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REPORT

TO

IOWA ELECTRIC LIGHT AND POWER
CEDAR RAPIDS, IOWA

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM FOR THE DUANE ARNOLD ENERGY CENTER CEDAR RAPIDS, IOWA Docket No. 50-331

ANNUAL REPORT - PART I SUMMARY AND INTERPRETATION JANUARY-DECEMBER 1983

FOR SUBMITTAL TO
THE NUCLEAR REGULATORY COMMISSION

PREPARED AND SUBMITTED
BY
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PROJECT NO. 8001

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PREFACE

The staff members of the Teledyne Isotopes Midwest Laboratory (formerly Hazleton Environmental Sciences) were responsible for the acquisition of data presented in this report. All environmental samples, with the exception of aquatic, were collected by personnel of DAEC. Aquatic samples were collected by Ecological Analysts, Inc. personnel.

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

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1.0 INTRODUCTION

This report summarizes and interprets results of the Environmental Radiological Monitoring Program conducted by Teledyne Isotopes Midwest Laboratory at the Duane Arnold Energy Center, Cedar Rapids, Iowa, during the period January - December, 1983. This Program monitors the levels of radioactivity in the air, terrestrial, and aquatic environments in order to assess the impact of the Plant on its surroundings.

Tabulation of the individual analyses made during the year are not included in this report. These data are included in a reference document (TIML, 1984) available at the Iowa Electric Light and Power Company.

Duane Arnold Energy Center (DAEC) is located in Linn County on the Cedar River, Iowa, and is operated by Iowa Electric Light and Power Company. Duane Arnold Nuclear Station is a 538 MWe boiling water reactor. Initial criticality was attained on 23 March 1974. The reactor reached 100% power on 12 August 1974. Commercial operation began on 1 February 1975.

2.0 SUMMARY

The Environmental Radiological Monitoring Program required by the U.S. Nuclear Regulatory Commission (NRC) Technical Specifications for the Duane Arnold Nuclear Generating Plant is described. Results for 1983 are summarized and discussed.

Program findings show background levels of radioactivity in the environmental samples collected in the vicinity of the Duane Arnold Energy Center. No effect on the environment due to the operation of the Duane Arnold Nuclear Plant is indicated.

3.0 ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM

3.1 Program Design and Data Interpretation

The purpose of the Environmental Radiological Monitoring Program at the Duane Arnold Energy Center (DAEC) is to assess the impact of the plant on its environment. For this purpose, samples are collected from the air, terrestrial, and aquatic environments and analyzed for radioactive content. In addition, ambient gamma radiation levels are monitored by thermoluminescent dosimeters (TLD's).

Sources of environmental radiation include the following:

(1) natural background radiation arising from cosmic rays and primordial radionuclides;

(2) fallout from atmospheric nuclear detonations;

(3) releases from nuclear power plants.

In interpreting the data, effects due to the DAEC operation must be distinguished from those due to other sources.

A major interpretive aid in assessment of these effects is the design of the monitoring program at the DAEC which is based on the indicator-control concept. Most types of samples are collected both at indicator locations (nearby, downwind, or downstream) and at control locations (distant, upwind, or upstream). A station effect would be indicated if the radiation level at an indicator location was significantly larger than that at the control location. The difference would have to be greater than could be accounted for by typical fluctuations in radiation levels arising from other sources.

An additional interpretive technique involves analyses for specific radionuclides present in the environmental samples collected from the DAEC site. The DAEC's monitoring program includes analyses for strontium-89, strontium-90, and iodine-131, which are fission products, and tritium, which is produced by cosmic rays, atmospheric nuclear detonations, and also by nuclear power plants. Most samples are also analyzed for gamma-emitting isotopes with results for the following groups quantified: zirconium-95, cesium-137, and cerium-144. These three gamma-emitting isotopes were selected as radiological impact indicators because of the different characteristic proportions in which they appear in the fission

product mix produced by a nuclear reactor and that produced by a nuclear detonation. Each of the three isotopes is produced in roughly equivalent amounts by a reactor: each constitutes about 10% of the total activity of fission products 10 days after reactor shutdown. On the other hand, 10 days after a nuclear explosion, the contributions of zirconium-95, cerium -144, and cesium-137 to the activity of the resulting debris are in the approximate ratio 4:1:0.03 (Eisenbud, 1963).

The other group quantified consists of niobium-95, ruthenium-103, and -106, cesium-134, barium-lanthanum-140, and cerium-141. These isotopes are released in small quantities by nuclear power plants, but to date their major source of injection into the general environment has been atmospheric nuclear testing. Nuclides of the next group, manganese-54, cobalt-58, and -60, and zinc-65, are activation products and arise from activation of corrosion products. They are typical components of nuclear power plant's effluents, but are not produced in significant quantities by nuclear detonations. Nuclides of the final group, beryllium-7, which is of cosmogenic origin, and potassium-40, a naturally-occuring isotope, were chosen as calibration monitors and should not be considered radiological impact indicators.

Characteristic properties of isotopes quantified in gamma-spectroscopic analyses are presented in Table 5.1. Other means of distinguishing sources of environmental radiation can be employed in interpreting the data. Current radiation levels can be compared with previous levels, including those measured before the Plant became operational. Results of the DAEC's Monitoring Program can be related to those obtained in other parts of the world. Finally, results can be related to events known to cause elevated levels of radiation in the environment, e.g., atmospheric nuclear detonations.

3.2 Program Description

The sampling and analysis schedule for the environmental radiological monitoring program at the DAEC is summarized in Table 5.2 and is briefly reviewed below. Table 5.3 defines the sampling location codes used in Table 5.2 and specifies for each location its type (indicator or control) and its distance, direction, and sector relative to the reactor site. The types of samples collected at each location and the frequency of collections are presented in Table 5.4 using codes defined in Table 5.5.

To monitor the air environment, airborne particulates are collected on membrane filters by continuous pumping at sixteen locations. Also, airborne iodine is collected by continuous pumping through charcoal filters at eight of these locations. Twelve of the sixteen locations

are indicators and four are controls (D-1, D-2, D-12, and D-13). Filters are changed and counted weekly. Particulate filters are analyzed for gross beta activity. If gross beta activity exceeds 10 pCi/m^3, gamma isotopic analysis is performed. Quarterly composites of airborne particulates from each location are analyzed for strontium-89, strontium-90, and gamma scanned on a germanium detector.

Charcoal filters are analyzed for I-131 on two composites: one from locations D-8, D-12, and D-14, and one from locations D-4, D-5, D-7, D-11, and D-15. If iodine-131 is detected, each cartridge is analyzed individually.

Ambient gamma radiation is monitored at fifteen (15) air sampling locations. In addition, gamma radiation is monitored at forty-eight (48) special locations: sixteen (16) in a circle within 0.5 mi radius of the DAEC stack; sixteen (16) in 22.5° sectors within 1 mi of the DAEC stack; and sixteen (16) in 22.5° sectors between 1 and 3 miles of the DAEC stack. The sensors are placed in quintuplicate at each location and are exchanged and analyzed monthly. Additionally, a second set of dosimeters is placed at the same locations and exchanged and analyzed annually.

Precipitation samples are collected monthly from one location and analyzed for gross beta and tritium.

Milk samples are collected monthly from nine locations during the non-grazing season, October through April, and weekly during the grazing season, May 1 through September 30. Two of the locations are control (D-102 and D-105) and the rest are indicators. During the non-grazing season, milk samples from all indicator and all control locations are composited separately, and analyzed for iodine-131. If the level of iodine-131 in any of the composites equals or exceeds 2.4 pCi/l, the milk is resampled from each location and analyzed individually for iodine-131. During the grazing season, milk from five locations within a five mile radius of the DAEC stack (D-63, D-93, D-94, D-101, and D-106) is analyzed individually for iodine-131. Milk from two locations within a ten mile radius of the DAEC stack (D-72 and D-96) and from two control locations (D-102 and D-105) are composited separately and also analyzed for iodine-131. If the level of iodine-131 in any of the composites equals or exceeds 2.4 pCi/l, the milk is resampled and analyzed individually for iodine-131. In addition, monthly composites of weekly collections from each location are analyzed for strontium-89, strontium-90, elemental calcium, and gamma-emitting isotopes.

For additional monitoring of the terrestrial environment, grain, hay, and broad leaf natural vegetation samples are collected annually from eleven locations: two controls (D-102 and D-105) and nine indicators (D-57, D-58, D-63, D-72, D-93, D-94, D-96, D-101, and D-106). Grain and hay are analyzed for gamma-emitting isotopes and broad leaf vegetation is analyzed for iodine-131. Meat and poultry are collected annually during

or immediately following a grazing period from animals fed on crops grown within and outside ten miles of DAEC. The samples are analyzed for gamma-emitting isotopes. A wildlife sample is collected semi-annually within a 10 mile radius of DAEC and analyzed for gamma-emitting isotopes. Also, potable ground water is collected at least every two hours from a treated municipal water system (D-53), daily from the inlet to the municipal water treatment system (D-54), and monthly from five additional ground water locations (D-55, D-57, D-58, D-59, and D-60). The samples are composited into monthly and quarterly composites for each location. Gross beta analysis is performed on all monthly composites. If gross beta activity exceeds 10 pCi/l, gamma isotopic, strontium-89, and strontium-90 analyses are performed. Strontium-89, strontium-90 and tritium analyses are performed on all quarterly composites.

Soil samples are collected three times per year at two control locations (D-102 and D-105) and eleven indicator locations (D-15, D-16, D-57, D-58, D-63, D-72, D-93, D-94, D-96, D-101, and D-106). The samples are analyzed for strontium-90 and gamma-emitting isotopes.

Surface water is collected monthly from seven river and pond locations, two control (D-49 and D-73) and five indicator (D-50, D-51, D-52, D-99, and D-103). All monthly samples are analyzed for gross beta and gamma-emitting isotopes. If gross beta activity exceeds 10 pCi/l the samples are analyzed for strontium-89 and strontium-90. Tritium, strontium-89, and strontium-90 analyses are performed on quarterly composites from each location.

The aquatic environment is also monitored by upstream and downstream (D-49 and D-61) quarterly collections of aquatic biota (periphyton) and semi-annual collections of fish and river sediment. River sediment is also collected at the plant's intake and discharge (D-50 and D-51). Fish and aquatic biota are analyzed for gamma-emitting isotopes. River sediment is analyzed for strontium-90 and gamma-emitting isotopes.

3.3 Program Execution

The program was executed as described in the preceding section with the following exceptions:

(1) TLD data for several locations was not available for some months because TLDs were stolen, destroyed by either animals or vandals, or lost in the field. The lost TLDs are listed below.

Location	Month Lost
D-13,36	January
D-13	February
D-27,44	March
D-9,14,44	April
D-22,42,76,84	May
D-1,45,78,83	June
D-42	October
D-91	November
D-13	December

(2) No annual TLD data was available for locations D-13, D-16, and D-42 because they were lost in the field.

(3) No air particulates were available for analyses from locations D-1 thru D-14 and D-16 for the collection period ending 11-10-83 because they were lost in transit.

(4) No charcoal cartridges were available for analyses from locations D-4, D-5, D-7, D-8, D-11, D-12, and D-14, for the collection period ending 11-10-83 because they were lost in transit.

(5) No air particulates were available for analyses from locations D-9 and D-16 for the collection periods ending 12-22 and 12-29-83 because pump vanes were frozen.

(6) No air particulate and charcoal were available for analyses from location D-14 for the collection period ending 12-09-83 because of blown fuse.

(7) No air particulates and charcoal were available for analyses from location D-15 for the collection period from 10-05 thru 12-09-83 because electricity was shut off, due to relocation of sampler.

(8) No air particulate was available for analysis from location D-16 for the collection period ending 8-10-83 because electricity was shut off.

(9) No well water was collected from location D-60 in January 1983 because the well was shut off.

3.4 Laboratory Procedures

All strontium-89, strontium-90, and iodine-131 analyses in milk were made by using a sensitive radiochemical procedure which involves separation of the element of interest by use of an ion-exchange resin and subsequent beta counting.

All gamma-spectroscopic analyses were performed with high resolution germanium detectors. Levels of iodine-131 in natural vegetation were determined by germanium spectrometry. Levels of airborne iodine-131 in charcoal samples were measured by germanium spectrometry.

Tritium levels were determined by the liquid scintillation technique.

Analytical Procedures used by the TIML are specified in detail elsewhere (HES, 1981). Procedures are based on those prescribed by the National

Center for Radiological Health of the U.S. Public Health Service (U. S. Public Health Service, 1967) and by the Health and Safety Laboratory of the U. S. Atomic Energy Commission (U. S. Atomic Energy Commission, 1972).

Details of TIML's QA Program are presented elsewhere (Hazleton Environmental Sciences, 1982 under revision). The TIML QA Program includes participation in laboratory intercomparison (crosscheck) programs. Results obtained in crosscheck programs are presented in Appendix A.

3.5 Program Modifications

Effective in July, 1983, strontium-89 and strontium-90 analyses were performed on all quarterly composites of surface water and ground water. Composites of the first and second quarters of 1983 were retrieved from storage and analyzed.

Also, in July, 1983, gamma isotopic analyses for milk samples were performed on monthly composites rather than on individual weekly samples.

4.0 RESULTS AND DISCUSSION

All of the scheduled collections and analyses were made except those listed in Table 5.6.

All results are summarized in Table 5.7 in a format recommended by the Nuclear Regulatory Commission in Regulatory Guide 4.8. For each type of analysis of each sampled medium, this table lists the mean and range of all indicator and control locations. The locations with the highest mean and range are also shown.

The tabulated results of all measurements made in 1983 are not included in this section, although references to these results will be made in the discussion. The complete tabulation of the 1983 results is contained in Part II of the 1983 annual report on the Environmental Radiological Monitoring Program for the Duane Arnold Energy Center.

4.1 The Effect of Chinese Atmospheric Nuclear Detonation

There were no reported atmospheric nuclear tests in 1983. The last reported test was conducted by the People's Republic of China on 16 October 1980. The reported yield was in the 200 kiloton to 1 megaton range.

4.2 Program Findings

Results obtained show background levels of radioactivity in the environmental samples collected in 1983. The residual effect of previous nuclear tests was detected in some of the milk, vegetation, and soil samples (strontium-90 and cesium-137). No Plant effect was indicated.

Airborne Particulates

The average annual gross beta activity in airborne particulates was nearly identical at both indicator and control locations (0.022 and 0.024 pCi/m^3, respectively) and was about the same as in 1982 (0.026 pCi/m^3). The highest averages for gross beta were for the month of December and the fourth quarter.

The spring peak, which is usually observed in April - May (second quarter), was not evident in 1983.

This peak has been observed almost annually (1976, 1979 and 1980 were also exceptions) for many years (Wilson et al., 1969). The spring peak has been attributed to fallout of nuclides from the stratosphere (Gold et al., 1964).

Two pieces of evidence indicate conclusively that the elevated observed activity during the fourth quarter was not attributable to the Plant. In the first place, elevated activity of similar size occurred simultaneously at both the indicator and control locations. Secondly, a similar pattern was observed at other nuclear power plant locations in the Midwest.

Strontium-89 and -90 levels were below their respective LLDs in all samples.

Except for beryllium-7, which is produced continuously in the upper atmosphere by cosmic-ray interactions (Arnold and Al-Salih, 1955), all other gamma-emitting isotopes were below their respective LLD levels. None of the activities detected were attributable to the Plant operation.

Airborne Iodine

Airborne iodine-131 results were below the detection limits of 0.006 pCi/m^3 for all indicator locations and below 0.01 pCi/m^3 for all control locations.

Ambient Radiation (TLD's)

The mean monthly doses as measured by the monthly TLDs measured 3.6±0.6 mR/30 days at indicator locations and 3.4±0.5 mR/30 days at control locations. Annual TLDs, normalized to 30 days, yielded 4.6±0.5 mR/30 days and 4.0 ±0.8 mR/30 days for indicator and control locations, respectively. Since standard deviations were larger than the differences, the differences are not statistically significant. No Plant effect was indicated.

Precipitation

Gross beta levels varied widely indicating the relationship between the level of activity and amount of rainfall, and ranged from 2.3 to 32.4 pCi/l. Tritium was below the LLD of 330 pCi/l in all samples. No Plant effect was indicated.

Milk

Iodine-131 results were below the detection limit of 0.4 pCi/l in all samples.

Strontium-89 was below the LLD level of 5 pCi/l in all samples.

Strontium-90 activity was detected in all samples and was nearly identical at both indicator locations (2.3 pCi/l) and control locations (2.4 pCi/l), ranging from 0.7 pCi/l to 6.3 pCi/l. The activity and range were similar to those observed in 1980, 1981, and 1982. Strontium-90 levels in this range are attributable to worldwide fallout from previous atmospheric nuclear tests, and reflect the long half-life (28.64 years) of this isotope. Cesium-137 results were below the LLD level of 15 pCi/l in all samples. Cesium-137 is also a long-lived component (with a half-life of 30.24 years) of worldwide fallout and is found in the environment in trace amounts. The apparent absence of the effect of the latest nuclear test (October 1980) on strontium-90 and cesium-137 results is consistent with the low initial production of these isotopes in nuclear explosions (Eisenbud, 1963). No other gamma-emitting isotopes, except potassium-40, were detected in any milk samples. This is consistent with the finding of the National Center for Radiological Health that most radiocontaminants in feed do not find their way into milk due to the selective metabolism of the cow. The common exceptions are radioisotopes of potassium, cesium, strontium, barium, and iodine (National Center for Radiological Health, 1968). Calcium was measured in all samples and ranged from 0.8 g/l to 1.6 g/l, averaging 1.2 g/l. The measured concentrations of calcium are in agreement with the published national values (National Center for Radiological Health, 1968).

In summary, the milk data for 1983 show no radiological effects of the Plant operation, but the presence of strontium-90 in milk samples does exhibit a long range residual effect of previous atmospheric nuclear tests.

Ground Water

Ground water samples were analyzed monthly for gross beta activity. Quarterly composites were also analyzed for gross beta (for the first and second quarters only) and for tritium. The annual mean for gross beta in monthly measurements (3.3 pCi/l) was similar to the mean in quarterly measurements (3.5 pCi/l). The location with the highest mean, 6.1 pCi/l, was D-59, Frantz Cottage, 0.5 mi distant from DAEC. The levels were similar to those observed in 1980, 1981 and 1982. Tritium was below the LLD level of 330 pCi/l in all samples. There was no indication of a Plant effect.

Meat and Poultry

In meat and poultry, naturally-occurring potassium-40 was the only gamma-emitting isotope detected. All other gamma-emitting isotopes were below their respective LLD's. Thus, no Plant effect was indicated.

Wildlife

In wildlife samples (opossum and woodchuck), collected on the site, the only gamma-emitting isotope detected was naturally-occurring potassium-40. The average activity was 3.42 pCi/g wet weight. No Plant effect was indicated.

Vegetation

Iodine-131 results in broad leaf vegetation were below the LLD level of 0.096 pCi/g wet weight in all samples. In corn, strontium-90 activity was below the LLD level of 0.006 pCi/g wet weight in all samples. In hay, strontium-90 was detected in all samples and was slightly higher at indicator locations (0.179 pCi/g wet weight) than at control locations (0.145 pCi/g wet weight). In soy beans and oats, strontium-90 was also detected in all samples and was also slightly higher at indicator locations (0.021 pCi/g wet weight) than at control (0.014 pCi/g wet weight) locations. Presence of strontium-90 in hay and soy beans is attributable to the fallout from nuclear tests. No Plant effect was indicated.

Except for potassium-40, which was observed in all samples, all other gamma-emitting isotopes were below detection limits in all samples. No Plant effect was indicated.

Soil

Strontium-90 was detected in all soil samples and averaged 0.09 pCi/g dry weight for indicator locations and 0.10 pCi/g dry weight for control locations. The difference is not statistically significant.

The predominant gamma-emitting isotope detected was potassium-40. The measured activity was nearly identical at both indicator and control locations (11.47 pCi/g dry weight and 11.56 pCi/g dry weight, respectively).

Cesium-137 was detected in all samples and the activity was similar at both the indicator locations (0.34 pCi/g dry weight) and the control locations (0.40 pCi/g dry weight).

Presence of strontium-90 and cesium-137 in soil is attributable to the fallout from previous nuclear tests in the atmosphere. No Plant effect was indicated.

Surface Water

Mean gross beta activity was slightly higher at indicator locations (5.2 pCi/l) than at the control locations (3.3 pCi/l) and was similar to that observed in 1980, 1981, and 1982. The difference is not statistically significant. Tritium was below the LLD level of 330 pCi/l in all samples. Strontium -89 and strontium-90 were below the LLD levels of 10 pCi/l and 2.0 pCi/l, respectively, in all samples. No gamma-emitting isotopes were detected in any of the samples analyzed. No Plant effect on surface water was indicated.

Fish

All gamma-emitting isotopes, except naturally-occuring potassium-40, in edible portions were below detection limits. No Plant effect on fish was indicated.

Periphyton

Periphyton samples were collected in February, May, August, and November. All gamma-emitting isotopes, except potassium-40, were below detection limits. No Plant effect was indicated.

River Sediments

River sediments were collected in May and November and analyzed for strontium-90 and gamma-emitting isotopes. Strontium-90 results were below the LLD level of 0.015 pCi/g dry weight in all samples. All gamma-emitting isotopes, except potassium-40, were below detection limits in all samples. There was no indication of Plant effect.

5.0 Tables

Table 5.1 Characteristic properties of isotopes quantified in gamma-spectroscopic analyses.

