139.8 ± 1.6	145.0	116.0 - 174.0
			Cs-134	48.8 ± 2.9	52.8	42.8 - 62.8
			Cs-137	65.2 ± 2.9	63.4	53.4 - 73.4
SPF-3681	FISH (JELLO)	May, 1993	Cs-137	68.2 ± 7.7	67.6	57.6 - 77.6
	Concentrations are in pCi/Total Volume (550g).					
SPW-3842	WATER	Jun, 1993	Th-230	4.2 ± 0.5	4.5	2.7 - 6.3
SPW-4160	WATER	Jun, 1993	Alpha	8.9 ± 1.4	12.9	7.7 - 18.1
			Beta	22.0 ± 1.9	31.9	19.1 - 44.7
SPW-4232	WATER	Aug, 1993	Fe-55	1684.0 ± 415.0	1420.0	1136.0 - 1704.0
SPW-4246	WATER	Aug, 1993	Sr-90	32.2 ± 2.6	30.4	24.3 - 36.5
SPM-4247	MILK	Aug, 1993	Sr-89	29.1 ± 4.9	35.4	25.4 - 45.4
			Sr-90	18.3 ± 1.3	19.2	9.2 - 29.2

Table A-3. In-house "spike" samples.

Lab Code	Sample Type	Date Collected	Analyses	Concentration in pCi/L[a] Teledyne Results 2s, n=1[b]	Known Activity	Control[c] Limits
SPW-4248	WATER	Aug, 1993	H-3	9910.0 ± 300.0	10430.0	8344.0 - 12516.0
SPW-4250	WATER	Aug, 1993	Co-60	247.0 ± 23.1	247.7	222.9 - 272.5
			Cs-134	141.6 ± 15.9	141.1	127.0 - 155.2
			Cs-137	283.5 ± 27.8	247.2	222.5 - 271.9
	The cause of the high Cs-137 data is unknown. All data was reviewed, no errors where found in the calculations. The employee was observed performing this analysis and no deviations from the procedure where observed. The employee's results have been good in the past; no further action is planned.					
SPF-4251	FISH (JELLO)	Aug, 1993	Cs-134	68.8 ± 3.3	75.3	65.3 - 85.3
			Cs-137	203.6 ± 8.2	198.1	178.3 - 217.9
SPS-4262	SEDIMENT (BOTTOM)	Aug, 1993	Cs-134	74.1 ± 9.9	71.0	61.0 - 81.0
			Cs-137	212.4 ± 14.8	197.8	178.0 - 217.6
SPW-4377	WATER	Sep, 1993	I-131	39.0 ± 10.0	42.1	30.1 - 54.1
SPM-4378	MILK	Sep, 1993	I-131	44.5 ± 5.5	42.1	30.1 - 54.1
SPCH-4379	CHARCOAL	Sep, 1993	I-131	90.3 ± 13.5	84.3	67.4 - 101.2
SPVE-4380	VEGETATION (SAW DUST)	Sep, 1993	I-131	193.2 ± 20.0	170.2	136.2 - 204.2
SPW-4381	WATER	Sep, 1993	Sr-89	21.9 ± 4.0	28.8	18.8 - 38.8
			Sr-90	19.5 ± 1.8	19.0	9.0 - 29.0
SPW-4382	WATER	Sep, 1993	I-129	18.1 ± 1.0	18.6	6.6 - 30.6
SPW-4421	WATER	Oct, 1993	H-3	16900.0 ± 368.0	17380.0	13904.0 - 20856.0
SPW-4428	WATER	Oct, 1993	Co-60	19.3 ± 3.1	18.3	8.3 - 28.3
			Cs-134	31.5 ± 3.3	33.5	23.5 - 43.5
			Cs-137	44.4 ± 3.6	43.2	33.2 - 53.2
SPM-4426	MILK	Oct, 1993	I-131	49.7 ± 8.6	44.5	32.5 - 56.5
			Cs-134	30.8 ± 4.5	33.0	23.0 - 43.0
			Cs-137	43.4 ± 6.0	43.2	33.2 - 53.2
SPW-4427	WATER	Oct, 1993	I-131	95.2 ± 10.6	88.9	71.1 - 106.7

[a] All results are in pCi/L, except elemental potassium (K) data in milk, which are in mg/L.; air filter samples, which are in pCi/Filter; charcoal which are in pCi/charcoal; and food products which are in mg/kg.

[b] All samples prior to January 1991 are the results or three determinations; after January 1991, all determinations are single.

[c] Control Limits are based on EPA publication; "Environmental Radioactive Laboratory Intercomparison Studies Program", Fiscal Year 1981-1982, EPA-600/4-81-004 (see Attachment A) or limits imposed by Teledyne's Midwest Laboratory.

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

Lab Code	Sample Type	Sample Date	Analyses	Concentration pCi/L[a]. Teledyne Results (4.66 Sigma) LLD	Teledyne Results (4.66 Sigma) Activity[b]	Acceptance Criteria (4.66 Sigma)
SPW-8039	WATER	Jan 1990	Ra-226	< 0.2		< 1.0
SPM-8040	MILK	Jan 1990	Sr-89	< 0.8		< 5.0
			Sr-90	< 1.0		< 1.0
SPM-8208	MILK	Jan 1990	Sr-89	< 0.8		< 5.0
			Sr-90	N/A	1.6 ± 0.5	< 1.0
			Cs-134	< 3.6		< 10.0
			Cs-137	< 4.7		< 10.0
	Low level of Sr-90 concentration in milk (1-5 pCi/L) is not unusual.					
SPM-8312	MILK	Feb 1990	Sr-89	< 0.3		< 5.0
			Sr-90	N/A	1.2 ± 0.3	< 1.0
	Low level of Sr-90 concentration in milk (1-5 pCi/L) is not unusual.					
SPW-8312	WATER	Feb 1990	Sr-89	< 0.6		< 5.0
			Sr-90	< 0.7		< 1.0
SPM-8314	MILK	Mar 1990	I-131	< 0.3		< 1.0
SPM-8510	MILK	May 1990	I-131	< 0.2		< 1.0
			Cs-134	< 4.6		< 10.0
			Cs-137	< 4.8		< 10.0
SPW-8511	WATER	May 1990	H-3	< 200.0		< 300.0
SPM-8600	MILK	Jul 1990	Sr-89	< 0.8		< 5.0
			Sr-90	N/A	1.7 ± 0.6	< 1.0
			I-131	< 0.3		< 1.0
			Cs-134	< 5.0		< 10.0
			Cs-137	< 7.0		< 10.0
	Low level of Sr-90 concentration in milk (1-5 pCi/L) is not unusual.					
SPM-8877	MILK	Aug 1990	I-131	< 0.2		< 1.0
SPW-8925	WATER	Aug 1990	H-3	< 200.0		< 300.0
SPW-8926	WATER	Aug 1990	Gr. Alpha	< 0.3		< 1.0
			Gr. Beta	< 0.7		< 5.0
SPW-8927	WATER	Aug 1990	U-234	< 0.01		< 1.0
			U-235	< 0.02		< 1.0
			U-238	< 0.01		< 1.0
SPW-8928	WATER	Aug 1990	Mn-54	< 4.0		< 10.0
			Co-58	< 4.1		< 10.0
			Co-60	< 2.4		< 10.0
			Cs-134	< 3.3		< 10.0
			Cs-137	< 3.7		< 10.0