Designation	Comment	Isotope	Half-life[a]
I. Naturally occurring			
A. Cosmogenic	Produced by interaction of cosmic rays with atmosphere	Be-7	53.2 d
B. Terrestrial	Primordial	K-40	1.26×10^9 y
II. Fission Products[b]	Nuclear detonations constitute the major environmental source		
A. Short-lived		I-131	8.04 d
		Ba-140	12.8 d
B. Other than short-lived		Nb-95	35.15 d
		Zr-95	65 d
		Ru-103	39.35 d
		Ru-106	368.2 d
		Cs-134	2.061 y
		Cs-137	30.174 y
		Ce-141	32.5 d
		Ce-144	284.31 d
III. Activation Products	Typically found in nuclear power plant effluents	Mn-54	312.5 d
		Co-58	70.78 d
		Co-60	5.26 y
		Zn-65	245 d

[a] Half-lives are taken from Appendix E of Environmental Quarterly, 1 January 1978, EML-334 (U. S. Department of Energy, 1978).
[b] Includes fission-product daughters.

Table 5.2. Sample collection and analysis program, 1983.

Medium	Locations No.	Locations Codes[a] or Description	Collection Type/ Frequency[b]	Analysis[c]
Airborne Particulates	16	D-1-16	C/W	GB (GS if GB >10 pCi/m^3)
	16	D-1-16	QC of above	GS, Sr-89,-90
Airborne Iodine	2	Comp. (D-8,12,14) Comp. (D-4,5,7,11,15)	C/W	I-131 (Individual analysis if I-131 is detected)
Ambient Radiation	63	D-1,2,3,4,6-48 76-91	C/M	Ambient gamma
	63	D-1,2,3,4,6-48 76-91	C/A	Ambient gamma
Precipitation	1	Onsite	M	GB, H-3
Milk	2	Comp. (D-63,72,93,94, 96,101,106) Comp. (D-102, 105)	Monthly (during non grazing season)	I-131 (Resample and analyze individually if I-131 $\geq$2.4 pCi/l)
	5	D-63,93,94,101,106	Weekly (during grazing season)	I-131
	2	Comp. (D-72,96) Comp. (D-102,105)	Weekly (during grazing season)	I-131 (Resample and analyze individually for I-131 if I-131 >2.4 pCi/l)
	9	D-63,72,93,94,96,101, 102,105,106	MC of weekly collections	GS, Sr-89,-90, Ca

Table 5.2. (continued)

Medium	Locations No.	Locations Codes[a] or Description	Collection Type/ Frequency[b]	Analysis[c]
Ground Water	1	D-53	G/H	
	1	D-54	G/D	
			MC of above	GB (GS, Sr-89, -90 if GB >10 pCi/l)
			QC of above	H-3, Sr-89,-90
	5	D-55,57,58,59,60	G/M	GB (GS, Sr-89, -90 if GB >10 pCi/l)
			QC of above	H-3, Sr-89,-90
Meat and Poultry	6	From animals fed on crops grown within 10 miles of DAEC and outside 10 miles	Annually during or immediately following grazing season	GS (On edible portions)
Wildlife	1	Inside 10 mile radius of plant	Semi-Annually	GS on flesh
Vegetation	11	D-57,58,63,72,93,94,96, 101,102,105,106	Annually at harvest time One sample each, grain and broad leaf vegetation	GS and Sr-90 (On edible portion on grain samples) I-131 (broad leaf vegetation)
Soil	13	D-15,16,57,58,63,72, 93,94,96,101,102, 105,106	3 times per year	GS, Sr-90

Table 5.2. (continued)

Medium	Locations No.	Locations Codes[a] or Description	Collection Type/ Frequency[b]	Analysis[c]
Surface Water	7	D-49-52,73,99,103	G/M	GB, GS (Sr-89,-90 if GB > 10pCi/l)
			QC of above	H-3, Sr-89,-90
Fish	2	D-49,61	1 sample per 6 months (ESM)	GS (On edible portions)
Aquatic Biota (periphyton)	2	D-49,61	Quarterly (as available)	GS
River Sediment	4	D-49,50,51,61	ESM or SA	GS, Sr-90

[a] Location codes are defined in Table 5.3. Control stations are indicated by a (C). All other stations are indicators.

[b] Collection type is coded as follows: C/ = continuous, G/ = grab. Collection frequency is coded as follows: H = hourly, D = daily, W = weekly, M = monthly, Q = quarterly, SA = semi-annually, ESM = every six months.

[c] Analysis type is coded as follows: GB = gross beta, GS = gamma spectroscopy, H-3 = tritium, Sr-89 = strontium-89, Sr-90 = strontium-90, I-131 = iodine 131. Analysis frequency is coded as follows: MC = monthly composite, QC = quarterly composite.

Table 5.3 Sampling locations, Duane Arnold Energy Center.

Code	Type[a]	Sampling Location		
		Sampling Point	Location Description	Distance and Direction from Site Stack
D-1	C	1	Cedar Rapids	11 mi @ 135° SE
D-2	C	2	Marion	11 mi @ 125° SE
D-3		3	Hiawatha	7 mi @ 130° SE
D-4		4	Johnson	3 mi @ 140° SE
D-5		5	Palo	3 mi @ 200° SW
D-6		6	Center Point	7 mi @ 0° N
D-7		7	Shellsburg	6 mi @ 255° W
D-8		8	Urbana	9 mi @ 345° NW
D-9		9	Route W26	7 mi @ 295° NW
D-10		10	Atkins	8 mi @ 210° SW
D-11		11	Toddville	4 mi @ 90° E
D-12	C	12	Iowa City	25 mi @ 160° S
D-13	C	13	Alburnett	8 mi @ 70° NE
D-14		14	Alice Substation	7 mi @ 35° NE
D-15		15	On-site, North	0.5 mi @ 305° NW
D-16		16	On-site, South	0.5 mi @ 190° S
D-17		17		0.5 mi N
D-18		18		0.5 mi NE
D-19		19		0.5 mi NE
D-20		20		0.5 mi NE
D-21		21		0.5 mi E
D-22		22		0.5 mi SE
D-23		23		0.5 mi SE
D-24		24		0.5 mi S
D-25		25		0.5 mi SW
D-26		26		0.5 mi SW
D-27		27		0.5 mi SW
D-28		28		0.5 mi SW
D-29		29		0.5 mi SW
D-30		30		0.5 mi W
D-31		31		0.5 mi NW
D-32		32		0.5 mi NW
D-33		33		3.0 mi N
D-34		34		3.0 mi NE
D-35		35		3.0 mi NE
D-36		36		3.0 mi NE
D-37		37		3.0 mi E
D-38		38		3.0 mi SE
D-39		39		3.0 mi SE
D-40		40		3.0 mi SE
D-41		41		3.0 mi S
D-42		42		3.0 mi SW
D-43		43		1.0 mi SW

Table 5.3 (continued)

Code	Type[a]	Sampling Location		
		Sampling Point	Location Description	Distance and Direction from Site Stack
D-44		44		1.0 mi SW
D-45		45		1.0 mi SW
D-46		46		1.0 mi W
D-47		47		1.0 mi NW
D-48		48		1.0 mi NW
D-49	C	49	Lewis access, upstream of DAEC	
D-50		50	Plant Intake	
D-51		51	Plant Discharge	
D-52		52	Cedar Rapids City Park	7.5 mi SE
D-53		53	Treated Municipal Water	
D-54		54	Inlet to Municipal Water Treatment System	
D-55		55	On-site Well	
D-57		57	Bull (Off-site well)	
D-58		58	Frantz Farm, 0.5 mi of DAEC	
D-59		59	Frantz Cottage, 0.5 mi of DAEC	
D-60		60	Wiley, Off-site within 1.0 mi of DAEC	
D-61		61	One-half mile downstream of plant discharge	
D-63		63	Andrews Farm, 1.5 mi NW	
D-72		72	Van Note Farm, within 2 miles of site, SW	
D-73	C	73	Hansen Farm, within 22 miles of site	
D-76		76		0.5 mi NE
D-77		77		0.5 mi NE
D-78		78		0.5 mi NE
D-79		79		0.5 mi E
D-80		80		0.5 mi SE
D-81		81		0.5 mi SE

Table 5.3 (continued)

Code	Type[a]	Sampling Location		
		Sampling Point	Location Description	Distance and Direction from Site Stack
D-82		82		0.5 mi SE
D-83		83		0.5 mi S
D-84		84		0.5 mi SW
D-85		85		0.5 mi SW
D-86		86		0.5 mi SW
D-87		87		0.5 mi SW
D-88		88		0.5 mi W
D-89		89		0.5 mi W
D-90		90		0.5 mi NW
D-91		91		0.5 mi N
D-93		93	Yarborough Farm	2.8 mi of site, NW
D-94		94	Hines Farm	2.7 mi NE
D-96		96	Keiper Farm	7.5 mi SW
D-99		99	Pleasant Creek	2.2 mi NW
D-101		101	Flecksing Farm	4.0 mi NE
D-102	C	102	McCardle Farm	20.0 mi NW
D-103		103	Park Pond	1.5 mi E
D-105	C	105	Schulte Farm	21.3 mi SW
D-106		106	David R. Stallman	4.5 mi SE

[a]"C" denotes control location. All other locations are indicators.

Table 5.4 Type and frequency of collection.

Location	Loc. Type[a]	Weekly	Monthly	Quarterly	Semi-Annually	Annually
D-1	C	AP	TLD			TLD
D-2	C	AP	TLD			TLD
D-3		AP	TLD			TLD
D-4		AP,AI	TLD			TLD
D-5		AP,AI				
D-6		AP	TLD			TLD
D-7		AP,AI	TLD			TLD
D-8		AP,AI	TLD			TLD
D-9		AP	TLD			TLD
D-10		AP	TLD			TLD
D-11		AP,AI	TLD			TLD
D-12	C	AP,AI	TLD			TLD
D-13	C	AP	TLD			TLD
D-14		AP,AI	TLD			TLD
D-15		AP,AI	TLD	SO[b]		TLD
D-16		AP	TLD	SO[b]		TLD
D-17-48			TLD			TLD
D-49	C		SW	SL	F,BS	
D-50			SW		BS	
D-51			SW		BS	
D-52			SW			
D-53			WW[c]			
D-54			WW[d]			
D-55			WW			
D-57			WW	SO[b]		G[e]
D-58			WW	SO[b]		G[e]
D-59			WW			
D-60			WW			
D-61				SL	F,BS	
D-63			M[f]	SO[b]		G[e]
D-72			M[f]	SO[b]		G[e]
D-73	C		SW			
D-76-91			TLD			TLD
D-93			M[f]	SO[b]		G[e]
D-94			M[f]	SO[b]		G[e],ME
D-96			M[f]	SO[b]		G[e]
D-99			SW			

Table 5.4 (continued)

Location	Loc. Type[a]	Weekly	Monthly	Quarterly	Semi-Annually	Annually
D-101			M[f]	SO[b]		G[e]
D-102	C		M[f]	SO[b]		G[e],ME
D-103			SW			
D-105	C		M[f]	SO[b]		G[e]
D-106			M[f]	SO[b]		G[e]
On-site			P			
Inside 10 mile radius of Plant						ME,WL
Outside 10 mile radius of Plant	C					ME

[a] Control locations are indicated by a "C" in this column. All other locations are indicators.
[b] Soil is collected three times per year.
[c] Collected hourly and composited monthly and quarterly.
[d] Collected daily and composited monthly and quarterly.
[e] Vegetation (G) includes broad leaf vegetation and grain.
[f] Monthly from October through April; weekly from May through September.

Table 5.5 Sample codes used in Table 5.4.

Code	Description
AP	Airborne Particulates
AI	Airborne Iodine
TLD	Thermoluminescent Dosimeter
P	Precipitation
M	Milk
WW	Well Water
G	Vegetation (broad leaf and grain)
ME	Meat and Poultry
SO	Soil
SW	Surface Water
F	Fish
SL	Periphyton (aquatic biota)
BS	River Sediment
WL	Wildlife

Table 5.6 Missed collections and analyses, 1983, DAEC.

Sample	Analysis	Location	Collection Date or Period	Comments
TLD		D-13,36	January	Lost in the field
		D-13	February	Lost in the field
		D-27,44	March	Lost in the field
		D-9,14,44	April	Lost in the field
		D-22,42, 76,84	May	Lost in the field
		D-1,45,78,83	June	Lost in the field
		D-42	October	Lost in the field
		D-91	November	Lost in the field
		D-13	December	Lost in the field
		D-13,16,42	Jan-Dec, 1983	Lost in the field
Air Particulates	Gross beta	D-1 thru D-14, D-16	11-10-83	Lost in transit
Charcoal	I-131	D-4,5,7,8,11 12,14	11-10-83	Lost in transit
Air Particulates	Gross beta	D-9,16	12-22-83 12-29-83	Frozen vanes Frozen vanes
Air particulates	Gross beta	D-14	12-09-83	Blown fuse
Charcoal	I-131	D-14	12-09-83	Blown fuse
Air Particulates	Gross beta	D-15	10-05 thru 12-09-83	No electricity
Charcoal	I-131	D-15	10-05 thru 12-09-83	No electricity
Air Particulates	Gross beta	D-16	8-10-83	No electricity
Well Water	Gross beta	D-60	Jan., 1983	Well shut off for winter

Table 5.7 Environmental Radiological Monitoring Program Summary.
Name of facility Duane Arnold Energy Center Docket No. 50-331
Location of facility Linn, Iowa Reporting period January-December 1983
(County, state)

Sample Type (Units)	Type and Number of Analyses[a]		LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean Location[d]	Mean(F) Range	Control Locations Mean(F) Range	Number of Non-routine Results[e]
Airborne Particulates (pCi/m^3)	GB	801	0.001[f]	0.022 (597/597) (0.002-0.071)	D-10, Atkins 8 mi @ 210° SW D-13, Alburnett 8 mi @ 70° NE	0.025 (51/51) (0.011-0.067) 0.025 (51/51) (0.012-0.066)	0.024 (204/204) (0.007-0.066)	0
	Sr-89	64	0.0051	<LLD	-	-	<LLD	0
	Sr-90	64	0.0020	<LLD	-	-	<LLD	0
	GS	64						
	Be-7		0.096	0.129 (12/48) (0.097-0.178)	D-3, Hiawatha 7 mi @ 130° SE	0.174 (1/4) -	0.152 (4/16) (0.120-0.192)	0
	Nb-95		0.015	<LLD	-	-	<LLD	0
	Zr-95		0.016	<LLD	-	-	<LLD	0
	Ru-103		0.013	<LLD	-	-	<LLD	0
	Ru-106		0.038	<LLD	-	-	<LLD	0
	Cs-134		0.0054	<LLD	-	-	<LLD	0
	Cs-137		0.0049	<LLD	-	-	<LLD	0
	Ce-141		0.019	<LLD	-	-	<LLD	0
	Ce-144		0.024	<LLD	-	-	<LLD	0
Airborne Iodine (pCi/m^3)	I-131	102						
(D-4,5,7,11&15 composite)		51	0.006	<LLD	-	-	<LLD	0
(D-8,12&14 composite)		51	0.01	<LLD	-	-	<LLD	0

Table 5.7 (continued)
Name of facility Duane Arnold Energy Center

Sample Type (Units)	Type and Number of Analyses[a]		LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean Location[d]	Mean(F) Range	Control Locations Mean(F) Range	Number of Non-routine Results[e]
TLD Monthly (mR/30 days)	Gamma	737	1	3.6 (693/693) (2.0-7.3)	D-15, 0.5 mi W	4.7 (12/12) (2.9-6.7)	3.4 (44/44) (2.6-4.9)	0
TLD-Annual (mR/365 days)	Gamma	60	1	56.4 (57/57) (37.2-79.2)	D-90, 0.5 mi NW	79.2 (1/1) -	48.2 (3/3) (45.2-50.5)	0
TLD-Annual Normalized to 30 days (mR/30 days)	Gamma	60	1	4.6 (56/56) (3.1-6.5)	D-90, 0.5 mi NW	6.5 (1/1)	4.0 (3/3) (3.7-4.2)	0
Precipitation (pCi/l)	GB	12	1.0	11.6 (12/12) (2.3-32.4)	On-site	11.6 (12/12) (2.3-32.4)	None	0
	H-3	12	330	<LLD	-	-	None	0
Milk (pCi/l)	I-131	169	0.4	<LLD	-	-	<LLD	0
	Sr-89	40	5	<LLD	-	-	<LLD	0
	Sr-90	40	0.59	2.3 (30/30) (0.7-6.3)	D-93, Yarborough Farm 2.8 mi of site NW	4.1 (5/5) (2.8-6.3)	2.4 (10/10) (1.8-3.5)	0
	GS	98						
	K-40		100	1420 (79/79) (940-2070)	D-101, Flecksing Farm 4.0 mi NE	1780 (12/12) (1570-2070)	1330 (19/19) (1030-1620)	0
	Cs-137		15	<LLD	-	-	<LLD	0
	Ba-La-140		15	<LLD	-	-	<LLD	0
(g/l)	Ca	45	0.1	1.2 (35/35) (0.8-1.6)	D-63, Andrews Farm 1.5 mi of site NW D-105, Schulte Farm 21.3 mi SW D-106, Stallman Farm 4.5 mi SE	1.3 (5/5) (1.1-1.6) 1.3 (5/5) (1.2-1.8) 1.3 (5/5) (1.1-1.6)	1.2 (10/10) (1.0-1.8)	0
Ground Water (pCi/l) (monthly)	Gross Beta	83	0.9	3.3 (76/83) (0.9-21.5)	D-59, Frantz Cottage 0.5 mi of DAEC	6.1 (12/12) (3.1-21.5)	None	0
Ground Water (pCi/l) (quarterly comp.)	Gross Beta	14	0.5	3.5 (11/14) (1.5-6.9)	D-58, Frantz Farm 0.5 mi of DAEC	6.8 (2/2) (6.7-6.9)	None	0
	H-3	28	330	<LLD	-	-	None	0

Table 5.7 (continued)
Name of facility Duane Arnold Energy Center

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean		Control Locations Mean(F) Range	Number of Non-routine Results[e]
				Location[d]	Mean(F) Range		
Meat and Poultry (pCi/g wet)	GS 6						
	K-40	1.0	3.17 (3/3) (2.39-4.19)	D-94 Hines Farm 2.7 mi NE	4.19 (1/1) -	2.27 (3/3) (1.85-2.65)	0
	Mn-54	0.046	<LLD	-	-	<LLD	0
	Co-58	0.071	<LLD	-	-	<LLD	0
	Co-60	0.053	<LLD	-	-	<LLD	0
	Cs-134	0.044	<LLD	-	-	<LLD	0
	Cs-137	0.046	<LLD	-	-	<LLD	0
	Other gammas	0.41	<LLD	-	-	<LLD	0
Wildlife (pCi/g wet)	GS 2						
	K-40	1.0	3.42 (2/2) (3.36-3.48)	Inside 10 miles of plant	3.42 (2/2) (3.36-3.48)	None	0
	Mn-54	0.055	<LLD	-	-	None	0
	Co-58	0.089	<LLD	-	-	None	0
	Co-60	0.053	<LLD	-	-	None	0
	Cs-134	0.054	<LLD	-	-	None	0
	Cs-137	0.062	<LLD	-	-	None	0
	Other gammas	0.54	<LLD	-	-	None	0
Broad Leaf Vegetation (pCi/g wet)	I-131 11	0.096	<LLD	-	-	<LLD	0

Table 5.7 (continued)
Name of facility Duane Arnold Energy Center

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean Location[d]	Mean(F) Range	Control Locations Mean(F) Range	Number of Non-routine Results[e]
Vegetation-Corn (pCi/g wet)	Sr-90 8	0.006	<LLD	-	-	<LLD	0
	GS 8						
	K-40	0.5	2.91 (6/6) (2.35-3.73)	D-96, Keiper Farm 7.5 mi SW	3.73 (1/1) -	2.92 (2/2) (2.88-2.97)	0
	Cs-134	0.036	<LLD	-	-	<LLD	0
	Cs-137	0.041	<LLD	-	-	<LLD	0
	Other gammas	0.32	<LLD	-	-	<LLD	0
Vegetation-Hay (pCi/g wet)	Sr-90 7	0.050	0.179 (6/6) (0.086-0.300)	D-96, Keiper Farm 7.5 mi SW	0.300 (1/1) -	0.145 (1/1) -	0
	GS 7						
	K-40	0.5	8.82 (6/6) (5.27-11.60)	D-105, Schulte Farm 21.3 mi SW	13.76 (1/1) -	13.76 (1/1)	0
	Cs-134	0.072	<LLD	-	-	<LLD	0
	Cs-137	0.082	<LLD	-	-	<LLD	0
	Other gammas	0.57	<LLD	-	-	<LLD	0
Vegetation - Soybeans, Oats (pCi/g wet)	Sr-90 6	0.006	0.021 (4/4) (0.009-0.033)	D-72, Van Note Farm, within 2 mi Offsite SW	0.033 (1/1) -	0.014 (2/2) (0.013-0.014)	0
	GS 6						
	K-40	0.5	7.57 (4/4) (3.66-14.9)	D-96, Keiper Farm 7.5 mi SW	14.90 (1.1) -	10.57 (2/2) (7.74-13.40)	0
	Cs-134	0.056	<LLD	-	-	<LLD	0
	Cs-137	0.053	<LLD	-	-	<LLD	0
	Other gammas	0.047	<LLD	-	-	LLD	0