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

Lab Code	Sample Type	Sample Date	Analyses	Concentration pCi/L[a]. Teledyne Results (4.66 Sigma) LLD	Teledyne Results (4.66 Sigma) Activity[b]	Acceptance Criteria (4.66 Sigma)
SPW-8929	WATER	Aug 1990	Sr-89	< 1.4		< 5.0
			Sr-90	< 0.6		< 1.0
SPW-69	WATER	Sep 1990	Sr-89	< 1.8		< 5.0
			Sr-90	< 0.8		< 1.0
SPW-106	WATER	Oct 1990	H-3	< 180.0		< 300.0
			I-131	< 0.3		< 1.0
SPM-107	MILK	Oct 1990	I-131	< 0.4		< 1.0
			Cs-134	< 3.3		< 10.0
			Cs-137	< 4.3		< 10.0
SPW-370	WATER	Oct 1990	Mn-54	< 1.7		< 10.0
			Co-58	< 2.6		< 10.0
			Co-60	< 1.6		< 10.0
			Cs-134	< 1.7		< 10.0
			Cs-137	< 1.8		< 10.0
SPW-372	WATER	Dec 1990	Gr. Alpha	< 0.3		< 1.0
			Gr. Beta	< 0.8		< 5.0
SPM-406	MILK	Jan 1991	Sr-89	< 0.4		< 5.0
			Sr-90	N/A	1.8 ± 0.4	< 1.0
			Cs-134	< 3.7		< 10.0
			Cs-137	< 5.2		< 10.0
Low level of Sr-90 concentration in milk (1-5 pCi/L) is not unusual.						
SPM-421	MILK	Feb 1991	I-131	< 0.3		< 1.0
SPM-451	MILK	Feb 1991	Ra-226	< 0.1		< 1.0
			Ra-228	< 0.9		< 1.0
SPW-514	WATER	Mar 1991	Sr-89	< 1.1		< 5.0
			Sr-90	< 0.9		< 1.0
SPW-586	WATER	Apr 1991	I-131	< 0.2		< 1.0
			Co-60	< 2.5		< 10.0
			Cs-134	< 2.4		< 10.0
			Cs-137	< 2.2		< 10.0
SPM-587	MILK	Apr 1991	I-131	< 0.2		< 1.0
			Cs-134	< 1.7		< 10.0
			Cs-137	< 1.9		< 10.0
SPW-837	WATER	Jun 1991	Gr. Alpha	< 0.6		< 1.0
			Gr. Beta	< 1.1		< 5.0

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

Lab Code	Sample Type	Sample Date	Analyses	Concentration pCi/L[a]. Teledyne Results (4.66 Sigma) LLD	Teledyne Results (4.66 Sigma) Activity[b]	Acceptance Criteria (4.66 Sigma)
SPM-953	MILK	Jul 1991	Sr-89	< 0.7		< 5.0
			Sr-90	N/A	0.4 ± 0.3	< 1.0
			I-131	< 0.2		< 1.0
			Cs-137	< 4.9		< 10.0
Low level of Sr-90 concentration in milk (1-5 pCi/L) is not unusual.						
SPM-1236	MILK	Oct 1991	I-131	< 0.2		< 1.0
			Cs-134	< 3.7		< 10.0
			Cs-137	< 4.6		< 10.0
SPW-1254	WATER	Oct 1991	Sr-89	< 2.8		< 5.0
			Sr-90	< 0.7		< 1.0
SPW-1256	WATER	Oct 1991	I-131	< 0.4		< 1.0
			Co-60	< 3.6		< 10.0
			Cs-134	< 4.0		< 10.0
			Cs-137	< 3.0		< 10.0
SPW-1259	WATER	Oct 1991	H-3	< 160.0		< 300.0
SPW-1444	WATER	Dec 1991	Gr. Alpha	< 0.4		< 1.0
			Gr. Beta	< 0.8		< 5.0
SPM-1578	MILK	Jan 1992	Sr-89	< 0.5		< 5.0
			Sr-90	N/A	1.3 ± 0.4	< 1.0
			I-131	< 0.2		< 1.0
			Cs-134	< 7.2		< 10.0
			Cs-137	< 8.0		< 10.0
Low level of Sr-90 concentration in milk (1-5 pCi/L) is not unusual.						
SPW-1860	WATER	Mar 1992	Sr-89	< 0.6		< 5.0
			Sr-90	< 0.4		< 1.0
SPW-2067	WATER	Apr 1992	H-3	< 168.0		< 300.0
SPW-2114	WATER	Apr 1992	C-14	< 1.0		< 200.0
SPM-2119	MILK	Apr 1992	Co-60	< 6.3		< 10.0
			Cs-134	< 4.5		< 10.0
			Cs-137	< 5.4		< 10.0
SPW-2126	WATER	Apr 1992	I-131	< 0.2		< 1.0
SPM-2133	MILK	Apr 1992	I-131	< 0.2		< 1.0
SPW-2220	WATER	May 1992	Co-60	< 2.1		< 10.0
			Cs-134	< 2.1		< 10.0
			Cs-137	< 2.3		< 10.0
SPW-2369	WATER	Jun 1992	Gr. Alpha	< 0.4		< 1.0
			Gr. Beta	< 0.8		< 5.0

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

Lab Code	Sample Type	Sample Date	Analyses	Concentration pCi/L[a]. Teledyne Results (4.66 Sigma) LLD	Teledyne Results (4.66 Sigma) Activity[b]	Acceptance Criteria (4.66 Sigma)
SPM-2500	MILK	Aug 1992	I-131	< 0.4		< 1.0
			Sr-89	< 1.2		< 5.0
			Sr-90	< 0.9		< 1.0
SPW-2666	WATER	Sep 1992	Sr-89	< 0.8		< 5.0
			Sr-90	< 0.5		< 1.0
SPW-2828	WATER	Oct 1992	Co-60	< 4.8		< 10.0
			Cs-134	< 6.0		< 10.0
			Cs-137	< 6.1		< 10.0
			I-131	< 0.3		< 1.0
			H-3	< 177.0		< 300.0
SPM-2829	MILK	Oct 1992	Co-60	< 9.3		< 10.0
			Cs-134	< 6.4		< 10.0
			Cs-137	< 7.2		< 10.0
SPW-3212	WATER	Oct 1992	Ra-228	< 1.0		< 1.0
SPW-3057	WATER	Nov 1992	Ra-226	< 0.03		< 1.0
SPW-3294	WATER	Dec 1992	Gr. Alpha	< 0.4		< 1.0
			Gr. Beta	< 0.8		< 5.0
SPM-3342	MILK	Jan 1993	Sr-89	< 0.7	-0.9 ± 1.1	< 5.0
			Sr-90	N/A	1.6 ± 0.5	< 1.0
			Cs-134	< 4.1	-0.9 ± 2.6	< 10.0
			Cs-137	< 3.9	0.8 ± 2.2	< 10.0
Low levels of Sr-90 concentration in milk (1-5 pCi/L) is not unusual.						
SPM-3386	MILK	Feb 1993	I-131	< 0.2	0.1 ± 0.1	< 1.0
SPW-3557	WATER	Mar 1993	Sr-89	< 0.5	0.3 ± 0.5	< 5.0
			Sr-90	< 0.5	0.1 ± 0.2	< 1.0
SPW-3598	WATER	Apr 1993	H-3	< 180.0	84.7 ± 94.2	< 300.0
SPW-3600	WATER	Apr 1993	I-131	< 0.2	0.1 ± 0.2	< 1.0
SPW-3601	WATER	Apr 1993	Co-60	< 4.2		< 10.0
			Cs-134	< 4.4		< 10.0
			Cs-137	< 3.4		< 10.0
			I-131	< 0.4	0.3 ± 0.9	< 1.0
Activity results for the gamma-emitters are not available for this sample.						
SPM-3651	MILK	May 1993	I-131	< 0.2	0.1 ± 0.1	< 1.0
			Cs-134	< 4.4		< 10.0
			Cs-137	< 6.3		< 10.0
Activity results for the gamma-emitters are not available for this sample.						
SPFP-3680	FOOD	May 1993	Cs-137	< 6.5	0.0 ± 0.0	< 10.0