Table 5.7 (continued)
Name of facility Duane Arnold Energy Center

Sample Type (Units)	Type and Number of Analyses[a]		LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean Location[d]	Location with Highest Annual Mean Mean(F) Range	Control Locations Mean(F) Range	Number of Non-routine Results[e]
Soil (pCi/g dry)	Sr-90	39	0.01	0.092 (33/33) (0.026-0.218)	D-63, Andrews Farm 1.5 mi NW	0.151 (3/3) (0.057-0.218)	0.102 (6/6) (0.061-0.151)	0
	GS	39						
	K-40		0.5	11.47 (33/33) (7.75-16.80)	D-105, Schulte Farm 21.3 mi SW	14.27 (3/3) (12.50-1780)	11.56 (6/6) (7.69-17.36)	0
	Mn-54		0.072	<LLD	-	-	<LLD	0
	Co-58,-60		0.10	<LLD	-	-	<LLD	0
	Nb-95		0.30	<LLD	-	-	<LLD	0
	Zr-95		0.20	<LLD	-	-	<LLD	0
	Cs-134		0.12	<LLD	-	-	<LLD	0
	Cs-137		0.10	0.34 (33/33) (0.10-0.70)	D-63, Andrews Farm 1.5 mi NW	0.55 (3/3) (0.26-0.70)	0.40 (6/6) (0.29-0.55)	0
	Other gammas		0.69	<LLD	-	-	<LLD	0
Surface Water (pCi/l)	GB	84	1.0	5.2 (60/60) (1.7-21.1)	D-99, Pleasant Creek 2.2 mi NW	8.0 (12/12) (5.5-21.1)	3.3 (24/24) (1.4-7.0)	0
	H-3	28	330	<LLD	-	-	<LLD	0
	Sr-89	28	10[h]	<LLD	-	-	<LLD	0
	Sr-90	28	2.0	<LLD	D-99, Pleasant Creek 2.2 mi NW	2.0 (1/4) -	<LLD	0
	GS	84						
	Mn-54		15	<LLD	-	-	<LLD	0
	Co-58,-60		15	<LLD	-	-	<LLD	0
	Zr-Nb-95		37	<LLD	-	-	<LLD	0
	Cs-134		15	<LLD	-	-	<LLD	0
	Cs-137		15	<LLD	-	-	<LLD	0

Table 5.7 (continued)
Name of facility Duane Arnold Energy Center

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean Location[d]	Location with Highest Annual Mean Mean(F) Range	Control Locations Mean(F) Range	Number of Non-routine Results[e]
Fish (Edible portion) (pCi/g wet)	GS 15						
	K-40	0.5	2.77 (7/7) (2.17-3.81)	D-61, 0.5 miles Downstream of Plant Discharge	3.07 (8/8) (2.39-4.10)	3.07 (8/8) (2.39-4.10)	0
	Mn-54	0.078	<LLD	-	-	<LLD	0
	Co-58,-60	0.089	<LLD	-	-	<LLD	0
	Cs-134,-137	0.064	<LLD	-	-	<LLD	0
	Other gammas	0.43	<LLD	-	-	<LLD	0
Periphyton (pCi/g wet)	GS 8						
	K-40	1.0[i]	6.73 (4/4) (1.24-12.90)	D-49, Lewis Access Upstream of DAEC	15.30 (2/4) (8.31-22.30)	15.30 (2/4) (8.31-22.30)	0
	Cs-134	1.70	<LLD	-	-	<LLD	0
	Cs-137	1.55	<LLD			<LLD	0
	Other gammas	14.26	<LLD	-	-	<LLD	0
River Sediments (pCi/g dry)	Sr-90 9	0.015	<LLD	-	-	<LLD	0
	GS 9						
	K 40	1.0	8.25 (6/6) (6.78-9.99)	D-49, Lewis Access Upstream of DAEC	8.83 (3/3) (6.29-10.40)	8.83 (3/3) (6.29-10.40)	0
	Mn-54	0.058	<LLD	-	-	<LLD	0
	Co-58,-60	0.071	<LLD	-	-	<LLD	0
	Zr-Nb-95	0.12	<LLD	-	-	<LLD	0

Table 5.7 (continued)
Name of facility Duane Arnold Energy Center

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean		Control Locations Mean(F) Range	Number of Non-routine Results[e]
				Location[d]	Mean(F) Range		
River Sediments (pCi/g dry) (continued)	Cs-134	0.074	<LLD	-	-	<LLD	0
	Cs-137	0.068	<LLD	-	-	<LLD	0
	Other gammas	0.60	<LLD	-	-	<LLD	0

[a] GB = gross beta; GS = gamma scan.
[b] LLD = nominal lower limit of detection based on 4.66 sigma error for background sample.
[c] Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (F).
[d] Locations are specified (1) by name and code (Table 5.3) and (2) distance, direction, and sector relative to reactor site.
[e] Nonroutine results are those which exceed ten times the control station value. If no control station value is available, the result is considered nonroutine if it exceeds ten times the preoperational value for the location.
[f] One (1) result has been excluded in the determination of LLD for gross beta. Higher than normal LLD (<0.004 pCi/M^3) resulted from filter paper being torn and parts of it missing.
[g] One (1) result (<1.4 pCi/l) has been excluded in determination of LLD for Sr-90 in milk. Higher than normal LLD resulted from low recovery.
[h] Two (2) results (<26.2 and <22.8 pCi/l) have been excluded from determination of LLD for Sr-89 in surface water. In July 1983 Tech Specs were changed to include analyses for strontium-89 and -90 in two water samples. Higher than normal LLDs resulted from delay in analyses.
[i] One sample resulted in an elevated LLD for K-40 due to small amount of periphyton sample available for analysis. It has been excluded in determination of LLD.

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Appendix A

Crosscheck Program Results

Note: Appendix A will be updated twice a year and the complete Appendix will be included in January and July monthly reports only. Please refer to January and July reports for information.

Appendix A

Crosscheck Program Results

Teledyne Isotopes Midwest Laboratories (formerly Hazleton Environmental Sciences) has participated in interlaboratory comparison (crosscheck) programs since the formulation of its quality control program in December 1971. These programs are operated by agencies which supply environmental-type samples (e.g., milk or water) containing concentrations of radionuclides known to the issuing agency but not to participant laboratories. The purpose of such a program is to provide an independent check on the laboratory's analytical procedures and to alert it to any possible problems.

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

The results in Table A-1 were obtained through participation in the environmental sample crosscheck program for milk and water samples during the period 1980 through 1983. This program has been conducted by the U. S. Environmental Protection Agency Intercomparison and Calibration Section, Quality Assurance Branch, Environmental Monitoring and Support Laboratory, Las Vegas, Nevada.

The results in Table A-2 were obtained for thermoluminescent dosimeters (TLD's) during the period 1976, 1977, 1979, 1980, and 1981 through participation in the Second, Third, Fourth, and Fifth International Intercomparison of Environmental Dosimeters under the sponsorships listed in Table A-2.

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne Isotopes Midwest Laboratory results for milk and water samples, 1980 through 1983[a].

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TIML Result ±2σ[c]	EPA Result ±3σ, n=1[d]
STW-206	Water	Jan. 1980	Gross Alpha	19.0±2.0	30.0±8.0
			Gross Beta	48.0±2.0	45.0±5.0
STW-208	Water	Jan. 1980	Sr-89	6.1±1.2	10.0±0.5
			Sr-90	23.9±1.1	25.5±1.5
STW-209	Water	Feb. 1980	Cr-51	112±14	101±5.0
			Co-60	12.7±2.3	1±5.0
			Zn-65	29.7±2.3	25±5.0
			Ru-106	71.7±1.5	51±5
			Cs-134	12.0±2.0	10±5.0
			Cs-137	30.0±2.7	30±5.0
STW-210	Water	Feb. 1980	H-3	1800±120	1750±340
STW-211	Water	March 1980	Ra-226	15.7±0.2	16.0±2.4
			Ra-228	3.5±0.3	2.6±0.4
STM-217	Milk	May 1980	Sr-89	4.4±2.6[g]	5±5
			Sr-90	10.0±1.0	12±1.5
STW-221	Water	June 1980	Ra-226	2.0±0.0	1.7±0.8
			Ra-228	1.6±0.1	1.7±0.8
STW-223	Water	July 1980	Gross Alpha	31±3.0	38±5.0
			Gross Beta	44±4	35±5.0
STW-224	Water	July 1980	Cs-137	33.9±0.4	35±5.0
			Ba-140	<12	0
			K-40	1350±60	1550±78
			I-131	<5.0	0
STW-225	Water	Aug. 1980	H-3	1280±50	1210±329
STW-226	Water	Sept. 1980	Sr-89	22±1.2	24±8.6
			Sr-90	12±0.6	15±2.6
STW-228	Water	Sept. 1980	Gross Alpha	NA[e]	32.0±8.0
			Gross Beta	22.5±0.0	21.0±5.0
STW-235	Water	Dec. 1980	H-3	2420±30	2240±604

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TIML Result ±2σ[c]	EPA Result ±3σ, n=1[d]
STW-237	Water	Jan. 1981	Sr-89	13.0±1.0	16±8.7
			Sr-90	24.0±0.6	34±2.9
STM-239	Milk	Jan. 1981	Sr-89	<210	0
			Sr-90	15.7±2.6	20±3.0
			I-131	30.9±4.8	26±10.0
			Cs-137	46.9±2.9	43±9.0
			Ba-140	<21	0
			K-40	1330±53	1550±134
STW-240	Water	Jan. 1981	Gross alpha	7.3±2.0	9±5.0
			Gross beta	41.0±3.1	44±5.0
STW-243	Water	Mar. 1981	Ra-226	3.5±0.06	3.4±0.5
			Ra-228	6.5±2.3	7.3±1.1
STW-245	Water	Apr. 1981	H-3	3210±115	2710±355
STW-249	Water	May 1981	Sr-89	51±3.6	36±8.7
			Sr-90	22.7±0.6	22±2.6
STW-251	Water	May 1981	Gross alpha	24.0±5.3	21±5.2
			Gross beta	16.1±1.9	14±5.0
STW-252	Water	Jun. 1981	H-3	2140±95	1950±696
STW-255	Water	Jul. 1981	Gross alpha	20±1.5	22±9.5
			Gross beta	13.0±2.0	15±8.7
STW-259	Water	Sep. 1981	Sr-89	16.1±1.0	23±5
			Sr-90	10.3±0.9	11±1.5
STW-265	Water	Oct. 1981	Gross alpha	71.2±19.1	80±20
			Gross beta	123.3±16.6	111±5.6
			Sr-89	14.9±2.0	21±5
			Sr-90	13.1±1.7	14.4±1.5
			Ra-226	13.0±2.0	12.7±1.9
STW-269	Water	Dec. 1981	H-3	2516±181	2700±355

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TIML Result ±2σ[c]	EPA Result ±3σ, n=1[d]
STW-270	Water	Jan. 1982	Sr-89	24.3±2.0	21.0±5.0
			Sr-90	9.4±0.5	12.0±1.5
STW-273	Water	Jan. 1982	I-131	8.6±0.6	8.4±1.5
STW-275	Water	Feb. 1982	H-3	1580±147	1820±342
STW-276	Water	Feb. 1982	Cr-51	<61	0
			Co-60	26.0±3.7	20±5
			Zn-65	<13	15±5
			Ru-106	<46	20±5
			Cs-134	26.8±0.7	22±5
			Cs-137	29.7±1.4	23±5
STW-277	Water	Mar. 1982	Ra-226	11.9±1.9	11.6±1.7
STW-278	Water	Mar. 1982	Gross alpha	15.6±1.9	19±5
			Gross beta	19.2±0.4	19±5
STW-280	Water	Apr. 1982	H-3	2690±80	2860±360
STW-281	Water	Apr. 1982	Gross alpha	75±7.9	85±21
			Gross beta	114.1±5.9	106±5.3
			Sr-89	17.4±1.8	24±5
			Sr-90	10.5±0.6	12±1.5
			Ra-226	11.4±2.0	10.9±1.5
			Co-60	<4.6	0
STW-284	Water	May 1982	Gross alpha	31.5±6.5	27.5±7
			Gross beta	25.9±3.4	29±5
STW-285	Water	June 1982	H-3	1970±1408	1830±340
STW-286	Water	June 1982	Ra-226	12.6±1.5	13.4±3.5
			Ra-228	11.1±2.5	8.7±2.3
STW-287	Water	June 1982	I-131	6.5±0.3	4.4±0.7
STW-290	Water	Aug. 1982	H-3	3210±140	2890±619
STW-291	Water	Aug. 1982	I-131	94.6±2.5	87±15

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TIML Result ±2σ[c]	EPA Result ±3σ, n=1[d]
STW-292	Water	Sept 1982	Sr-89	22.7±3.8	24.5±8.7
			Sr-90	10.9±0.3	14.5±2.6
STW-296	Water	Oct. 1982	Co-60	20.0±1.0	20±8.7
			Zn-65	32.3±5.1	24±8.7
			Cs-134	15.3±1.5	19.0±8.7
			Cs-137	21.0±1.7	20.0±8.7
STW-297	Water	Oct. 1982	H-3	2470±20	2560±612
STW-298	Water	Oct. 1982	Gross alpha	32±30	55±24
			Gross beta	81.7±6.1	81±8.7
			Sr-89	<2	0
			Sr-90	14.1±0.9	17.2±2.6
			Cs-134	<2	1.8±8.7
			Cs-137	22.7±0.6	20±8.7
			Ra-226	13.6±0.3	12.5±3.2
			Ra-228	3.9±1.0	3.6±0.9
STW-301	Water	Nov. 1982	Gross alpha	12.0±1.0	19.0±8.7
			Gross beta	34.0±2.7	24.0±8.7
STW-302	Water	Dec. 1982	I-131	40.0±0.0	37.0±10
STW-303	Water	Dec. 1982	H-3	1940±20	1990±345
STW-304	Water	Dec. 1982	Ra-226	11.7±0.6	11.0±1.7
			Ra-228	<3	0
STW-306	Water	Jan. 1983	Sr-89	20.0±8.7	29.2±5
			Sr-90	21.7±8.4	17.2±1.5
STW-307	Water	Jan. 1983	Gross alpha	29.0±4.0[g]	29.0±13
			Gross beta	29.3±0.6	31.0±8.7
STM-309	Milk	Feb. 1983	Sr-89	35±2.0	37±8.7
			Sr-90	13.7±0.6	18±2.6
			I-131	55.7±3.2	55±10.4
			Cs-137	29±1.0	26±8.7
			Ba-140	<27	0
			K-40	1637±5.8	1512±131

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TIML Result ±2σ[c]	EPA Result ±3σ, n=1[d]
STAF-326	Air filter	August 1983	Gross beta	42±2	36±8.7
			Sr-90	14±2	10±2.6
			Cs-137	19±1	15±8.7
STW-328	Water	Sept. 1983	Gross alpha	2.3±0.6	5±8.7
			Gross beta	10.7±1.2	9±8.7
STW-329	Water	Sept. 1983	Ra-226	3.0±0.2	3.1±0.81
			Ra-228	3.2±0.7	2.0±0.52
STW-331	Water	Oct. 1983	H-3	1303±32	1210±570
STW-335	Water	Dec. 1983	I-131	19.6±1.9	20±10.4

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

[b] All results are in pCi/l, except for elemental potassium (K) data which are in mg/l.

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

[d] USEPA results are presented as the known values ± control limits of 3σ for n=1.

[e] NA = Not analyzed.

[f] Analyzed but not reported to the EPA.

[g] Results after calculations corrected (error in calculations when reported to EPA).

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

Lab Code	TLD Type	Measurement	mR: Teledyne Result ±2σ [a]	mR: Known Value	mR: Average ±2σ [d] (all participants)
2nd International Intercomparison[b]					
115-2[b]	CaF_2:Mn Bulb	Gamma-Field	17.0±1.9	17.1[c]	16.4±7.7
		Gamma-Lab	20.8±4.1	21.3[c]	18.8±7.6
3rd International Intercomparison[e]					
115-3[e]	CaF_2:Mn Bulb	Gamma-Field	30.7±3.2	34.9±4.8[f]	31.5±3.0
		Gamma-Lab	89.6±6.4	91.7±14.6[f]	86.2±24.0
4th International Intercomparison[g]					
115-4[g]	CaF_2:Mn Bulb	Gamma-Field	14.1±1.1	14.1±1.4[f]	16.09.0
		Gamma-Lab (Low)	9.3±1.3	12.2±2.4[f]	12.0±7.6
		Gamma-Lab (High)	40.4±1.4	45.8±9.2[f]	43.9±13.2
5th International Intercomparison[h]					
115-5A[h]	CaF_2:Mn Bulb	Gamma-Field	31.4±1.8	30.0±6.0[i]	30.2±14.6
		Gamma-Lab at beginning	77.4±5.8	75.2±7.6[i]	75.8±40.4
		Gamma-Lab at the end	96.6±5.8	88.4±8.8[i]	90.7±31.2

Table A-2. (Continued)

Lab Code	TLD Type	Measurement	mR: Teledyne Result ±2σ[a]	mR: Known Value	mR: Average ± 2σ[d] (all participants)
115-5B[h]	LiF-100 Chips	Gamma-Field	30.3±4.8	30.0±6[i]	30.2±14.6
		Gamma-Lab at beginning	81.1±7.4	75.2±7.6[i]	75.8±40.4
		Gamma-Lab at the end	85.4±11.7	88.4±8.8[i]	90.7±131.2

[a]Lab result given is the mean ±2σ standard deviations of three determinations.
[b]Second International Intercomparison of Environmental Dosimeters conducted in April of 1976 by the Health and Safety Laboratory (GASL), New York, New York, and the School of Public Health of the University of Texas, Houston, Texas.
[c]Value determined by sponsor of the intercomparison using continuously operated pressurized ion chamber.
[d]Mean ±2σ standard deviations of results obtained by all laboratories participating in the program.
[e]Third International Intercomparison of Environmental Dosimeters conducted in summer of 1977 by Oak Ridge National Laboratory and the School of Public Health of the University of Texas, Houston, Texas.
[f]Value ±2σ standard deviations as determined by sponsor of the intercomparison using continuously operated pressurized ion chamber.
[g]Fourth International Intercomparison of Environmental Dosimeters conducted in summer of 1979 by the School of Public Health of the University of Texas, Houston, Texas.
[h]Fifth International Intercomparison of Environmental Dosimeter conducted in fall of 1980 at Idaho Falls, Idaho and sponsored by the School of Public Health of the University of Texas, Houston, Texas and Environmental Measurements Laboratory, New York, New York, U.S. Department of Energy.
[i]Value determined by sponsor of the intercomparison using continuously operated pressurized ion chamber.

Appendix B

Data Reporting Conventions

Data Reporting Conventions

1.0. All activities are decay corrected to collection time.

2.0. Single Measurements

Each single measurement is reported as follows:

$$x \pm s$$

where x = value of the measurement;

s = 2σ counting uncertainty (corresponding to the 95% confidence level).

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

$$<L \ .$$

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

3.0. Duplicate Analyses

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

Reported result: $x \pm s$

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

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

3.2. Individual results: $<L_1$
$<L_2$

Reported result: $<L$

where L = lower of L_1 and L_2

3.3. Individual results: $x \pm s$
$<L$

Reported result: $x \pm s$ if $x \leq L$;
$<L$ otherwise

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.

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REPORT

TO

IOWA ELECTRIC LIGHT AND POWER
CEDAR RAPIDS, IOWA

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM FOR THE DUANE ARNOLD ENERGY CENTER CEDAR RAPIDS, IOWA

Docket No. 50-331

ANNUAL REPORT - PART II
DATA TABULATIONS AND ANALYSES
JANUARY-DECEMBER 1983

PREPARED AND SUBMITTED
BY
TELEDYNE ISOTOPES MIDWEST LABORATORY
PROJECT NO. 8001

Approved by: L. G. Huebner

L. G. Huebner
General Manager

21 March 1984

PREFACE

The staff members of the Teledyne Isotopes Midwest Laboratory (formerly Hazleton Environmental Sciences) were responsible for the acquisition of data presented in this report. All environmental samples were collected by personnel of DAEC.

The report was prepared by L. Nicia, Group Leader, under the direction of L.G. Huebner, General Manager. She was assisted in the report preparation by other staff members of the laboratory.

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1.0 INTRODUCTION

The following consists of data tabulations and analyses for the Annual Report - Part II for the 1983 Environmental Radiological Monitoring Program conducted at the Duane Arnold Energy Center, Cedar Rapids, Iowa.

A summary with interpretation of the data presented here is contained in a separate report to the Iowa Electric Light and Power Company.

2.0 DATA TABLES

Table 1. Sampling locations, Duane Arnold Energy Center.

Code	Type[a]	Sampling Location		
		Sampling Point	Location Description	Distance and Direction from Site Stack
D-1	C	1	Cedar Rapids	11 mi @ 135° SE
D-2	C	2	Marion	11 mi @ 125° SE
D-3		3	Hiawatha	7 mi @ 130° SE
D-4		4	Johnson	3 mi @ 140° SE
D-5		5	Palo	3 mi @ 200° SW
D-6		6	Center Point	7 mi @ 0° N
D-7		7	Shellsburg	6 mi @ 255° W
D-8		8	Urbana	9 mi @ 345° NW
D-9		9	Route W26	7 mi @ 295° NW
D-10		10	Atkins	8 mi @ 210° SW
D-11		11	Toddville	4 mi @ 90° E
D-12	C	12	Iowa City	25 mi @ 160° S
D-13	C	13	Alburnett	8 mi @ 70° NE
D-14		14	Alice Substation	7 mi @ 35° NE
D-15		15	On-site, North	0.5 mi @ 305° NW
D-16		16	On-site, South	0.5 mi @ 190° S
D-17		17		0.5 mi N
D-18		18		0.5 mi NE
D-19		19		0.5 mi NE
D-20		20		0.5 mi NE
D-21		21		0.5 mi E
D-22		22		0.5 mi SE
D-23		23		0.5 mi SE
D-24		24		0.5 mi S
D-25		25		0.5 mi SW
D-26		26		0.5 mi SW
D-27		27		0.5 mi SW
D-28		28		0.5 mi SW
D-29		29		0.5 mi SW
D-30		30		0.5 mi W
D-31		31		0.5 mi NW
D-32		32		0.5 mi NW
D-33		33		3.0 mi N
D-34		34		3.0 mi NE
D-35		35		3.0 mi NE
D-36		36		3.0 mi NE
D-37		37		3.0 mi E
D-38		38		3.0 mi SE
D-39		39		3.0 mi SE
D-40		40		3.0 mi SE
D-41		41		3.0 mi S
D-42		42		3.0 mi SW
D-43		43		1.0 mi SW

Table 1. (continued)

Code	Type[a]	Sampling Location		
		Sampling Point	Location Description	Distance and Direction from Site Stack
D-44		44		1.0 mi SW
D-45		45		1.0 mi SW
D-46		46		1.0 mi W
D-47		47		1.0 mi NW
D-48		48		1.0 mi NW
D-49	C	49	Lewis access, upstream of DAEC	
D-50		50	Plant Intake	
D-51		51	Plant Discharge	
D-52		52	Cedar Rapids City Park	7.5 mi SE
D-53		53	Treated Municipal Water	
D-54		54	Inlet to Municipal Water Treatment System	
D-55		55	On-site Well	
D-57		57	Bull (Off-site well)	
D-58		58	Frantz Farm, 0.5 mi of DAEC	
D-59		59	Frantz Cottage, 0.5 mi of DAEC	
D-60		60	Wiley, Off-site within 1.0 mi of DAEC	
D-61		61	One-half mile downstream of plant discharge	
D-63		63	Andrews Farm, 1.5 mi NW	
D-72		72	Van Note Farm, within 2 miles of site, SW	
D-73	C	73	Hansen Farm, within 22 miles of site	
D-76		76		0.5 mi NE
D-77		77		0.5 mi NE
D-78		78		0.5 mi NE
D-79		79		0.5 mi E
D-80		80		0.5 mi SE
D-81		81		0.5 mi SE

Table 1. (continued)

Code	Type[a]	Sampling Location		
		Sampling Point	Location Description	Distance and Direction from Site Stack
D-82		82		0.5 mi SE
D-83		83		0.5 mi S
D-84		84		0.5 mi SW
D-85		85		0.5 mi SW
D-86		86		0.5 mi SW
D-87		87		0.5 mi SW
D-88		88		0.5 mi W
D-89		89		0.5 mi W
D-90		90		0.5 mi NW
D-91		91		0.5 mi N
D-93		93	Yarborough Farm	2.8 mi of site, NW
D-94		94	Hines Farm	2.7 mi NE
D-96		96	Keiper Farm	7.5 mi SW
D-99		99	Pleasant Creek	2.2 mi NW
D-101		101	Flecksing Farm	4.0 mi NE
D-102	C	102	McCardle Farm	20.0 mi NW
D-103		103	Park Pond	1.5 mi E
D-105	C	105	Schulte Farm	21.3 mi SW
D-106		106	David R. Stallman	4.5 mi SE

[a]"C" denotes control location. All other locations are indicators.

Table 2. Type and frequency of collection.

Location	Loc. Type[a]	Weekly	Monthly	Quarterly	Semi-Annually	Annually
D-1	C	AP	TLD			TLD
D-2	C	AP	TLD			TLD
D-3		AP	TLD			TLD
D-4		AP,AI	TLD			TLD
D-5		AP,AI				
D-6		AP	TLD			TLD
D-7		AP,AI	TLD			TLD
D-8		AP,AI	TLD			TLD
D-9		AP	TLD			TLD
D-10		AP	TLD			TLD
D-11		AP,AI	TLD			TLD
D-12	C	AP,AI	TLD			TLD
D-13	C	AP	TLD			TLD
D-14		AP,AI	TLD			TLD
D-15		AP,AI	TLD	SO[b]		TLD
D-16		AP	TLD	SO[b]		TLD
D-17-48			TLD			TLD
D-49	C		SW	SL	F,BS	
D-50			SW		BS	
D-51			SW		BS	
D-52			SW			
D-53			WW[c]			
D-54			WW[d]			
D-55			WW			
D-57			WW	SO[b]		G[e]
D-58			WW	SO[b]		G[e]
D-59			WW			
D-60			WW			
D-61				SL	F,BS	
D-63			M[f]	SO[b]		G[e]
D-72			M[f]	SO[b]		G[e]
D-73	C		SW			
D-76-91			TLD			TLD
D-93			M[f]	SO[b]		G[e]
D-94			M[f]	SO[b]		G[e],ME
D-96			M[f]	SO[b]		G[e]
D-99			SW			

Table 2 (continued)

Location	Loc. Type[a]	Weekly	Monthly	Quarterly	Semi-Annually	Annually
D-101			M[f]	SO[b]		G[e]
D-102	C		M[f]	SO[b]		G[e],ME
D-103			SW			
D-105	C		M[f]	SO[b]		G[e]
D-106			M[f]	SO[b]		G[e]
On-site Inside 10 mile radius of Plant			P		WL	ME
Outside 10 mile radius of Plant	C					ME

[a] Control locations are indicated by a "C" in this column. All other locations are indicators.
[b] Soil is collected three times per year.
[c] Collected hourly and composited monthly and quarterly.
[d] Collected daily and composited monthly and quarterly.
[e] Vegetation (G) includes broad leaf vegetation and grain.
[f] Monthly from October through April; weekly from May through September.

Table 3. Sample codes used in Table 2

Code	Description
AP	Airborne Particulates
AI	Airborne Iodine
TLD	Thermoluminescent Dosimeter
P	Precipitation
M	Milk
WW	Well Water
G	Vegetation (broad leaf and grain)
ME	Meat and Poultry
SO	Soil
SW	Surface Water
F	Fish
SL	Periphyton (aquatic biota)
BS	River Sediment
WL	Wildlife

Table 4. Airborne particulates collected at Location D-1, (Cedar Rapids), analysis for gross beta. Collection: Weekly.

Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)	Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)
1-06-83	285	0.035±0.004	7-07-83	286	0.012±0.003
1-13-83	285	0.024±0.003	7-14-83	290	0.024±0.003
1-20-83	284	0.019±0.003	7-21-83	288	0.023±0.003
1-27-83	288	0.018±0.003	7-28-83	[illegible]	0.024±0.004
2-03-83	286	0.028±0.004	8-04-83	289	0.026±0.004
2-10-83	285	0.025±0.004	8-10-83	278[a]	0.034±0.004
2-17-83	286	0.023±0.003	8-18-83	299[b]	0.042±0.004
2-24-83	286	0.018±0.003	8-25-83	294	0.028±0.004
3-03-83	286	0.019±0.003	9-01-83	291	0.028±0.003
3-10-83	285	0.013±0.003	9-08-83	289	0.029±0.004
3-17-83	287	0.015±0.003	9-15-83	280	0.022±0.003
3-24-83	285	0.025±0.004	9-22-83	271	0.013±0.003
3-31-83	285	0.016±0.003	9-29-83	276	0.040±0.003
1st Qtr. mean ± s.d.		0.021±0.006	3rd Qtr. mean ± s.d.		0.026±0.009
4-07-83	286	0.012±0.003	10-05-83	238[a]	0.049±0.005
4-14-83	385	0.012±0.003	10-13-83	323[b]	0.018±0.003
4-21-83	287	0.020±0.004	10-19-83	249[a]	0.022±0.004
4-28-83	288	0.028±0.004	10-27-83	335[b]	0.019±0.003
5-05-83	284	0.014±0.003	11-03-83	278	0.028±0.004
5-12-83	289	0.016±0.003	11-10-83	ND[c]	ND[c]
5-19-83	288	0.013±0.003	11-16-83	234[a]	0.023±0.004
5-26-83	349	0.016±0.003	11-23-83	267	0.027±0.004
6-02-83	288	0.013±0.003	12-01-83	333[b]	0.017±0.003
6-09-83	287	0.014±0.003	12-09-83	314	0.071±0.005
6-16-83	287	0.022±0.003	12-15-83	225	0.024±0.004
6-23-83	285	0.021±0.003	12-22-83	272	0.050±0.005
6-30-83	286	0.017±0.003	12-29-83	268	0.038±0.004
2nd Qtr. mean ± s.d.		0.017±0.005	4th Qtr. mean ± s.d.		0.032±0.017

[a] Pump ran for 6 days only.
[b] Pump ran for 8 days.
[c] ND = No data. Sample not received; lost in transit by UPS.

Table 5. Airborne particulates collected at Location D-2, (Marion) analysis for gross beta. Collection: Weekly.

Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)	Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)
1-06-83	285	0.031±0.004	7-07-83	285	0.012±0.003
1-13-83	285	0.020±0.003	7-14-83	284	0.025±0.004
1-20-83	280	0.020±0.003	7-21-83	289	0.021±0.003
1-27-83	283	0.020±0.003	7-28-83	290	0.021±0.003
2-03-83	281	0.034±0.004	8-04-83	286	0.027±0.004
2-10-83	282	0.025±0.004	8-10-83	257[b]	0.031±0.004
2-17-83	272	0.014±0.003	8-18-83	324[c]	0.039±0.004
2-24-83	279	0.014±0.003	8-25-83	284	0.023±0.004
3-03-83	277	0.020±0.003	9-01-83	284	0.028±0.003
3-10-83	280	0.017±0.003	9-08-83	288	0.028±0.004
3-17-83	279	0.012±0.003	9-15-83	283	0.019±0.002
3-24-83	277	0.027±0.004	9-22-83	278	0.019±0.003
3-31-83	267	0.017±0.003	9-29-83	284	0.040±0.003
1st Qtr. mean ± s.d.		0.021±0.007	3rd Qtr. mean ± s.d.		0.025±0.008
4-07-83	275	0.007±0.003[a]	10-05-83	241[b]	0.044±0.005
4-14-83	271	0.007±0.003[a]	10-13-83	334[c]	0.021±0.003
4-21-83	286	0.023±0.004	10-19-83	250[b]	0.028±0.004
4-28-83	283	0.028±0.004	10-27-83	321[c]	0.018±0.003
5-05-83	284	0.014±0.003	11-03-83	262	0.030±0.004
5-12-83	286	0.022±0.003	11-10-83	ND[d]	ND[d]
5-19-83	284	0.012±0.003	11-16-83	242[b]	0.024±0.004
5-26-83	315	0.014±0.003	11-23-83	286	0.017±0.003
6-02-83	287	0.020±0.003	12-01-83	328[c]	0.016±0.003
6-09-83	286	0.016±0.003	12-09-83	325	0.062±0.005
6-16-83	285	0.020±0.003	12-15-83	246	0.018±0.003
6-23-83	287	0.023±0.003	12-22-83	288	0.050±0.005
6-30-83	287	0.021±0.003	12-29-83	284	0.039±0.004
2nd Qtr. mean ± s.d.		0.017±0.006	4th Qtr. mean ± s.d.		0.031±0.015

[a] Filter light; very small amount of air particulate matter on the filter paper.
[b] Pump ran for 6 days only.
[c] Pump ran for 8 days.
[d] ND = No data. Sample not received; lost in transit by UPS.

Table 6. Airborne particulates collected at Location D-3, (Hiawatha) analysis for gross beta. Collection: Weekly.

Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)	Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)
1-06-83	281	0.028±0.004	7-07-83	286	0.013±0.003
1-13-83	286	0.020±0.003	7-14-83	284	0.028±0.004
1-20-83	284	0.016±0.003	7-21-83	286	0.020±0.003
1-27-83	278	0.019±0.003	7-28-83	286	0.026±0.004
2-03-83	282	0.032±0.004	8-04-83	284	0.030±0.004
2-10-83	286	0.023±0.003	8-10-83	245[b]	0.035±0.004
2-17-83	278	0.023±0.003	8-18-83	326[c]	0.038±0.004
2-24-83	286	0.016±0.003	8-25-83	286	0.031±0.004
3-03-83	282	0.019±0.003	9-01-83	286	0.030±0.003
3-10-83	289	0.016±0.003	9-08-83	286	0.035±0.004
3-17-83	292	0.012±0.003	9-15-83	285	0.020±0.002
3-24-83	288	0.025±0.004	9-22-83	286	0.023±0.003
3-31-83	286	0.016±0.003	9-29-83	285	0.053±0.003
1st Qtr. mean ± s.d.		0.020±0.006	3rd Qtr. mean ± s.d.		0.029±0.010
4-07-83	293	0.015±0.003	10-05-83	245[b]	0.052±0.005
4-14-83	290	0.010±0.003	10-13-83	324[c]	0.025±0.003
4-21-83	295	0.022±0.004	10-21-83	327[c]	0.030±0.004
4-28-83	293	0.024±0.004	10-27-83	246[b]	0.017±0.004
5-05-83	292	0.013±0.003	11-03-83	288	0.036±0.004
5-12-83	296	0.020±0.003	11-10-83	ND[d]	ND[d]
5-19-83	295	0.014±0.003	11-16-83	260[b]	0.019±0.004
5-26-83	284	0.011±0.003	11-23-83	288	0.015±0.003
6-02-83	297	0.014±0.003	12-01-83	331[c]	0.016±0.003
6-09-83	286	0.010±0.003	12-09-83	329	0.071±0.005
6-16-83	284	0.016±0.003	12-15-83	250	0.026±0.004
6-23-83	287	0.009±0.003[a]	12-22-83	283	0.038±0.005
6-30-83	249	0.018±0.003	12-29-83	289	0.035±0.004
2nd Qtr. mean ± s.d.		0.015±0.005	4th Qtr. mean ± s.d.		0.032±0.017

[a] Filter light; very small amount of air particulate matter on the filter paper.
[b] Pump ran for 6 days only.
[c] Pump ran for 8 days.
[d] ND = No data. Sample not received; lost in transit by UPS.

Table 7. Airborne particulates collected at Location D-4, (Johnson) analysis for gross beta. Collection: Weekly.

Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)	Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)
1-06-83	285	0.015±0.003	7-07-83	284	0.013±0.003
1-13-83	286	0.023±0.003	7-14-83	286	0.021±0.003
1-20-83	284	0.019±0.003	7-21-83	286	0.021±0.003
1-27-83	286	0.024±0.003	7-28-83	285	0.024±0.004
2-03-83	286	0.036±0.004	8-04-83	285	0.023±0.004
2-10-83	285	0.025±0.004	8-10-83	244[b]	0.031±0.004
2-17-83	286	0.030±0.004	8-18-83	326[c]	0.030±0.004
2-24-83	285	0.018±0.003	8-25-83	287	0.003±0.002[a]
3-03-83	295	0.020±0.003	9-01-83	284	0.025±0.003
3-10-83	286	0.017±0.003	9-08-83	286	0.035±0.004
3-17-83	286	0.016±0.003	9-15-83	286	0.019±0.002
3-24-83	285	0.027±0.004	9-22-83	286	0.017±0.003
3-31-83	285	0.019±0.003	9-29-83	285	.041±0.003
1st Qtr. mean ± s.d.		0.022±0.006	3rd Qtr. mean ± s.d.		0.023±0.010
4-07-83	286	0.012±0.003	10-05-83	246[b]	0.044±0.005
4-14-83	295	0.007±0.003[a]	10-13-83	324[c]	0.022±0.003
4-21-83	294	0.018±0.003	10-19-83	246[b]	0.027±0.004
4-28-83	293	0.017±0.003	10-27-83	326[c]	0.020±0.003
5-05-83	296	0.014±0.003	11-03-83	288	0.033±0.004
5-12-83	285	0.017±0.003	11-10-83	ND[d]	ND[d]
5-19-83	286	0.014±0.003	11-16-83	243[b]	0.024±0.004
5-26-83	323	0.014±0.003	11-23-83	286	0.026±0.004
6-02-83	284	0.012±0.003	12-01-83	328[c]	0.022±0.003
6-09-83	286	0.015±0.003	12-09-83	325	0.066±0.005
6-16-83	284	0.023±0.003	12-15-83	245	0.048±0.005
6-23-83	286	0.018±0.003	12-22-83	286	0.049±0.005
6-30-83	286	0.019±0.003	12-29-83	285	0.041±0.004
2nd Qtr. mean ± s.d.		0.015±0.004	4th Qtr. mean ± s.d.		0.035±0.014

[a] Filter light; very small amount of air particulate matter on the filter paper.
[b] Pump ran for 6 days only.
[c] Pump ran for 8 days.
[d] ND = No data. Sample not received; lost in transit by UPS.

Table 8. Airborne particulates collected at Location D-5, (Palo), analysis for gross beta. Collection: Weekly.

Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)	Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)
1-06-83	285	0.028±0.004	7-07-83	285	0.012±0.003
1-13-83	286	0.020±0.003	7-14-83	286	0.029±0.004
1-20-83	285	0.016±0.003	7-21-83	285	0.029±0.004
1-27-83	285	0.012±0.003	7-28-83	285	0.026±0.004
2-03-83	285	0.012±0.003	8-04-83	285	0.023±0.004
2-10-83	286	0.008±0.003[a]	8-10-83	245[b]	0.032±0.004
2-17-83	285	0.014±0.003	8-18-83	327[c]	0.033±0.004
2-24-83	285	0.008±0.003[a]	8-25-83	395	0.027±0.004
3-03-83	285	0.008±0.003[a]	9-01-83	285	0.026±0.003
3-10-83	286	0.008±0.002[a]	9-08-83	286	0.036±0.004
3-17-83	286	0.007±0.002[a]	9-15-83	286	0.022±0.003
3-24-83	285	0.009±0.003[a]	9-22-83	286	0.019±0.003
3-31-83	285	0.003±0.002[a]	9-29-83	285	0.040±0.003
1st Qtr. mean ± s.d.		0.012±0.007	3rd Qtr. mean ± s.d.		0.027±0.008
4-07-83	285	0.004±0.002[a]	10-05-83	247[b]	0.044±0.005
4-14-83	285	0.005±0.002[a]	10-13-83	291[c]	0.020±0.003
4-21-83	286	0.004±0.003[a]	10-19-83	203[b]	0.029±0.005
4-28-83	283	0.026±0.004	10-27-83	326[c]	0.018±0.003
5-05-83	286	0.016±0.003	11-03-83	295	0.033±0.004
5-12-83	285	0.016±0.003	11-10-83	ND[d]	ND[d]
5-19-83	285	0.013±0.003	11-16-83	254[b]	0.024±0.004
5-26-83	309	0.013±0.003	11-23-83	285	0.026±0.004
6-02-83	286	0.019±0.003	12-01-83	322[c]	0.023±0.003
6-09-83	284	0.016±0.003	12-09-83	324	0.069±0.005
6-16-83	285	0.022±0.003	12-15-83	252	0.033±0.004
6-23-83	286	0.021±0.003	12-22-83	289	0.048±0.005
6-30-83	286	0.024±0.003	12-29-83	291	0.042±0.004
2nd Qtr. mean ± s.d.		0.015±0.007	4th Qtr. mean ± s.d.		0.034±0.015

[a] Filter light; very small amount of air particulate matter on the filter paper.
[b] Pump ran for 6 days only.
[c] Pump ran for 8 days.
[d] ND = No data. Sample not received; lost in transit by UPS.

Table 9. Airborne particulates collected at Location D-6, (Center Point), analysis for gross beta. Collection: Weekly.

Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)	Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)
1-06-83	315	0.029±0.004	7-07-83	279[c]	0.012±0.003
1-13-83	286	0.017±0.003	7-14-83	286	0.022±0.003
1-20-83	285	0.022±0.003	7-21-83	285	0.024±0.004
1-27-83	286	0.021±0.003	7-28-83	285	0.026±0.004
2-03-83	285	0.028±0.004	8-04-83	285	0.027±0.004
2-10-83	285	0.021±0.003	8-10-83	244[b]	0.030±0.004
2-17-83	285	0.028±0.004	8-18-83	326[d]	0.034±0.004
2-24-83	285	0.020±0.003	8-25-83	285	0.013±0.003
3-03-83	285	0.023±0.003	9-01-83	285	0.081±0.004
3-10-83	286	0.017±0.003	9-08-83	286	0.020±0.003
3-17-83	286	0.003±0.002[a]	9-15-83	285	0.012±0.002
3-24-83	237[b]	0.028±0.004	9-22-83	286	0.010±0.003
3-31-83	285	0.022±0.003	9-29-83	284	0.024±0.002
1st Qtr. mean ± s.d.		0.021±0.007	3rd Qtr. mean ± s.d.		0.026±0.018
4-07-83	286	0.016±0.003	10-05-83	246[b]	0.021±0.004
4-14-83	286	0.013±0.003	10-13-83	324[d]	0.011±0.003
4-21-83	285	0.024±0.004	10-19-83	246[b]	0.013±0.003
4-28-83	284	0.028±0.004	10-27-83	326[d]	0.011±0.003
5-05-83	285	0.017±0.003	11-03-83	288	0.018±0.003
5-12-83	285	0.026±0.004	11-10-83	ND[e]	ND[e]
5-19-83	286	0.016±0.003	11-16-83	241[b]	0.020±0.004
5-26-83	347	0.016±0.003	11-23-83	281	0.027±0.004
6-02-83	284	0.016±0.003	12-01-83	326[d]	0.018±0.003
6-09-83	285	0.018±0.003	12-09-83	322	0.066±0.005
6-16-83	284	0.024±0.003	12-15-83	242	0.047±0.005
6-23-83	286	0.023±0.003	12-22-83	297	0.052±0.005
6-30-83	282	0.024±0.003	12-29-83	287	0.035±0.004
2nd Qtr. mean ± s.d.		0.020±0.005	4th Qtr. mean ± s.d.		0.028±0.018

[a] Filter paper light; very little air particulate matter on the filter.
[b] Pump ran for 6 days only.
[c] Low volume because severe weather shut down the sampler during electrical outages in the area that week.
[d] Pump ran for 8 days.
[e] ND = No data. Sample not received; lost in transit by UPS.