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

Lab Code	Sample Type	Sample Date	Analyses	Concentration pCi/L[a]. Teledyne Results (4.66 Sigma) LLD	Teledyne Results (4.66 Sigma) Activity[b]	Acceptance Criteria (4.66 Sigma)
SPW-3844	WATER	Jun 1993	Th-228	< 0.1	0.0 ± 0.1	< 1.0
			Th-230	< 0.1	0.2 ± 0.1	< 1.0
			Th-232	< 0.1	0.0 ± 0.0	< 1.0
SPW-4234	WATER	Jun 1993	Gr. Alpha	< 0.3	0.0 ± 0.2	< 1.0
			Gr. Beta	< 0.8	0.2 ± 0.3	< 5.0
SPS-4059	SEDIMENT (BOTTOM)	Jul 1993	Cs-134	< 5.0	0.0 ± 0.0	< 10.0
			Cs-137	< 7.2	0.0 ± 0.0	< 10.0
SPVE-4060	VEGETATION (SAW DUST)	Jul 1993	I-131(g)	< 13.5	0.0 ± 0.0	< 20.0
			Cs-134	< 4.8	0.0 ± 0.0	< 10.0
			Cs-137	< 6.4	0.0 ± 0.0	< 10.0
SPM-4061	MILK	Jul 1993	Cs-134	< 8.6	0.0 ± 0.0	< 10.0
			Cs-137	< 5.8	0.0 ± 0.0	< 10.0
SPM-4062	MILK	Jul 1993	Cs-134	< 3.8	1.5 ± 1.5	< 10.0
			Cs-137	< 4.4	-1.6 ± 3.3	< 10.0
SPW-4063	WATER	Jul 1993	Co-60	< 4.0	1.2 ± 2.3	< 10.0
			Cs-134	< 3.7	0.3 ± 1.2	< 10.0
			Cs-137	< 3.2	0.4 ± 3.2	< 10.0
SPAP-4064	AIR FILTER (COMPOSITE)	Jul 1993	Cs-134	< 2.1	0.0 ± 0.0	< 10.0
			Cs-137	< 2.8	0.0 ± 0.0	< 10.0
SPCH-406	CHARCOAL	Jul 1993	I-131	< 0.1	0.0 ± 0.0	< 1.0
	Based on a volume of 300 m^3					
SPW-4233	WATER	Aug 1993	Fe-55	< 506.0	0.0 ± 0.3	< 1000.0
SPM-4235	MILK	Aug 1993	I-131	< 0.1	0.0 ± 0.2	< 1.0
			Cs-134	< 8.1	1.6 ± 1.8	< 10.0
			Cs-137	< 4.2	-1.7 ± 3.4	< 10.0
			Sr-89	< 0.8	-1.0 ± 1.1	< 5.0
			Sr-90	N/A	1.8 ± 0.5	< 1.0
	Low level of Sr-90 concentration in milk (1-5 pCi/L) is not unusual.					
SPW-4241	WATER	Aug 1993	H-3	< 190.0	72.9 ± 99.1	< 300.0
SPW-4243	WATER	Aug 1993	Sr-89	< 1.1	-0.6 ± 0.9	< 5.0
			Sr-90	< 0.7	0.4 ± 0.4	< 1.0
			I-131	< 0.5	0.0 ± 0.1	< 1.0
			Co-60	< 7.0	0.4 ± 3.1	< 10.0
			Cs-134	< 7.6	0.8 ± 15.6	< 10.0
			Cs-137	< 5.4	-0.7 ± 4.2	< 10.0

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

Lab Code	Sample Type	Sample Date	Analyses	Concentration pCi/L[a]. Teledyne Results (4.66 Sigma) LLD	Teledyne Results (4.66 Sigma) Activity[b]	Acceptance Criteria (4.66 Sigma)
SPW-4244	WATER	Aug 1993	U-233/234	< 0.1	0.1 ± 0.1	< 1.0
			U-235	< 0.1	0.0 ± 0.1	< 1.0
			U-238	< 0.1	0.1 ± 0.1	< 1.0
			Th-228	< 0.4	-0.1 ± 0.3	< 1.0
			Th-230	< 0.1	0.0 ± 0.1	< 1.0
			Th-232	< 0.1	0.0 ± 0.0	< 1.0
			Pu-238	< 1.0	0.4 ± 0.7	< 1.0
			Pu-239/240	< 0.3	0.1 ± 0.2	< 1.0
SPW-4245	WATER	Aug 1993	Ra-226	< 0.1	0.0 ± 0.0	< 1.0
			Ra-228	< 0.8	-0.2 ± 0.5	< 1.0
SPW-4422	WATER	Oct 1993	H-3	< 180.0	-27.5 ± 88.9	< 300.0

[a] All results are in pCi/L, except for air filter samples, which are in pCi/Filter.
[b] Prior to 1993, results where reported as only an LLD, the activity reported is the net activity result.

APPENDIX B

DATA REPORTING CONVENTIONS

Data Reporting Conventions

1.0 All activities except gross alpha and gross beta are decay corrected to collection time or the end of the collection period.

2.0 Single Measurements

Each single measurement is reported as follows:

$$x \pm s$$

where x = value of the measurement;

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

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

$$<L$$

where L = the lower limit of detection based on 4.66σ uncertainty for a background sample.

3.0 Duplicate analyses

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

Reported result: $x \pm s$

where $x = (1/2)(x_1 \pm x_2)$

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

3.2 Individual results: $<L_1$

$<L_2$

Reported result: $<L$

where L = lower of L_1 and L_2

3.3 Individual results: $x \pm s$

$<L$

Reported result: $x \pm s$ if $x \geq L$;

$<L$ otherwise

4.0. Computation of Averages and Standard Deviations

4.1 Averages and standard deviations listed in the tables are computed from all of the individual measurements over the period averaged; for example, an annual standard deviation would not be the average of quarterly standard deviations. The average $\bar{x}$ and standard deviation(s) of a set of n numbers $x_1, x_2 \ldots x_n$ are defined as follows:

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

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

4.2 Values below the highest lower limit of detection are not included in the average.

4.3 If all of the values in the averaging group are less than the highest LLD, the highest LLD is reported.

4.4 If all but one of the values are less than the highest LLD, the single value x and associated two sigma error is reported.

4.5 In rounding off, the following rules are followed:

4.5.1. If the figure following those to be retained is less than 5, the figure is dropped, and the retained figures are kept unchanged. As an example, 11.443 is rounded off to 11.44.

4.5.2. If the figure following those to be retained is greater than 5, the figure is dropped and the last retained figure is raised by 1. As an example, 11.446 is rounded off to 11.45.

4.5.3. If the figure following those to be retained is 5, and if there are no figures other than zeros beyond the five, the figure five is dropped, and the last-place figure retained is increased by one if it is an odd number or it is kept unchanged if an even number. As an example, 11.435 is rounded off to 11.44, while 11.425 is rounded off to 11.42.

APPENDIX C

Maximum Permissible Concentrations of Radioactivity in Air and Water Above Background in Unrestricted Areas

Table C-1. Maximum permissible concentrations of radioactivity in air and water above natural background in unrestricted areas[a].

Air		Water	
Gross alpha	3 pCi/m^3	Strontium-89	3,000 pCi/L
Gross beta	100 pCi/m^3	Strontium-90	300 pCi/L
Iodine-131[b]	0.14 pCi/m^3	Cesium-137	20,000 pCi/L
		Barium-140	20,000 pCi/L
		Iodine-131	300 pCi/L
		Potassium-40[c]	3,000 pCi/L
		Gross alpha	30 pCi/L
		Gross beta	100 pCi/L
		Tritium	3×10^6 pCi/L

[a] Taken from Code of Federal Regulations Title 10, Part 20, Table II and appropriate footnotes. Concentrations may be averaged over a period not greater than one year.

[b] From 10 CFR 20 but adjusted by a factor of 700 to reduce the dose resulting from the air-grass-cow-milk-child pathway.

[c] A natural radionuclide.