Table 10. Airborne particulates collected at Location D-7, (Shellsburg), analysis for gross beta. Collection: Weekly.

Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)	Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)
1-06-83	285	0.025±0.004	7-07-83	139[b]	0.010±0.004
1-13-83	286	0.020±0.003	7-14-83	239[c]	0.020±0.004
1-20-83	285	0.015±0.003	7-21-83	275	0.017±0.003
1-27-83	286	0.015±0.003	7-28-83	283	0.024±0.004
2-03-83	285	0.025±0.004	8-04-83	278	0.014±0.003
2-10-83	285	0.018±0.003	8-10-83	238[d]	0.019±0.004
2-17-83	285	0.021±0.003	8-18-83	318[e]	0.030±0.004
2-24-83	286	0.016±0.003	8-25-83	281	0.024±0.004
3-03-83	285	0.015±0.003	9-01-83	277	0.028±0.003
3-10-83	286	0.014±0.003	9-08-83	283	0.031±0.004
3-17-83	286	0.011±0.003	9-15-83	286	0.023±0.003
3-24-83	285	0.014±0.003	9-22-83	285	0.016±0.003
3-31-83	285	0.016±0.003	9-29-83	281	0.037±0.003
1st Qtr. mean ± s.d.		0.017±0.004	3rd Qtr. mean ± s.d.		0.022±0.008
4-07-83	286	0.013±0.003	10-05-83	243[d]	0.033±0.004
4-14-83	286	0.011±0.003	10-13-83	329[e]	0.020±0.003
4-21-83	285	0.011±0.003	10-19-83	246[d]	0.012±0.003
4-28-83	284	0.007±0.003[a]	10-27-83	324[e]	0.008±0.002
5-05-83	285	0.014±0.002	11-03-83	288	0.013±0.003
5-12-83	285	0.012±0.002	11-10-83	ND[f]	ND[f]
5-19-83	286	0.011±0.003	11-16-83	243[d]	0.022±0.004
5-26-83	270	0.010±0.003	11-23-83	286	0.026±0.004
6-02-83	286	0.014±0.003	12-01-83	318[e]	0.022±0.003
6-09-83	286	0.006±0.003[a]	12-09-83	326	0.062±0.005
6-16-83	285	0.018±0.003	12-15-83	245	0.043±0.005
6-23-83	286	0.010±0.003	12-22-83	286	0.052±0.005
6-30-83	285	0.021±0.003	12-29-83	284	0.044±0.005
2nd Qtr. mean ± s.d.		0.012±0.004	4th Qtr. mean ± s.d.		0.030±0.017

[a] Filter light; very little air particulate matter on the filter paper.
[b] Low volume; sampler ran for only 82.0 hours due to vandalism.
[c] Pump ran for only 141.0 hours; the electricity was shut off.
[d] Pump ran for 6 days only.
[e] Pump ran for 8 days.
[f] ND = No data. Sample not received; lost in transit by UPS.

Table 11. Airborne particulates collected at Location D-8, (Urbana), analysis for gross beta. Collection: Weekly.

Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)	Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)
1-06-83	285	0.029±0.004	7-07-83	271[b]	0.013±0.003
1-13-83	286	0.019±0.003	7-14-83	276	0.024±0.004
1-20-83	285	0.013±0.003	7-21-83	288	0.025±0.004
1-27-83	286	0.016±0.003	7-28-83	281	0.025±0.004
2-03-83	285	0.025±0.004	8-04-83	281	0.028±0.004
2-10-83	285	0.019±0.003	8-10-83	244[c]	0.030±0.004
2-17-83	285	0.025±0.003	8-18-83	328[d]	0.030±0.004
2-24-83	286	0.016±0.003	8-25-83	285	0.031±0.004
3-03-83	285	0.013±0.003	9-01-83	279	0.025±0.003
3-10-83	286	0.016±0.003	9-08-83	286	0.011±0.003
3-17-83	286	0.009±0.002[a]	9-15-83	285	0.011±0.002
3-24-83	285	0.019±0.003	9-22-83	34[e]	0.030±0.020
3-31-83	284	0.016±0.003	9-29-83	270	0.044±0.003
1st Qtr. mean ± s.d.		0.018±0.006	3rd Qtr. mean ± s.d.		0.025±0.009
4-07-83	286	0.010±0.003	10-05-83	248[c]	0.036±0.004
4-14-83	266	0.008±0.003[a]	10-13-83	318[d]	0.020±0.003
4-21-83	261	0.021±0.004	10-19-83	245[c]	0.022±0.004
4-28-83	278	0.024±0.004	10-27-83	324[d]	0.018±0.003
5-05-83	273	0.012±0.003	11-03-83	292	0.027±0.004
5-12-83	270	0.015±0.003	11-10-83	ND[f]	ND[f]
5-19-83	272	0.013±0.003	11-16-83	243[c]	0.021±0.004
5-26-83	285	0.012±0.003	11-23-83	285	0.027±0.004
6-02-83	272	0.016±0.003	12-01-83	302[d]	0.020±0.003
6-09-83	276	0.015±0.003	12-09-83	325	0.066±0.005
6-16-83	276	0.023±0.003	12-15-83	245	0.043±0.005
6-23-83	277	0.021±0.003	12-22-83	287	0.043±0.005
6-30-83	272	0.016±0.003	12-29-83	284	0.040±0.004
2nd Qtr. mean ± s.d.		0.016±0.005	4th Qtr. mean ± s.d.		0.032±0.014

[a] Filter light; very small amount of air particulate matter on the filter paper.
[b] Severe weather shut down the sampler during electrical outages in the area that week.
[c] Pump ran for 6 days only.
[d] Pump ran for 8 days.
[e] Pump ran for 47.2 hours only.
[f] ND = No data. Sample not received; lost in transit by UPS.

Table 12. Airborne particulates collected at Location D-9, (Route W26), analysis for gross beta. Collection: Weekly.

Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)	Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)
1-06-83	292	0.031±0.004	7-07-83	280[b]	0.011±0.003
1-13-83	286	0.015±0.003	7-14-83	286	0.026±0.004
1-20-83	284	0.019±0.003	7-21-83	286	0.023±0.003
1-27-83	292	0.021±0.003	7-28-83	287	0.020±0.003
2-03-83	285	0.026±0.004	8-04-83	288	0.024±0.004
2-10-83	285	0.019±0.003	8-10-83	245[c]	0.030±0.004
2-17-83	285	0.021±0.003	8-18-83	326[d]	0.032±0.004
2-24-83	286	0.014±0.003	8-25-83	288	0.029±0.004
3-03-83	285	0.014±0.003	9-01-83	280	0.024±0.003
3-10-83	286	0.013±0.003	9-08-83	285	0.025±0.003
3-17-83	286	0.010±0.002	9-15-83	286	0.019±0.002
3-24-83	285	0.018±0.003	9-22-83	278	0.018±0.003
3-31-83	285	0.015±0.003	9-29-83	290	0.040±0.003
1st Qtr. mean ± s.d.		0.018±0.006	3rd Qtr. mean ± s.d.		0.025±0.007
4-07-83	286	0.013±0.003	10-05-83	251[c]	0.036±0.004
4-14-83	277	0.009±0.003[a]	10-13-83	322[d]	0.021±0.003
4-21-83	286	0.017±0.003	10-19-83	225[c]	0.022±0.004
4-28-83	284	0.013±0.003	10-27-83	321[d]	0.020±0.003
5-05-83	284	0.013±0.003	11-03-83	269	0.034±0.004
5-12-83	285	0.021±0.003	11-10-83	ND[e]	ND[e]
5-19-83	286	0.013±0.003	11-16-83	244[c]	0.023±0.004
5-26-83	341	0.016±0.003	11-23-83	293	0.025±0.004
6-02-83	284	0.013±0.003	12-01-83	318[d]	0.015±0.003
6-09-83	285	0.016±0.003	12-09-83	333	0.062±0.005
6-16-83	285	0.022±0.003	12-15-83	236	0.015±0.003
6-23-83	286	0.021±0.003	12-22-83	ND[f]	ND[f]
6-30-83	286	0.021±0.003	12-29-83	ND[f]	ND[f]
2nd Qtr. mean ± s.d.		0.016±0.004	4th Qtr. mean ± s.d.		0.027±0.014

[a] Filter light; very small amount of air particulate matter on the filter paper.
[b] Severe weather shut down the sampler during electrical outages in the area that week.
[c] Pump ran for 6 days only.
[d] Pump ran for 8 days.
[e] ND = No data. Sample not received; lost in transit by UPS.
[f] ND = No data; frozen vane.

Table 13. Airborne particulates collected at Location D-10, (Atkins), analysis for gross beta. Collection: Weekly.

Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)	Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)
1-06-83	289	0.036±0.004	7-07-83	278[d]	0.013±0.003
1-13-83	285	0.021±0.003	7-14-83	284	0.030±0.004
1-20-83	285	0.017±0.003	7-21-83	286	0.025±0.004
1-27-83	291	0.024±0.003	7-28-83	284	0.028±0.004
2-03-83	289	0.031±0.004	8-04-83	286	0.035±0.004
2-10-83	288	0.029±0.004	8-10-83	245[b]	0.043±0.005
2-17-83	285	0.023±0.003	8-18-83	324[c]	0.043±0.004
2-24-83	286	0.018±0.003	8-25-83	287	0.036±0.004
3-03-83	287	0.024±0.003	9-01-83	285	0.032±0.003
3-10-83	285	0.014±0.003	9-08-83	292	0.031±0.004
3-17-83	287	0.014±0.003	9-15-83	288	0.018±0.002
3-24-83	284	0.029±0.004	9-22-83	292	0.018±0.003
3-31-83	285	0.016±0.003	9-29-83	288	0.045±0.003
1st Qtr. mean ± s.d.		0.023±0.007	3rd Qtr. mean ± s.d.		0.030±0.010
4-07-83	286	0.014±0.003	10-05-83	249[b]	0.045±0.005
4-14-83	286	0.011±0.003	10-13-83	328[c]	0.021±0.003
4-21-83	285	0.023±0.004	10-19-83	243[b]	0.022±0.004
4-28-83	283	0.032±0.004	10-27-83	325[c]	0.024±0.003
5-05-83	285	0.018±0.003	11-03-83	289	0.032±0.004
5-12-83	292	0.021±0.003	11-10-83	ND[d]	ND[d]
5-19-83	261	0.013±0.003	11-16-83	248[b]	0.022±0.004
5-26-83	322	0.015±0.003	11-23-83	285	0.019±0.003
6-02-83	261	0.013±0.003	12-01-83	325[c]	0.018±0.003
6-09-83	266	0.013±0.003	12-09-83	330	0.067±0.005
6-16-83	253	0.027±0.004	12-15-83	243	0.019±0.004
6-23-83	284	0.026±0.003	12-22-83	284	0.016±0.004
6-30-83	287	0.033±0.004	12-29-83	284	0.012±0.003
2nd Qtr. mean ± s.d.		0.020±0.008	4th Qtr. mean ± s.d.		0.026±0.015

[a] Severe weather shut down the sampler during electrical outages in the area that week.
[b] Pump ran for 6 days only.
[c] Pump ran for 8 days.
[d] ND = No data. Sample not received; lost in transit by UPS.

Table 14. Airborne particulates collected at Location D-11, (Toddville), analysis for gross beta. Collection: Weekly.

Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)	Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)
1-06-83	285	0.030±0.004	7-07-83	237[b]	0.010±0.003
1-13-83	286	0.024±0.003	7-14-83	294	0.020±0.003
1-20-83	284	0.021±0.003	7-21-83	286	0.021±0.003
1-27-83	286	0.022±0.003	7-28-83	284	0.027±0.004
2-03-83	286	0.033±0.004	8-04-83	285	0.026±0.004
2-10-83	285	0.025±0.004	8-10-83	256[c]	0.034±0.004
2-17-83	286	0.028±0.004	8-18-83	325[d]	0.034±0.004
2-24-83	285	0.021±0.003	8-25-83	286	0.028±0.004
3-03-83	285	0.021±0.003	9-01-83	284	0.014±0.002
3-10-83	286	0.017±0.003	9-08-83	286	0.005±0.002[e]
3-17-83	289	0.013±0.003	9-15-83	286	0.008±0.002[e]
3-24-83	289	0.024±0.003	9-22-83	286	0.003±0.002[e]
3-31-83	285	0.014±0.003	9-29-83	285	0.008±0.002[e]
1st Qtr. mean ± s.d.		0.023±0.006	3rd Qtr. mean ± s.d.		0.018±0.011
4-07-83	294	0.010±0.002	10-05-83	246[c]	0.005±0.003[e]
4-14-83	291	0.011±0.003	10-13-83	324[d]	0.005±0.002[e]
4-21-83	291	0.019±0.003	10-19-83	246[c]	0.005±0.003[e]
4-28-83	293	0.024±0.004	10-27-83	326[d]	0.005±0.002[e]
5-05-83	288	0.017±0.003	11-03-83	288	0.002±0.002[e]
5-12-83	299	0.016±0.003	11-10-83	ND[f]	ND[f]
5-19-83	291	0.011±0.003	11-16-83	243[c]	0.017±0.004
5-26-83	373	0.018±0.003	11-23-83	286	0.022±0.004
6-02-83	294	0.014±0.003	12-01-83	328[d]	0.019±0.003
6-09-83	288	0.015±0.003	12-09-83	325	0.060±0.005
6-16-83	289	0.023±0.003	12-15-83	245	0.034±0.004
6-23-83	288	0.015±0.003	12-22-83	287	0.036±0.005
6-30-83	167[a]	0.033±0.005	12-29-83	284	0.035±0.004
2nd Qtr. mean ± s.d.		0.017±0.006	4th Qtr. mean ± s.d.		0.020±0.018

[a] Pump blew up; ran for only 91.8 hours.
[b] Pump ran for only 139.4 hours due to malfunction.
[c] Pump ran for 6 days only.
[d] Pump ran for 8 days.
[e] Filter light; very small amount of air particulate matter on the filter paper.
[f] ND = No data. Sample not received; lost in transit by UPS.

Table 15. Airborne particulates collected at Location D-12, (Iowa City), analysis for gross beta. Collection: Weekly.

Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)	Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)
1-06-83	309	0.030±0.004	7-07-83	280	0.013±0.003
1-13-83	285	0.023±0.003	7-14-83	278	0.021±0.003
1-20-83	285	0.020±0.003	7-21-83	284	0.022±0.003
1-27-83	289	0.018±0.003	7-28-83	284	0.024±0.004
2-03-83	290	0.032±0.004	8-04-83	287	0.025±0.004
2-10-83	292	0.029±0.004	8-10-83	246[b]	0.035±0.004
2-17-83	288	0.020±0.003	8-18-83	328[c]	0.029±0.004
2-24-83	302	0.016±0.003	8-25-83	288	0.021±0.003
3-03-83	300	0.020±0.003	9-01-83	285	0.030±0.003
3-10-83	297	0.016±0.003	9-08-83	286	0.037±0.004
3-17-83	296	0.011±0.002	9-15-83	280	0.020±0.002
3-24-83	292	0.027±0.004	9-22-83	283	0.020±0.003
3-31-83	284	0.015±0.003	9-29-83	286	0.046±0.003
1st Qtr. mean ± s.d.		0.021±0.006	3rd Qtr. mean ± s.d.		0.026±0.009
4-07-83	282	0.007±0.002[a]	10-05-83	245[b]	0.053±0.005
4-14-83	289	0.010±0.003	10-13-83	322[c]	0.022±0.003
4-21-83	296	0.022±0.004	10-19-83	249[b]	0.029±0.004
4-28-83	291	0.027±0.004	10-27-83	325[c]	0.022±0.003
5-05-83	296	0.013±0.003	11-03-83	288	0.032±0.004
5-12-83	285	0.018±0.003	11-10-83	ND[d]	ND[d]
5-19-83	298	0.008±0.003[a]	11-16-83	241[b]	0.024±0.004
5-26-83	265	0.010±0.003	11-23-83	285	0.027±0.004
6-02-83	293	0.011±0.003	12-01-83	329[c]	0.021±0.003
6-09-83	286	0.013±0.003	12-08-83	288	0.061±0.005
6-16-83	278	0.017±0.003	12-15-83	284	0.050±0.005
6-23-83	286	0.019±0.003	12-22-83	287	0.041±0.005
6-30-83	279	0.022±0.003	12-29-83	285	0.036±0.004
2nd Qtr. mean ± s.d.		0.015±0.006	4th Qtr. mean ± s.d.		0.035±0.014

[a] Filter light; very small amount of air particulate matter on the filter paper.
[b] Pump ran for 6 days only.
[c] Pump ran for 8 days.
[d] ND = No data. Sample not received; lost in transit by UPS.

Table 16. Airborne particulates collected at Location D-13, (Alburnett), analysis for gross beta. Collection: Weekly.

Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)	Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)
1-06-83	285	0.032±0.004	7-07-83	290	0.014±0.003
1-13-83	286	0.022±0.003	7-14-83	287	0.024±0.003
1-20-83	284	0.018±0.003	7-21-83	290	0.028±0.004
1-27-83	286	0.024±0.003	7-28-83	293	0.022±0.003
2-03-83	285	0.034±0.004	8-04-83	286	0.026±0.004
2-10-83	285	0.025±0.004	8-10-83	244[b]	0.014±0.003
2-17-83	286	0.028±0.004	8-18-83	62[a]	0.024±0.011
2-24-83	285	0.020±0.003	8-25-83	286	0.027±0.004
3-03-83	285	0.018±0.003	9-01-83	285	0.028±0.003
3-10-83	286	0.015±0.003	9-08-83	286	0.038±0.004
3-17-83	286	0.015±0.003	9-15-83	285	0.024±0.002
3-24-83	285	0.026±0.004	9-22-83	286	0.019±0.003
3-31-83	285	0.017±0.003	9-29-83	284	0.045±0.003
1st Qtr. mean ± s.d.		0.023±0.006	3rd Qtr. mean ± s.d.		0.026±0.009
4-07-83	286	0.016±0.003	10-05-83	246[b]	0.049±0.005
4-14-83	286	0.012±0.003	10-13-83	324[c]	0.025±0.003
4-21-83	285	0.020±0.004	10-19-83	246[b]	0.030±0.004
4-28-83	284	0.026±0.004	10-27-83	326[c]	0.025±0.003
5-05-83	285	0.015±0.003	11-03-83	288	0.030±0.004
5-12-83	285	0.020±0.003	11-10-83	ND[d]	ND[d]
5-19-83	286	0.018±0.003	11-16-83	243[b]	0.021±0.004
5-26-83	326	0 014±0.003	11-23-83	286	0.025±0.004
6-02-83	284	0.015±0.003	12-01-83	301[c]	0.024±0.004
6-09-83	286	0.012±0.003	12-09-83	325	0.066±0.005
6-16-83	296	0.025±0.003	12-15-83	245	0.048±0.005
6-23-83	296	0.020±0.003	12-22-83	291	0.044±0.005
6-30-83	292	0.021±0.003	12-29-83	284	0.038±0.004
2nd Qtr. mean ± s.d.		0.018±0.004	4th Qtr. mean ± s.d.		0.035±0.014

[a] Low volume due to pump malfunction.
[b] Pump ran for 6 days only.
[c] Pump ran for 8 days.
[d] ND = No data. Sample not received; lost in transit by UPS.

Table 17. Airborne particulates collected at Location D-14, (Alice), analysis for gross beta. Collection: Weekly.

Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)	Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)
1-06-83	285	0.028±0.004	7-07-83	283	0.013±0.003
1-13-83	286	0.020±0.003	7-14-83	286	0.022±0.003
1-20-83	285	0.017±0.003	7-21-83	286	0.024±0.004
1-27-83	286	0.019±0.003	7-28-83	285	0.019±0.003
2-03-83	285	0.030±0.004	8-04-83	286	0.010±0.003
2-10-83	285	0.025±0.004	8-10-83	244[b]	0.005±0.003[c]
2-17-83	285	0.020±0.003	8-18-83	326[d]	0.003±0.002[c]
2-24-83	280	0.015±0.003	8-25-83	286	0.002±0.002
3-03-83	275	0.018±0.003	9-01-83	285	0.007±0.004[c]
3-10-83	285	0.015±0.003	9-08-83	286	0.008±0.003[c]
3-17-83	284	0.011±0.003	9-15-83	285	0.005±0.002[c]
3-24-83	284	0.021±0.003	9-22-83	286	0.011±0.003
3-31-83	282	0.018±0.003	9-29-83	284	0.012±0.002
1st Qtr. mean ± s.d.		0.020±0.005	3rd Qtr. mean ± s.d.		0.011±0.007
4-07-83	287	0.011±0.003	10-05-83	246[b]	0.003±0.002[c]
4-14-83	281	<0.004[a]	10-13-83	324[d]	0.003±0.002[c]
4-21-83	282	0.018±0.003	10-19-83	246[b]	0.009±0.003[c]
4-28-83	281	0.021±0.004	10-27-83	326[d]	0.005±0.002[c]
5-05-83	290	0.016±0.003	11-03-83	288	0.002±0.002[c]
5-12-83	285	0.016±0.003	11-10-83	ND[e]	ND[e]
5-19-83	286	0.013±0.003	11-16-83	247[b]	0.019±0.004
5-26-83	342	0.016±0.003	11-23-83	303	0.020±0.003
6-02-83	284	0.014±0.003	12-01-83	154[f]	0.025±0.006
6-09-83	286	0.016±0.003	12-09-83	ND[g]	ND[g]
6-16-83	284	0.024±0.003	12-15-83	245	0.042±0.005
6-23-83	286	0.017±0.003	12-22-83	291	0.051±0.005
6-30-83	285	0.027±0.003	12-29-83	284	0.023±0.004
2nd Qtr. mean ± s.d.		0.017±0.005	4th Qtr. mean ± s.d.		0.018±0.016

[a] Filter paper was torn into small pieces due to freezing rain.
[b] Pump ran for only 6 days.
[c] Filter light: very small amount of air particulate matter on the filter paper.
[d] Pump ran for 8 days.
[e] ND = No data. Sample not received; lost in transit by UPS.
[f] Electricity off after 89.6 hours due to ice storm.
[g] ND = No data. No sample due to blown fuse.

Table 18. Airborne particulates collected at Location D-15, (On-site), analysis for gross beta. Collection: Weekly.

Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)	Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)
1-06-83	275	0.030±0.004	7-07-83	270[c]	0.012±0.003
1-13-83	286	0.016±0.003	7-14-83	277	0 024±0.004
1-20-83	285	0.016±0.003	7-21-83	292	0.025±0.004
1-27-83	287	0.016±0.003	7-28-83	286	0.018±0.003
2-03-83	282	0.031±0.004	8-04-83	287	0.025±0.004
2-10-83	282	0.025±0.004	8-10-83	239[b]	0.036±0.005
2-17-83	227	0.025±0.004	8-18-83	316[d]	0.036±0.004
2-24-83	289	0.003±0.002[a]	8-25-83	121[e]	0.035±0.007
3-03-83	283	0.015±0.003	9-01-83	282	0.030±0.003
3-10-83	290	0.011±0.002	9-08-83	294	0.028±0.004
3-17-83	283	0.010±0.002	9-15-83	285	0.023±0.002
3-24-83	283	0.023±0.004	9-22-83	277	0.015±0.003
3-31-83	288	0.011±0.002	9-29-83	284	0.043±0.003
1st Qtr. mean ± s.d.		0.018±0.008	3rd Qtr. mean ± s.d.		0.027±0.009
4-07-83	281	0.007±0.003[a]	10-05-83	ND[f]	ND[f]
4-14-83	283	0.007±0.003[a]	10-13-83	ND[f]	ND[f]
4-21-83	279	0.020±0.004	10-19-83	ND[f]	ND[f]
4-28-83	280	0.022±0.004	10-27-83	ND[f]	ND[f]
5-05-83	289	0.014±0.003	11-03-83	ND[f]	ND[f]
5-12-83	288	0.013±0.003	11-10-83	ND[f]	ND[f]
5-19-83	288	0.011±0.003	11-16-83	ND[f]	ND[f]
5-26-83	296	0.012±0.003	11-23-83	ND[f]	ND[f]
6-02-83	290	0.014±0.003	12-01-83	ND[f]	ND[f]
6-09-83	288	0.017±0.003	12-09-83	ND[f]	ND[f]
6-16-83	288	0.022±0.003	12-15-83	112[g]	0.020±0.006[g]
6-23-83	286	0.023±0.003	12-22-83	286	0.055±0.005
6-30-83	235[b]	0.019±0.003	12-19-83	284	0.041±0.004
2nd Qtr. mean ± s.d.		0.015±0.006	4th Qtr. mean ± s.d.		0.039±0.018

[a] Filter paper light; very little air particulate matter on the filter.
[b] Pump ran for six days.
[c] Severe weather shut down the sampler during electrical outages in the area that week.
[d] Pump ran for 8 days.
[e] Pump ran for only 71.4 hours. Electricity was shut off.
[f] ND = No data; sampler being relocated.
[g] Pump back in service; ran for only 66 hours.

Table 19. Airborne particulates collected at Location D-16, (On-site), analysis for gross beta. Collection: Weekly.

Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)	Date Collected	Volume (m^3)	Gross Beta (pCi/m^3)
1-06-83	285	0.025±0.004	7-07-83	285	0.012±0.003
1-13-83	286	0.015±0.003	7-14-83	286	0.026±0.004
1-20-83	285	0.022±0.003	7-21-83	285	0.023±0.004
1-27-83	285	0.021±0.003	7-28-83	286	0.025±0.004
2-03-83	285	0.032±0.004	8-04-83	249[b]	0.014±0.003
2-10-83	287	0.025±0.004	8-10-83	ND[c]	ND[c]
2-17-83	285	0.022±0.003	8-18-83	327[d]	0.034±0.004
2-24-83	285	0.015±0.003	8-25-83	285	0.034±0.004
3-03-83	285	0.014±0.003	9-01-83	285	0.030±0.003
3-10-83	285	0.014±0.003	9-08-83	285	0.037±0.004
3-17-83	241[a]	0.010±0.003	9-15-83	286	0.018±0.002
3-24-83	285	0.021±0.003	9-22-83	285	0.018±0.003
3-31-83	285	0.014±0.003	9-29-83	285	0.042±0.003
1st Qtr. mean ± s.d.		0.019±0.006	3rd Qtr. mean ± s.d.		0.026±0.009
4-07-83	285	0.012±0.003	10-05-83	247[e]	0.050±0.005
4-14-83	285	0.012±0.003	10-13-83	320[d]	0.023±0.003
4-21-83	286	0.015±0.003	10-19-83	246[e]	0.030±0.004
4-28-83	283	0.024±0.004	10-27-83	326[d]	0.026±0.003
5-05-83	285	0.014±0.003	11-03-83	289	0.032±0.004
5-12-83	285	0.019±0.003	11-10-83	ND[f]	ND[f]
5-19-83	285	0.015±0.003	11-16-83	245[e]	0.025±0.004
5-26-83	325	0.014±0.003	11-23-83	286	0.027±0.004
6-02-83	286	0.013±0.003	12-01-83	329[d]	0.018±0.003
6-09-83	284	0.015±0.003	12-09-83	322	0.066±0.005
6-16-83	285	0.023±0.003	12-15-83	228	0.008±0.003
6-23-83	286	0.022±0.003	12-22-83	ND[g]	ND[g]
6-30-83	286	0.028±0.003	12-29-83	ND[g]	ND[g]
2nd Qtr. mean ± s.d.		0.017±0.005	4th Qtr. mean ± s.d.		0.031±0.016

[a] Pump ran for only 141.9 hours.
[b] Pump ran for only 146.7 hours. Electricity was shut off.
[c] ND = No data; no electricity.
[d] Pump ran for 8 days.
[e] Pump ran for 6 days only.
[f] ND = No data. Sample not received; lost in transit by UPS.
[g] ND = No data; frozen vane.

Table 20. Airborne particulate samples, quarterly composites of weekly samples, analysis for strontium-89, strontium-90, and gamma emitting isotopes.

Location	Isotope	Sample Description and Activity (pCi/m^3)			
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
D-1	Lab Code	DAP-322	DAP-420	DAP-513	DAP-612
	Volume (m^3)	3713	3889	3722	3336
	Sr-89	<0.0013	<0.0008	<0.0020	<0.0012
	Sr-90	<0.0005	<0.0003	<0.0005	0.0004±0.0003
	Be-7	<0.062	0.090±0.032	<0.037	<0.039
	Nb-95	<0.0019	<0.0065	<0.0066	<0.0065
	Zr-95	<0.0054	<0.0088	<0.0046	<0.0077
	Ru-103	<0.0037	<0.0050	<0.0062	<0.0070
	Ru-106	<0.0095	<0.0016	<0.018	<0.022
	Cs-134	<0.0019	<0.0030	<0.0022	<0.0016
	Cs-137	<0.0019	<0.0019	<0.0018	<0.0020
	Ce-141	<0.0062	<0.0033	<0.0080	<0.0071
	Ce-144	<0.011	<0.013	<0.0086	<0.0088
D-2	Lab Code	DAP-323	DAP-421	DAP-514	DAP-613
	Volume (m^3)	3627	4574	3716	3407
	Sr-89	<0.0019	<0.0007	<0.0021	<0.0013
	Sr-90	<0.0009	<0.0003	<0.0006	<0.0005
	Be-7	<0.053	0.077±0.027	<0.070	<0.037
	Nb-95	<0.0019	<0.0054	<0.0031	<0.0086
	Zr-95	<0.0048	<0.010	<0.0062	<0.0050
	Ru-103	<0.0040	<0.0043	<0.0060	<0.0066
	Ru-106	<0.020	<0.016	<0.029	<0.032
	Cs-134	<0.0019	<0.0028	<0.0020	<0.0026
	Cs-137	<0.0014	<0.0016	<0.0017	<0.0021
	Ce-141	<0.0050	0.0011±0.0005	<0.017	<0.0090
	Ce-144	<0.0071	<0.0011	<0.013	<0.012

Table 20. (continued)

Location	Isotope	Sample Description and Activity (pCi/m^3)			
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
D-3	Lab Code	DAP-324	DAP-422	DAP-515	DAP-614
	Volume (m^3)	3698	4598	3711	3460
	Sr-89	<0.0017	<0.0008	<0.0032	<0.0011
	Sr-90	<0.0008	<0.0003	<0.0009	0.0005±0.0003
	Be-7	0.082±0.022	0.079±0.026	0.174±0.038	0.076±0.022
	Nb-95	<0.0020	<0.0057	<0.0034	<0.0062
	Zr-95	<0.0026	<0.0084	<0.010	<0.0060
	Ru-103	<0.0028	<0.0057	<0.0082	<0.0047
	Ru-106	<0.013	<0.016	<0.019	<0.020
	Cs-134	<0.0016	<0.0020	<0.0031	<0.0022
	Cs-137	<0.0014	<0.0025	<0.0019	<0.0015
	Ce-141	<0.0045	<0.0028	<0.012	<0.0073
	Ce-144	<0.0071	<0.0054	<0.019	<0.0088
D-4	Lab Code	DAP-325	DAP-423	DAP-516	DAP-615
	Volume (m^3)	3720	4640	3710	3428
	Sr-89	<0.0017	<0.0007	<0.0024	<0.0012
	Sr-90	<0.0007	<0.0003	<0.0007	<0.0005
	Be-7	0.108±0.025	0.078±0.029	<0.034	<0.034
	Nb-95	<0.0017	<0.0049	<0.0034	<0.0051
	Zr-95	<0.0033	<0.0085	<0.0057	<0.0062
	Ru-103	<0.0031	<0.0059	<0.0043	<0.0051
	Ru-106	<0.013	<0.013	<0.017	<0.014
	Cs-134	<0.0015	<0.0025	<0.0016	<0.0020
	Cs-137	<0.0016	<0.0025	<0.0014	<0.0014
	Ce-141	<0.0068	<0.0028	<0.0090	<0.0069
	Ce-144	<0.0067	<0.0070	<0.0090	<0.0089

Table 20. (continued)

Location	Isotope	Sample Description and Activity (pCi/m^3) 1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
D-5	Lab Code	DAP-326	DAP-424	DAP-517	DAP-616
	Volume (m^3)	3709	3731	3821	3379
	Sr-89	<0.0019	<0.0009	<0.0023	<0.0013
	Sr-90	<0.0009	<0.0004	<0.0007	0.0007±0.0003
	Be-7	<0.040	0.087±0.036	<0.030	0.098±0.025
	Nb-95	<0.0019	<0.0074	<0.0044	<0.0063
	Zr-95	<0.0050	<0.0090	<0.0060	<0.0070
	Ru-103	<0.0023	<0.0051	<0.0061	<0.0046
	Ru-106	<0.012	<0.022	<0.016	<0.016
	Cs-134	<0.0014	<0.0031	<0.0016	<0.0022
	Cs-137	<0.0010	<0.0023	<0.0012	<0.0018
	Ce-141	<0.0039	<0.0030	<0.0085	<0.0070
	Ce-144	<0.011	<0.013	<0.0078	<0.0085
D-6	Lab Code	DAP-327	DAP-425	DAP-518	DAP-617
	Volume (m^3)	3691	3765	3701	3426
	Sr-89	<0.0027	<0.0009	<0.0017	<0.0013
	Sr-90	<0.0013	<0.0004	<0.0005	<0.0006
	Be-7	0.084±0.022	0.139±0.037	<0.078	<0.043
	Nb-95	<0.0023	<0.0048	<0.0050	<0.0084
	Zr-95	<0.0026	0.0066±0.0051	<0.0050	<0.0055
	Ru-103	<0.0033	<0.0092	<0.010	<0.0072
	Ru-106	<0.016	<0.020	<0.022	<0.026
	Cs-134	<0.0012	<0.0026	<0.0017	<0.0035
	Cs-137	<0.0014	<0.0022	<0.0019	<0.0022
	Ce-141	<0.0050	<0.0030	<0.0071	<0.012
	Ce-144	<0.011	<0.013	<0.010	<0.012

Table 20. (continued)

Location	Isotope	Sample Description and Activity (pCi/m^3) 1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
D-7	Lab Code	DAP-328	DAP-426	DAP-519	DAP-618
	Volume (m^3)	3710	3694	3464	3418
	Sr-89	<0.0017	<0.0010	<0.0028	<0.0012
	Sr-90	<0.0008	<0.0005	<0.0008	<0.0005
	Be-7	0.085±0.023	0.082±0.035	<0.036	<0.040
	Nb-95	<0.0026	<0.0045	<0.0079	<0.0090
	Zr-95	<0.0039	<0.014	<0.0059	<0.0071
	Ru-103	<0.0053	<0.0081	<0.0058	<0.0076
	Ru-106	<0.016	<0.014	<0.018	<0.026
	Cs-134	<0.0014	<0.0034	<0.0021	<0.0032
	Cs-137	<0.0017	<0.0020	<0.0017	<0.0021
	Ce-141	<0.0070	<0.0034	<0.0070	<0.010
	Ce-144	<0.0068	<0.015	<0.0087	<0.012
D-8	Lab Code	DAP-329	DAP-427	DAP-520	DAP-619
	Volume (m^3)	3709	3564	3408	3398
	Sr-89	<0.0017	<0.0011	<0.0019	<0.0011
	Sr-90	<0.0008	<0.0005	<0.0006	<0.0005
	Be-7	<0.054	0.097±0.042	<0.096	<0.042
	Nb-95	<0.0034	<0.0082	<0.0020	<0.0088
	Zr-95	<0.0020	<0.012	<0.0068	<0.0075
	Ru-103	<0.0056	<0.0076	<0.0088	<0.0062
	Ru-106	<0.019	<0.028	<0.017	<0.026
	Cs-134	<0.0012	<0.0028	<0.0019	<0.0024
	Cs-137	<0.0011	<0.0025	<0.0019	<0.0018
	Ce-141	<0.0074	<0.0036	<0.0084	<0.0083
	Ce-144	<0.0073	<0.015	<0.0068	<0.0096

Table 20. (continued)

Location	Isotope	Sample Description and Activity (pCi/m^3)			
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
D-9	Lab Code	DAP-330	DAP-428	DAP-521	DAP-620
	Volume (m^3)	3722	3755	3705	2812
	Sr-89	<0.0017	<0.0009	<0.0020	<0.0013
	Sr-90	<0.0008	<0.0004	<0.0006	<0.0004
	Be-7	<0.050	0.118±0.036	<0.079	<0.055
	Nb-95	<0.0019	<0.0096	<0.0020	<0.011
	Zr-95	<0.0043	<0.015	<0.0026	<0.011
	Ru-103	<0.0057	<0.0062	<0.0057	<0.0095
	Ru-106	<0.019	<0.017	<0.017	<0.018
	Cs-134	<0.0012	<0.0031	<0.0016	<0.0030
	Cs-137	<0.0015	<0.0009	<0.0013	<0.0027
	Ce-141	<0.0045	<0.0034	<0.0099	<0.010
	Ce-144	<0.011	<0.015	<0.0082	<0.013
D-10	Lab Code	DAP-331	DAP-429	DAP-522	DAP-621
	Volume (m^3)	3726	3651	3719	3433
	Sr-89	<0.0021	<0.0013	<0.0018	<0.0011
	Sr-90	<0.0011	<0.0005	<0.0006	<0.0004
	Be-7	0.094±0.024	0.087±0.039	0.110±0.028	<0.039
	Nb-95	<0.0023	<0.0064	<0.0062	<0.0069
	Zr-95	<0.0028	<0.012	<0.0058	<0.0055
	Ru-103	<0.0053	<0.0051	<0.0061	<0.0067
	Ru-106	<0.015	<0.023	<0.018	<0.016
	Cs-134	<0.0017	<0.0025	<0.0016	<0.0029
	Cs-137	<0.0014	<0.0031	<0.0015	<0.0019
	Ce-141	<0.0065	<0.0037	<0.0088	<0.0087
	Ce-144	<0.0074	<0.017	<0.0075	<0.0096

Table 20. (continued)

Location	Isotope	Sample Description and Activity (pCi/m^3)			
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
D-11	Lab Code	DAP-332	DAP-430	DAP-523	DAP-622
	Volume (m^3)	3717	3732	3680	3428
	Sr-89	<0.0012	<0.0013	<0.0024	<0.0010
	Sr-90	<0.0005	<0.0005	<0.0008	<0.0004
	Be-7	<0.056	0.093±0.040	<0.029	<0.040
	Nb-95	<0.0019	<0.0076	<0.0014	<0.0070
	Zr-95	<0.0054	<0.0071	<0.0068	<0.0074
	Ru-103	<0.0031	<0.0076	<0.0062	<0.0069
	Ru-106	<0.0090	<0.023	<0.010	<0.021
	Cs-134	<0.0019	<0.0026	<0.0014	<0.0023
	Cs-137	<0.0016	<0.0030	<0.0015	<0.0025
	Ce-141	<0.0042	<0.0036	<0.0092	<0.0079
	Ce-144	<0.0074	<0.016	<0.011	<0.011
D-12	Lab Code	DAP-333	DAP-431	DAP-524	DAP-623
	Volume (m^3)	3809	3724	3695	3428
	Sr-89	<0.0011	<0.0013	<0.0027	<0.0010
	Sr-90	<0.0005	<0.0005	<0.0009	<0.0004
	Be-7	0.092±0.024	0.120±0.037	0.192±0.038	<0.043
	Nb-95	<0.0023	<0.0095	<0.0039	<0.0080
	Zr-95	<0.0047	<0.0084	<0.0057	<0.0079
	Ru-103	<0.0034	<0.0076	<0.0078	<0.0062
	Ru-106	<0.015	<0.020	<0.025	<0.025
	Cs-134	<0.0012	<0.0020	<0.0019	<0.0021
	Cs-137	<0.0013	<0.0030	<0.0020	<0.0022
	Ce-141	<0.0050	<0.0034	<0.019	<0.0083
	Ce-144	<0.0074	<0.013	<0.015	<0.011

Table 20. (continued)

Location	Isotope	Sample Description and Activity (pCi/m^3)			
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
D-13	Lab Code	DAP-334	DAP-432	DAP-525	DAP-624
	Volume (m^3)	3709	3777	3464	3405
	Sr-89	<0.0012	<0.0012	<0.0027	<0.0014
	Sr-90	<0.0005	<0.0005	<0.0006	<0.0005
	Be-7	0.145±0.031	0.095±0.037	0.151±0.035	<0.040
	Nb-95	<0.0025	<0.0078	<0.0048	<0.0079
	Zr-95	<0.0028	<0.0078	<0.0081	<0.0075
	Ru-103	<0.0034	<0.0053	<0.0073	<0.0055
	Ru-106	<0.015	<0.020	<0.017	<0.018
	Cs-134	<0.0010	<0.0031	<0.0017	<0.0023
	Cs-137	<0.0014	<0.0022	<0.0031	<0.0024
	Ce-141	<0.0082	<0.0033	<0.010	<0.0078
	Ce-144	<0.0068	<0.015	<0.016	<0.010
D-14	Lab Code	DAP-335	DAP-433	DAP-526	DAP-625
	Volume (m^3)	3687	3759	3418	2954
	Sr-89	<0.0012	<0.0012	<0.0023	<0.0012
	Sr-90	<0.0005	<0.0005	<0.0005	<0.0004
	Be-7	<0.060	0.109±0.023	<0.056	<0.026
	Nb-95	<0.0022	<0.0048	<0.0036	<0.0049
	Zr-95	<0.0053	<0.0076	<0.0068	<0.0044
	Ru-103	<0.0051	<0.0045	<0.0050	<0.0039
	Ru-106	<0.016	<0.017	<0.014	<0.014
	Cs-134	<0.0012	<0.0022	<0.0023	<0.0019
	Cs-137	<0.0016	<0.0017	<0.0016	<0.0014
	Ce-141	<0.0067	<0.0022	<0.014	<0.0055
	Ce-144	<0.0091	<0.010	<0.0095	<0.0073

Table 20. (continued)

Location	Isotope	Sample Description and Activity (pCi/m^3)			
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
D-15	Lab Code	DAP-336	DAP-434	DAP-527	DAP-626
	Volume (m^3)	3640	3671	3510	682
	Sr-89	<0.0013	<0.0012	<0.0029	<0.0051
	Sr-90	<0.0006	<0.0005	<0.0007	<0.0020
	Be-7	<0.051	0.101±0.033	0.151±0.028	0.161±0.055
	Nb-95	<0.0020	<0.0061	<0.0073	<0.015
	Zr-95	<0.0053	<0.0078	<0.0064	<0.016
	Ru-103	<0.0043	<0.0079	<0.0063	<0.013
	Ru-106	<0.014	<0.019	<0.011	<0.038
	Cs-134	<0.0014	<0.0022	<0.0016	<0.0054
	Cs-137	<0.0011	<0.0020	<0.0016	<0.0049
	Ce-141	<0.0064	<0.0028	<0.0076	<0.019
	Ce-144	<0.0084	<0.014	<0.0080	<0.024
D-16	Lab Code	DAP-337	DAP-435	DAP-528	DAP-627
	Volume (m^3)	3664	3746	3429	2838
	Sr-89	<0.0012	<0.0012	<0.0022	<0.0023
	Sr-90	<0.0006	<0.0005	<0.0005	<0.0008
	Be-7	<0.057	0.095±0.039	0.178±0.041	<0.031
	Nb-95	<0.0025	<0.0088	<0.0037	<0.0055
	Zr-95	<0.0040	<0.010	<0.0070	<0.0054
	Ru-103	<0.0056	<0.0085	<0.0071	<0.0057
	Ru-106	<0.019	<0.023	<0.017	<0.017
	Cs-134	<0.0014	<0.0026	<0.0020	<0.0016
	Cs-137	<0.0015	<0.0023	<0.0023	<0.0016
	Ce-141	<0.0074	<0.0039	<0.012	<0.0074
	Ce-144	<0.011	<0.014	<0.015	<0.0084

Table 21. Charcoal samples, weekly composites from indicator locations D-4, D-5, D-7, D-11, and D-15; analysis for iodine-131. Collection: Weekly.

Date Collected	Volume (m^3)	I-131 Activity (pCi/m^3)	Date Collected	Volume (m^3)	I-131 Activity (pCi/m^3)
1-06-83	1415	<0.006	7-07-83	1215	<0.006
1-13-83	1430	<0.006	7-14-83	1382	<0.006
1-20-83	1423	<0.006	7-21-83	1425	<0.006
1-27-83	1430	<0.006	7-28-83	1423	<0.006
2-02-83	1424	<0.006	8-04-83	1420	<0.006
2-10-83	1423	<0.006	8-10-83	1222	<0.006
2-17-83	1369	<0.006	8-18-83	1612	<0.006
2-24-83	1430	<0.006	8-25-83	1259	<0.006
3-03-83	1423	<0.006	9-01-83	1413	<0.006
3-10-83	1434	<0.006	9-08-83	1435	<0.006
3-17-83	1430	<0.006	9-15-83	1429	<0.006
3-24-83	1427	<0.006	9-22-83	1420	<0.006
3-31-83	1428	<0.006	9-29-83	1419	<0.006
4-07-83	1441	<0.006	10-05-83	982	<0.006
4-14-83	1440	<0.006	10-13-83	1269	<0.006
4-21-83	1435	<0.006	10-19-83	941	<0.006
4-28-83	1433	<0.006	10-27-83	1302	<0.006
5-05-83	1444	<0.006	11-03-83	1160	<0.006
5-12-83	1442	<0.006	11-10-83	ND[a]	ND[a]
5-19-83	1436	<0.006	11-16-83	983	<0.006
5-26-83	1571	<0.006	11-23-83	1143	<0.006
6-02-83	1440	<0.006	12-01-83	1296	<0.006
6-09-83	1431	<0.006	12-09-83	1301	<0.006
6-16-83	1431	<0.006	12-15-83	1099	<0.006
6-23-83	1432	<0.006	12-22-83	1434	<0.006
6-30-83	1259	<0.006	12-29-83	1429	<0.006

[a] ND = No data. Samples not received; lost in transit by UPS.

Table 22. Charcoal samples, weekly composites from control locations D-8, D-12, and D-14; analysis for iodine-131. Collection: Weekly.

Date Collected	Volume (m^3)	I-131 Activity (pCi/m^3)	Date Collected	Volume (m^3)	I-131 Activity (pCi/m^3)
1-06-83	879	<0.01	7-07-83	834	<0.01
1-13-83	857	<0.01	7-14-83	840	<0.01
1-20-83	855	<0.01	7-21-83	858	<0.01
1-27-83	861	<0.01	7-28-83	849	<0.01
2-02-83	860	<0.01	8-04-83	854	<0.01
2-10-83	862	<0.01	8-10-83	734	<0.01
2-17-83	858	<0.01	8-18-83	983	<0.01
2-24-83	868	<0.01	8-25-83	859	<0.01
3-03-83	860	<0.01	9-01-83	849	<0.01
3-10-83	868	<0.01	9-08-83	858	<0.01
3-17-83	866	<0.01	9-15-83	850	<0.01
3-24-83	861	<0.01	9-22-83	603	<0.01
3-31-83	850	<0.01	9-29-83	841	<0.01
4-07-83	855	<0.01	10-05-83	739	<0.01
4-14-83	836	<0.01	10-13-83	965	<0.01
4-21-83	839	<0.01	10-19-83	740	<0.01
4-28-83	850	<0.01	10-27-83	975	<0.01
5-05-83	859	<0.01	11-03-83	869	<0.01
5-12-83	840	<0.01	11-10-83	ND[a]	ND[a]
5-19-83	856	<0.01	11-16-83	731	<0.01
5-26-83	892	<0.01	11-23-83	873	<0.01
6-02-83	849	<0.01	12-01-83	785	<0.01
6-09-83	848	<0.01	12-09-83	613	<0.01
6-16-83	838	<0.01	12-15-83	774	<0.01
6-23-83	849	<0.01	12-22-83	864	<0.01
6-30-83	836	<0.01	12-29-83	853	<0.01

[a] ND = No data. Samples not received; lost intransit by UPS.

Table 23. Ambient gamma radiation (TLD), monthly exposure.

Location No.	Location Descr.	mR/30 days					
		January	February	March	April	May	June
D-1	Cedar Rapids	3.2±0.3	4.1±0.7	3.9±0.5	3.0±0.3	3.3±0.4	ND[a]
D-2	Marion	3.3±0.5	3.9±0.4	4.2±0.6	3.1±0.2	3.5±0.3	3.0±0.2
D-3	Hiawatha	3.2±0.3	3.6±0.4	4.1±0.4	2.8±0.3	3.5±0.4	3.2±0.2
D-4	Johnson	3.7±0.6	3.5±0.6	4.4±0.6	3.3±0.2	4.1±1.0	2.8±0.1
D-6	Center Point	3.5±0.5	3.4±0.4	4.0±0.5	3.0±0.3	3.3±0.5	3.0±0.2
D-7	Shellsberg	3.3±0.3	3.5±0.3	4.2±0.6	3.3±0.3	3.4±0.4	3.1±0.1
D-8	Urbana	4.0±0.5	4.4±0.6	4.5±0.8	3.5±0.2	4.2±0.7	3.5±0.1
D-9	Route W26	3.8±0.3	4.5±0.8	5.1±0.4	ND[a]	4.5±0.5	3.6±0.3
D-10	Atkins	4.2±0.5	4.7±0.6	4.3±0.3	3.5±0.3	3.6±0.5	3.1±0.2
D-11	Toddville	3.2±0.3	3.9±0.5	4.4±0.4	3.6±0.5	3.5±0.4	3.2±0.2
D-12	Univ. of Iowa	3.5±0.3	3.9±0.3	3.8±0.4	3.3±0.3	3.2±0.6	3.2±0.2
D-13	Albrunett	ND[a]	ND[a]	4.9±0.8	3.1±0.2	3.1±0.4	3.2±0.4
D-14	Alice	3.8±0.5	3.8±0.6	4.7±0.4	ND[a]	4.1±0.4	3.0±0.1
D-15	On-Site	4.5±0.4	5.3±0.8	5.7±0.3	4.0±0.2	5.4±0.7	3.6±0.2
D-16	On-Site	3.4±0.3	4.2±0.5	4.6±0.8	3.1±0.2	4.6±1.0	3.0±0.1
Mean ± s.d.		3.6±0.4	4.1±0.5	4.4±0.5	3.3±0.3	3.8±0.6	3.2±0.2

Table 23. (continued)

Location	mR/30 days						
	July	August	September	October	November	December	Mean ± s.d.
D-1	3.0±0.4	2.9±0.2	4.1±0.3	3.0±0.3	3.3±0.3	3.5±0.6	3.3±0.5
D-2	3.4±0.3	2.9±0.2	4.7±0.4	3.2±0.4	3.4±0.3	3.9±0.6	3.4±0.6
D-3	3.5±0.3	3.2±0.3	4.0±0.4	2.6±0.4	3.0±0.2	4.3±1.0	3.3±0.4
D-4	3.0±0.4	2.7±0.3	4.1±0.2	3.0±0.4	3.3±0.3	2.8±0.5	3.4±0.6
D-6	3.0±0.3	2.9±0.3	3.8±0.3	2.9±0.3	3.3±0.3	3.9±0.7	3.2±0.4
D-7	3.8±0.2	3.3±0.4	4.1±0.2	2.8±0.4	3.2±0.3	3.5±0.7	3.4±0.4
D-8	4.0±0.3	3.4±0.4	4.8±0.2	2.9±0.3	3.8±0.2	4.4±1.4	4.0±0.4
D-9	4.3±0.5	3.3±0.2	4.8±0.4	3.4±0.4	4.4±0.6	3.6±0.5	4.0±0.7
D-10	4.0±0.4	3.0±0.2	5.6±0.2	2.9±0.3	3.5±0.1	3.7±1.0	3.8±0.8
D-11	3.3±0.2	2.7±0.3	4.2±0.5	3.0±0.3	3.8±0.2	3.2±0.6	3.4±0.6
D-12	2.9±0.4	2.9±0.2	4.6±0.3	2.7±0.4	3.6±0.4	3.5±0.7	3.4±0.6
D-13	3.3±0.3	2.8±0.2	3.7±0.2	2.6±0.3	3.0±0.2	ND[a]	3.3±0.7
D-14	4.0±0.2	3.0±0.3	4.6±0.3	3.3±0.4	3.8±0.2	4.0±0.7	3.7±0.6
D-15	5.5±0.4	3.7±0.3	6.7±0.4	3.9±0.4	5.3±0.3	4.1±0.5	4.7±1.1
D-16	4.1±0.4	3.0±0.2	4.6±0.2	2.7±0.3	4.1±0.9	4.9±1.2	3.7±0.7
Mean ± s.d.	3.7±0.7	3.0±0.3	4.6±0.8	3.0±0.4	3.7±0.6	3.8±0.5	3.7±0.7

Table 23. (continued)

Location No.	Location Descr.	mR/30 days					
		January	February	March	April	May	June
D-17	0.5 mi N	3.5±0.3	4.3±0.6	4.4±0.6	3.2±0.3	3.7±0.6	3.3±0.1
D-18	0.5 mi NNE	3.2±0.4	4.2±0.5	3.9±0.2	3.1±0.2	3.9±0.5	2.8±0.1
D-19	0.5 mi NE	3.8±0.8	4.1±0.6	4.3±0.6	3.2±0.3	3.8±0.5	2.7±0.1
D-20	0.5 mi ENE	3.9±0.4	4.6±0.4	5.0±1.0	3.1±0.2	3.9±0.9	3.0±0.2
D-21	0.5 mi E	3.7±0.4	3.9±0.6	4.2±0.4	3.1±0.5	4.0±0.4	3.0±0.3
D-22	0.5 mi ESE	3.2±0.3	3.5±0.4	4.0±0.6	3.1±0.2	ND[a]	2.6±0.2
D-23	0.5 mi SE	3.3±0.7	3.9±0.7	4.5±0.7	3.0±0.4	3.9±0.4	2.6±0.2
D-24	0.5 mi SSE	3.4±0.4	4.2±1.0	4.1±0.3	3.2±0.2	4.1±0.6	3.4±0.1
D-25	0.5 mi S	3.5±0.4	4.1±0.8	4.1±0.3	3.4±0.3	4.2±0.6	3.2±0.3
D-26	0.5 mi SSW	3.3±0.4	4.3±0.8	4.4±0.8	3.5±0.2	3.9±0.4	3.1±0.2
D-27	0.5 mi SW	5.3±0.6	3.8±0.6	ND[a]	3.5±0 3	4.3±0.5	3.5±0.4
D-28	0.5 mi WSW	4.0±0.4	4.3±0.7	6.1±1.4	3.8±0.5	5.0±0.6	4.0±0.4
D-29	0.5 mi W	3.9±0.3	5.0±0.6	5.7±1.0	3.7±0.3	4.7±0.5	3.7±0.3
D-30	0.5 mi WNW	4.2±0.5	4.7±0.5	4.9±0.5	3.8±0.3	5.0±0.5	3.8±0.3
D-31	0.5 mi NW	4.4±1.0	5.0±0.7	5.6±0.8	3.9±0.2	5.6±1.4	4.2±0.3
D-32	0.5 mi NNW	4.2±0.2	4.5±0.4	5.1±0.4	3.7±0.3	4.7±0.4	3.4±0.3
Mean ± s.d.		3.8±0.6	4.3±0.4	4.7±0.7	3.4±0.3	4.3±0.6	3.3±0.5

Table 23. (continued)

Location	mR/30 days						
	July	August	September	October	November	December	Mean ± s.d.
D-17	4.8±0.4	3.2±0.3	4.9±0.2	3.3±0.4	4.3±0.4	3.4±0.7	3.8±0.7
D-18	4.5±0.3	3.2±0.3	4.6±0.3	2.9±0.6	3.8±0.3	2.9±0.5	3.5±0.7
D-19	4.3±0.6	3.6±0.4	5.2±0.4	2.9±0.3	4.4±0.3	2.8±0.4	3.7±0.8
D-20	4.8±0.3	3.6±0.4	5.8±0.3	3.1±0.3	4.7±0.4	3.9±0.8	4.0±0.9
D-21	3.7±0.5	3.1±0.2	5.6±0.5	2.9±0.3	4.0±0.4	3.0±1.0	3.6±0.8
D-22	3.9±0.5	3.1±0.3	5.0±0.2	3.0±0.4	4.0±0.4	4.0±0.6	3.5±0.7
D-23	4.0±0.7	2.8±0.2	4.6±0.3	2.7±0.4	3.5±0.3	3.2±0.9	3.4±0.7
D-24	3.5±0.3	3.2±0.3	4.9±0.3	3.0±0.3	4.1±0.2	3.1±0.6	3.6±0.6
D-25	3.9±0.3	3.0±0.3	5.2±0.8	2.7±0.3	4.1±0.6	3.6±0.6	3.7±0.7
D-26	3.8±0.3	3.6±0.4	5.2±0.3	2.9±0.3	4.1±0.3	3.1±0.8	3.7±0.7
D-27	3.9±0.5	3.2±0.3	4.7±0.3	3.1±0.3	4.1±0.2	2.8±0.8	3.8±0.8
D-28	4.2±0.5	3.5±0.4	5.6±0.7	3.8±0.5	5.2±0.5	4.2±1.1	4.4±0.9
D-29	4.7±0.4	3.4±0.3	5.7±0.1	3.4±0.3	5.1±0.2	3.4±0.8	4.3±1.0
D-30	5.4±0.5	3.7±0.2	6.4±0.3	3.5±0.4	4.6±0.3	3.4±1.0	4.4±1.0
D-31	5.6±0.2	3.6±0.3	6.2±0.2	3.6±0.3	5.1±0.6	3.0±0.7	4.6±1.1
D-32	5.4±0.5	3.7±0.2	6.0±0.2	3.6±0.4	5.0±0.7	3.3±0.6	4.3±1.0
Mean ± s.d.	4.4±0.7	3.3±0.3	5.4±0.6	3.2±0.3	4.4±0.5	3.3±0.4	3.9±0.9

Table 23. (continued)

Location No.	Location Descr.	mR/30 days					
		January	February	March	April	May	June
D-33	3.0 mi N	3.7±0.2	4.0±0.6	4.2±0.4	3.3±0.3	4.4±0.8	3.2±0.2
D-34	3.0 mi NE	3.5±0.3	3.5±0.5	4.5±0.9	3.3±0.4	4.5±0.9	3.0±0.1
D-35	3.0 mi NE	3.3±0.5	3.7±0.4	4.0±0.6	3.1±0.3	4.2±0.8	3.0±0.2
D-36	3.0 mi NE	ND[a]	4.8±0.5	4.2±0.4	3.7±0.3	4.5±0.5	3.5±0.2
D-37	3.0 mi E	4.3±0.3	5.2±0.7	4.8±0.4	3.8±0.4	4.8±0.5	3.5±0.2
D-38	3.0 mi SE	3.4±0.3	3.8±0.5	4.5±0.3	3.3±0.4	4.1±0.6	3.4±0.2
D-39	3.0 mi SE	3.8±0.5	4.4±0.3	4.7±0.3	3.8±0.2	4.8±0.6	3.6±0.4
D-40	3.0 mi SE	3.4±0.5	3.9±0.4	4.5±0.6	3.8±0.2	5.1±0.7	3.1±0.2
D-41	3.0 mi S	5.2±0.5	4.1±0.5	4.4±0.3	3.6±0.3	4.6±0.8	3.1±0.2
D-42	3.0 mi SW	3.3±0.3	4.0±0.8	4.5±0.4	3.1±0.3	ND[a]	3.4±0.3
D-43	3.0 mi SW	3.6±0.9	3.7±0.4	4.2±0.5	3.3±0.3	3.5±0.5	3.0±0.2
D-44	1.0 mi SW	4.2±0.2	4.8±0.6	ND[a]	ND[a]	5.1±0.6	3.8±0.2
D-45	1.0 mi SW	3.6±0.4	4.5±0.8	5.0±0.5	3.5±0.3	4.7±0.6	ND[a]
D-46	1.0 mi W	3.6±0.3	4.5±0.5	4.6±0.4	3.7±0.3	4.9±0.6	3.8±0.2
D-47	1.0 mi NW	3.7±0.4	4.8±0.7	4.8±0.6	4.0±0.2	5.7±0.5	3.8±0.4
D-48	1.0 mi NW	4.0±0.5	4.2±0.6	4.9±0.4	3.7±0.3	4.7±0.7	3.7±0.2
Mean ± s.d.		3.8±0.5	4.2±0.5	4.5±0.3	3.5±0.3	4.6±0.5	3.4±0.3

Table 23. (continued)

Location	mR/30 days						
	July	August	September	October	November	December	Mean ± s.d.
D-33	4.4±0.5	3.3±0.2	5.1±0.3	3.1±0.4	4.0±0.1	1.8±0.4	3.7±0.8
D-34	3.9±0.3	3.0±0.3	5.1±0.3	3.0±0.3	4.1±0.2	2.4±0.5	3.6±0.8
D-35	4.2±0.3	3.0±0.3	4.2±0.2	3.0±0.4	3.8±0.3	1.8±0.5	3.5±0.7
D-36	3.7±0.4	3.2±0.2	5.7±0.7	3.2±0.3	4.9±0.3	3.0±0.6	4.0±0.9
D-37	5.0±0.3	3.1±0.3	5.6±0.4	3.4±0.3	4.9±0.2	3.8±0.5	4.3±0.9
D-38	4.0±0.4	3.2±0.3	4.8±0.2	3.2±0.3	4.2±0.2	2.0±0.7	3.7±0.7
D-39	4.6±0.5	3.5±0.4	5.5±0.2	3.3±0.3	4.4±0.2	2.8±0.6	4.1±0.8
D-40	3.9±0.4	3.1±0.3	5.2±0.3	3.3±0.5	3.8±0.3	2.6±0.6	3.8±0.8
D-41	4.5±0.3	3.2±0.4	6.1±0.3	3.4±0.4	4.3±0.3	3.0±0.7	4.1±1.0
D-42	3.7±0.3	3.0±0.3	4.7±0.5	ND[a]	3.6±0.2	2.8±0.4	3.6±0.7
D-43	3.5±0.3	2.7±0.2	4.3±0.3	2.8±0.3	3.7±0.3	2.3±0.8	3.4±0.6
D-44	5.0±0.3	3.6±0.2	5.1±0.3	3.6±0.4	5.1±0.2	3.4±0.9	4.3±0.9
D-45	4.5±0.5	3.7±0.3	6.0±0.5	3.7±0.4	5.2±0.4	2.5±0.6	4.2±1.0
D-46	5.1±0.3	3.8±0.3	6.4±0.5	4.1±0.4	4.7±0.2	2.4±0.4	4.3±1.0
D-47	5.2±0.3	3.4±0.3	6.5±0.4	3.7±0.4	4.9±0.4	2.4±0.5	4.4±1.1
D-48	5.2±0.4	3.9±0.3	7.3±0.5	3.6±0.3	4.9±0.2	3.5±0.6	4.4±1.2
Mean ± s.d.	4.4±0.6	3.3±0.3	5.5±0.8	3.4±0.3	4.4±0.5	2.7±0.6	4.0±0.9

Table 23. (continued)

Location No.	Location Descr.	mR/30 days					
		January	February	March	April	May	June
D-76	0.5 mi NE	3.6±0.4	4.2±0.5	4.6±0.4	3.7±0.4	ND[a]	3.0±0.1
D-77	0.5 mi NE	3.8±0.4	3.7±0.7	3.9±0.4	3.3±0.3	3.8±0.6	2.7±0.1
D-78	0.5 mi NE	3.6±0.6	4.6±0.5	4.4±0.6	3.2±0.2	3.9±0.7	ND[a]
D-79	0.5 mi E	3.9±0.4	4.5±0.9	4.1±0.5	3.2±0.2	4.0±0.7	2.8±0.2
D-80	0.5 mi SE	3.5±0.3	4.2±0.7	3.8±0.3	2.9±0.2	4.1±1.0	2.6±0.1
D-81	0.5 mi SE	3.3±0.4	3.9±0.4	3.9±0.5	3.4±0.2	3.8±0.4	2.6±0.1
D-82	0.5 mi SE	2.9±0.4	3.3±0.4	3.4±0.6	3.0±0.2	.4±0.7	3.0±0.3
D-83	0.5 mi S	3.7±0.4	4.0±0.3	4.3±0.9	3.4±0.3	3.8±0.5	ND[a]
D-84	0.5 mi SW	3.3±0.3	3.2±0.3	3.8±0.4	3.3±0.3	ND[a]	3.2±0.2
D-85	0.5 mi SW	3.6±0.3	4.1±0.7	4.4±0.4	3.2±0.3	3.6±0.4	2.9±0.2
D-86	0.5 mi SW	3.7±0.3	5.0±0.9	4.7±0.9	3.3±0.3	4.2±0.5	3.3±0.2
D-87	0.5 mi SW	4.2±0.3	4.1±0.5	4.7±0.3	3.7±0.3	4.9±0.3	3.6±0.3
D-88	0.5 mi W	4.8±1.0	4.3±0.4	5.3±0.5	3.8±0.2	4.5±0.4	3.5±0.2
D-89	0.5 mi W	4.5±0.8	4.7±0.5	5.0±0.6	3.6±0.3	4.6±0.3	3.9±0.2
D-90	0.5 mi NW	4.7±0.6	4.8±0.3	5.8±0.4	4.0±0.4	5.1±0.3	4.0±0.3
D-91	0.5 mi N	3.7±0.6	4.5±0.8	4.6±0.5	3.7±0.3	4.5±0.6	3.3±0.4
Mean ± s.d.		3.8±0.5	4.2±0.5	4.4±0.6	3.4±0.3	4.2±0.5	3.2±0.4

Table 23. (continued)

Location	mrem/30 days						
	July	August	September	October	November	December	Mean ± s.d.
D-76	4.6±0.5	3.5±0.2	5.4±0.5	3.3±0.4	4.4±0.3	2.6±0.7	3.9±0.8
D-77	3.6±0.4	3.1±0.3	4.7±0.2	2.8±0.4	3.7±0.2	2.9±1.0	3.5±0.6
D-78	4.9±0.3	3.4±0.2	5.5±0.5	3.2±0.5	4.8±0.4	4.1±0.7	4.2±0.8
D-79	3.9±0.5	3.3±0.3	4.6±0.2	3.3±0.5	4.7±0.4	3.1±0.5	3.8±0.7
D-80	3.9±0.2	3.2±0.3	4.3±0.3	2.6±0.3	3.7±0.1	2.2±0.6	3.4±0.7
D-81	3.3±0.2	2.8±0.3	7.3±0.4	2.7±0.4	3.8±0.4	2.6±0.5	3.6±1.3
D-82	3.2±0.2	3.3±0.2	3.9±0.2	2.6±0.3	3.4±0.3	2.0±0.7	3.1±0.5
D-83	3.9±0.3	2.9±0.3	4.6±0.3	2.9±0.4	4.2±0.3	2.5±0.5	3.6±0.7
D-84	3.8±0.3	3.2±0.4	5.0±0.6	2.9±0.3	4.0±0.2	2.4±0.6	3.4±0.7
D-85	3.8±0.3	3.0±0.3	5.3±0.4	3.0±0.3	4.6±0.2	2.6±0.9	3.6±0.8
D-86	4.4±0.3	3.3±0.3	5.0±0.4	3.1±0.3	4.9±0.2	2.8±1.1	3.9±0.9
D-87	4.7±0.3	3.3±0.2	5.6±0.3	3.4±0.3	4.4±0.2	2.6±0.8	4.1±0.9
D-88	5.0±0.6	3.7±0.4	6.0±0.4	3.4±0.6	4.6±0.3	3.4±0.7	4.3±0.9
D-89	5.3±0.2	3.8±0.2	6.5±0.4	3.9±0.6	4.9±0.3	2.8±0.5	4.4±1.0
D-90	5.2±0.5	3.7±0.3	6.8±0.5	3.7±0.3	5.3±0.5	3.4±0.3	4.6±1.1
D-91	4.4±0.6	4.2±0.6	6.0±0.5	3.6±0.6	ND[a]	3.2±0.7	4.1±0.9
Mean ± s.d.	4.2±0.7	3.4±0.4	5.4±0.9	3.2±0.4	4.4±0.5	2.9±0.6	3.9±0.9

[a] ND = No data. TLDs lost in the field.

Table 24. Ambient gamma radiation (TLD), annual exposure.

Location	mR/365 days	normalized to 30 days	Location	mR/365 days	normalized to 30 days
D-1	48.8±5.3	4.0±0.4	D-33	52.3±3.3	4.3±0.3
D-2	50.5±1.6	4.2±0.1	D-34	50.3±3.4	4.1±0.3
D-3	43.3±2.3	3.6±0.2	D-35	53.2±3.4	4.4±0.3
D-4	48.0±3.5	3.9±0.3	D-36	63.3±5.4	5.2±0.4
D-6	43.3±1.9	3.6±0.2	D-37	64.0±7.7	5.3±0.6
D-7	54.7±5.1	4.5±0.4	D-38	53.8±3.9	4.4±0.3
D-8.	55.6±3.9	4.6±0.3	D-39	51.5±10.7	4.2±0.9
D-9	67.2±5.7	5.5±0.5	D-40	58.7±7.0	4.8±0.6
D-10	55.9±7.3	4.6±0.6	D-41	55.7±3.7	4.6±0.3
D-11	53.2±3.6	4.4±0.3	D-42	LOST IN THE FIELD	
D-12	45.2±2.6	3.7±0.2	D-43	53.1±2.2	4.4±0.2
D-13	LOST IN THE FIELD		D-44	48.6±3.4	4.0±0.3
D-14	53.8±8.3	4.4±0.7	D-45	52.4±3.0	4.3±0.2
D-15	64.1±3.3	5.3±0.3	D-46	73.7±4.0	6.1±0.3
D-16	LOST IN THE FIELD		D-47	75.2±7.5	6.2±0.6
			D-48	71.4±3.9	5.9±0.3
Mean ± s.d.	52.6±7.3	4.3±0.6	Mean ± s.d.	58.5±8.9	4.8±0.8
D-17	56.9±5.9	4.7±0.5	D-76	43.4±2.9	3.6±0.2
D-18	52.6±1.3	4.3±0.1	D-77	58.8±2.0	4.8±0.2
D-19	47.0±5.8	3.9±0.5	D-78	69.1±2.8	5.7±0.2
D-20	46.2±2.1	3.8±0.2	D-79	51.1±3.3	4.2±0.3
D-21	55.0±2.0	4.5±0.2	D-80	53.6±3.0	4.4±0.2
D-22	41.7±4.7	3.4±0.4	D-81	49.9±5.0	4.1±0.4
D-23	50.5±2.9	4.2±0.2	D-82	39.1±4.6	3.2±0.4
D-24	52.9±3.6	4.4±0.3	D-83	57.3±2.4	4.7±0.2
D-25	42.0±3.2	3.4±0.3	D-84	64.0±5.3	5.3±0.4
D-26	41.7±2.9	3.4±0.2	D-85	49.5±7.7	4.1±0.6
D-27	55.9±3.8	4.6±0.3	D-86	67.8±5.0	5.6±0.4
D-28	37.2±3.5	3.1±0.3	D-87	55.4±5.5	4.6±0.4
D-29	64.2±9.7	5.3±0.8	D-88	72.6±3.0	6.0±0.2
D-30	64.1±3.7	5.3±0.3	D-89	70.8±3.6	5.8±0.3
D-31	71.4±6.9	5.9±0.6	D-90	79.2±3.6	6.5±0.3
D-32	67.6±2.8	5.6±0.2	D-91	71.8±2.5	5.9±0.2
Mean ± s.d.	52.9±10.1	4.4±0.8	Mean ± s.d.	59.5±11.8	4.9±1.0

Table 25. Milk samples collected during the non-grazing season, analysis for Iodine-131. Collection: Monthly, October through April.

Location and Date Collected	Lab Code	Activity (pCi/l) I-131
Indicator		
Composite[a]		
1-04-83	DMI-1402	<0.4
2-01-83	1445	<0.4
3-01-83	1498	<0.4
4-05-83	1587	<0.4
10-04-83	2684	<0.4
11-01-83	2804	<0.4
12-14-83	2902	<0.4
Control		
Composite[b]		
1-04-83	DMI-1403	<0.4
2-01-83	1446,7	<0.4
3-01-83	1499,1500	<0.4
4-05-83	1588	<0.4
10-04-83	2685	<0.4
11-01-83	2805	<0.4
12-14-83	2903	<0.4

[a]Composite of samples from locations D-63, D-72, D-93, D-94, D-96, D-101, and D-106.

[b]Composite of samples from locations D-102 and D-105.

Table 26. Milk samples collected during the grazing season, analysis for Iodine-131.
Collection: Weekly, May through September.

Date Collected	Activity (pCi/l)						
	D-63	D-93	D-94	D-101	D-106	Indicator[a]	Control[b]
5-03-83	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
5-10-83	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
5-17-83	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
5-24-83	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
5-31-83	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
6-07-83	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
6-14-83	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
6-21-83	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
6-28-83	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
7-05-83	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
7-12-83	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
7-19-83	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
7-26-83	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
8-02-83	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
8-09-83	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
8-16-83	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
8-23-83	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
8-30-83	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
9-06-83	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
9-13-83	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
9-20-83	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4[c]	<0.4
9-27-83	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4

[a] Composites of samples from Locations D-72 and D-96.
[b] Composites of samples from locations D-102 and D-105.
[c] Result of the analysis of milk from Location D-72 only; milk at Location D-96 was not available on that day. Milk from Location D-96 was collected on 9-15-83 and analyzed separately, yielding activity of <0.4 pCi/l.

Table 27. Milk samples collected during the grazing season, analysis for gamma-emitting isotopes. Collection: weekly.

Location and Date Collected	Lab Code	Activity (pCi/l) K-40	Cs-137	Ba-La-140[c]
Indicator				
D-63				
5-03-83	DMI-1641	1330±180	<15	<15
5-10-83	1688	1190±120	<15	<15
5-17-83	1727	1110±170	<15	<15
5-24-83	1766	1500±130	<15	<15
5-31-83	1801	1270±190	<15	<15
6-07-83	1871	1230±170	<15	<15
6-14-83	1910	1460±100	<15	<15
6-21-83	1948	1604±80	<15	<15
6-28-83	1992	1520±160	<15	<15
July Comp.[d]	2214	1100±180	<15	<15
Aug. Comp.[d]	2464	1160±190	<15	<15
Sept. Comp.[d]	2640	1260±110	<15	<15
Annual mean ± s.d.		1310±170	<15	<15
D-93				
5-03-83	DMI-1642	1810±180	<15	<15
5-10-83	1689	1480±190	<15	<15
5-17-83	1728,9	1670±100	<15	<15
5-24-83	1767	1840±230	<15	<15
5-31-83	1802	1420±190	<15	<15
6-07-83	1872	1860±200	<15	<15
6-14-83	1911	1710±200	<15	<15
6-21-83	1949	1400±170	<15	<15
6-28-83	1993	2030±190	<15	<15
July Comp.[d]	2216	1630±210	<15	<15
Aug. Comp.[d]	2466	1890±220	<15	<15
Sept. Comp.[d]	2642	1830±300	<15	<15
Annual mean ± s.d.		1710±200	<15	<15

Table 27. (continued)

Location and Date Collected	Lab Code	Activity (pCi/l) K-40	Cs-137	Ba-La-140[c]
D-94				
5-03-83	DMI-1643,4	1350±50	<15	<15
5-10-83	1690	1150±180	<15	<15
5-17-83	1730	1120±170	<15	<15
5-24-83	1768	1100±190	<15	<15
5-31-83	1803	1050±110	<15	<15
6-07-83	1873,4	1470±140	<15	<15
6-14-83	1912	1070±190	<15	<15
6-21-83	1950	1550±220	<15	<15
6-28-83	1994	940±170	<15	<15
July Comp.[d]	2217	1480±100	<15	<15
Aug. Comp.[d]	2467	1410±160	<15	<15
Sept. Comp.[d]	2643	1100±120	<15	<15
Annual mean ± s.d.		1230±200	<15	<15
D-101				
5-03-83	DMI-1645	1880±190	<15	<15
5-10-83	1691,2	1660±110	<15	<15
5-17-83	1731	1820±200	<15	<15
5-24-83	1769,70	1620±140	<15	<15
5-31-83	1804	1570±140	<15	<15
6-07-83	1875	1740±180	<15	<15
6-14-83	1913	1770±220	<15	<15
6-21-83	1951	2070±210	<15	<15
6-28-83	1995,6	1720±120	<15	<15
July Comp.[d]	2219	1920±120	<15	<15
Aug. Comp.[d]	2469	1800±240	<15	<15
Sept. Comp.[d]	2645	1810±160	<15	<15
Annual mean ± s.d.		1780±140	<15	<15

Table 27. (continued)

Location and Date Collected	Lab Code	Activity (pCi/l) K-40	Cs-137	Ba-La-140[c]
D-106				
5-03-83	DMI-1646	1200±40	<15	<15
5-10-83	1693	1340±220	<15	<15
5-17-83	1732	1510±240	<15	<15
5-24-83	1771	1330±150	<15	<15
5-31-83	1805	1140±130	<15	<15
6-07-83	1876	1320±190	<15	<15
6-14-83	1914,15	1110±130	<15	<15
6-21-83	1952	1360±110	<15	<15
6-28-83	1997	1400±110	<15	<15
July Comp.[d]	[illegible]223	1310±140	<15	<15
Aug. Comp.[d]		1460±170	<15	<15
Sept. Comp.[d]	2648,9	1110±90	<15	<15
Annual mean ± s.d.		1300±130	<15	<15

Table 27. (continued)

Location and Date Collected	Lab Code	Activity (pCi/l) K-40	Cs-137	Ba-La-140[c]
Indicator				
Composite[a]				
5-03-83	DMI-1647	1380±100	<15	<15
5-10-83	1694	1170±160	<15	<15
5-17-83	1733	1140±180	<15	<15
5-24-83	1772	1280±140	<15	<15
5-31-83	1806	1230±120	<15	<15
6-07-83	1877	1520±180	<15	<15
6-14-83	1916	1180±140	<15	<15
6-21-83	1953	1060±140	<15	<15
6-28-83	1998	1170±180	<15	<15
Annual mean ± s.d.		1240±140	<15	<15
D-72[e]				
May Comp.	DMI-1827	1070±110	<15	<15
June Comp.	2017	1180±120	<15	<15
July Comp.	2215	1730±170	<15	<15
Aug. Comp.	2465	1380±160	<15	<15
Sept. Comp.	2641	1050±150	<15	<15
Annual mean ± s.d.		1280±180	<15	<15
D-96[e]				
May Comp.	DMI-1830	1280±130	<15	<15
June Comp.	2020	1230±130	<15	<15
July Comp.	2218	1320±120	<15	<15
Aug. Comp.	2468	1250±130	<15	<15
Sept. Comp.	2644	1270±170	<15	<15
Annual mean ± s.d.		1270±40	<15	<15

Table 27. (continued)

Location and Date Collected	Lab Code	Activity (pCi/l) K-40	Cs-137	Ba-La-140[c]
Control				
Composite[b]				
5-03-83	DMI-1648	1220±170	<15	<15
5-10-83	1695	1230±130	<15	<15
5-17-83	1734	1300±180	<15	<15
5-24-83	1773	1210±130	<15	<15
5-31-83	1807	1250±170	<15	<15
6-07-83	1878	1340±170	<15	<15
6-14-83	1917	1290±100	<15	<15
6-21-83	1954	1620±210	<15	<15
6-28-83	1999	1310±200	<15	<15
Annual mean ± s.d.		1310±130	<15	<15
D-102[e]				
May Comp.	DMI-1832	1250±130	<15	<15
June Comp.	2022	1260±160	<15	<15
July Comp.	2221	1560±120	<15	<15
Aug. Comp.	2470,1	1320±90	<15	<15
Sept. Comp.	2646	1030±170	<15	<15
Annual mean ± s.d.		1280±190	<15	<15
D-105[e]				
May Comp.	DMI-1833	1480±140	<15	<15
June Comp.	2023	1570±130	<15	<15
July Comp.	2222	1530±140	<15	<15
Aug. Comp.	2472	1210±190	<15	<15
Sept. Comp.	2647	1230±180	<15	<15
Annual mean ± s.d.		1400±170	<15	<15

[a] Composite of samples from locations D-72 and D-96.
[b] Composites of samples form locations D-102 and D-105.
[c] Ba-La-140 Minimum sensitivity is at counting time.
[d] Program changed effective July, 1983. Gamma analyses on monthly composite of weekly samples instead of weekly analysis.
[e] Indicator and control locations will be analyzed individually on monthly composites.

Table 28. Milk samples collected during the grazing season, analysis for strontium-89, strontium-90 and elemental calcium. Collection: (monthly composites May through September).

Location and Date Collected	Lab Code	Calcium g/l	Activity (pCi/l) Sr-89	Activity (pCi/l) Sr-90
Indicator				
D-63				
May Comp.	DMI-1825,6	1.2	<1.3	2.1±0.4
June Comp.	2016	1.6	<1.2	2.3±0.6
July Comp.	2214	1.4	<1.1	2.4±0.5
Aug. Comp.	2464	1.2	<0.9	2.8±0.6
Sept. Comp.	2640	1.1	<5.0	2.0±0.6
Annual Mean ± s.d.		1.3±0.2	<5.0	2.3±0.3
D-72				
May Comp.	DMI-1827	1.2	<1.4	1.6±0.6
June Comp.	2017	1.1	<1.3	1.5±0.6
July Comp.	2215	1.1	<1.3	2.2±0.6
Aug. Comp.	2465	1.2	<0.9	2.7±0.6
Sept. Comp.	2641	1.0	<1.4	1.2±0.6
Annual Mean ± s.d.		1.1±0.1	<1.4	1.8±0.6
D-93				
May Comp.	DMI-1828	1.4	<1.3	6.3±0.7
June Comp.	2018	1.0	<1.2	3.8±0.7
July Comp.	2216	1.1	<1.3	3.8±0.7
Aug. Comp.	2466	1.1	<5.0	3.7±0.8
Sept. Comp.	2642	0.9	<1.4	2.8±0.7
Annual Mean ± s.d.		1.1±0.2	<5.0	4.1±1.3

Table 28. (continued)

Location and Date Collected		Lab Code	Calcium g/l	Activity (pCi/l) Sr-89	Sr-90
D-94					
May	Comp.	DMI-1829	1.3	<1.3	2.2±0.6
June	Comp.	2019	1.5	<2.0	3.9±0.7
July	Comp.	2217	1.2	<1.3	2.9±0.7
Aug.	Comp.	2467	1.0	<3.0	1.7±0.7
Sept.	Comp	2643	1.1	<1.4	1.7±0.6
Annual Mean ± s.d.			1.2±0.2	<3.0	2.5±0.9
D-96					
May	Comp.	DMI-1830	1.2	<1.3	2.7±0.6
June	Comp.	2020	1.1	<1.2	1.2±0.6
July	Comp.	2218	1.0	<1.2	1.8±0.6
Aug.	Comp.	2468	1.1	<3.0	1.2±0.7
Sept.	Comp.	2644	1.2	<1.2	0.7±0.5
Annual Mean ± s.d.			1.1±0.1	<3.0	1.5±0.8
D-101					
May	Comp.	DMI-1831	1.2	<1.3	2.1±0.6
June	Comp.	2021	1.2	<1.2	1.8±0.6
July	Comp.	2219,20	1.1	<1.3	2.2±0.4
Aug.	Comp.	2469	0.8	<4.0	1.3±0.7
Sept.	Comp.	2645	1.1	<1.2	1.7±0.5
Annual Mean ± s.d.			1.1±0.2	<4.0	1.8±0.4

Table 28. (continued)

Location and Date Collected	Lab Code	Calcium g/l	Activity (pCi/l) Sr-89	Activity (pCi/l) Sr-90
D-106				
May Comp.	DMI-1834	1.6	<1.7	1.4±0.7
June Comp.	2024	1.3	<1.4	2.4±0.5
July Comp.	2223	1.3	<1.1	1.8±0.6
Aug. Comp.	2473	1.1	<3.0	<1.4
Sept. Comp.	2648,9	1.3	<1.1	1.2±0.1
Annual Mean ± s.d.		1.3±0.2	<3.0	1.7±0.5
Control				
D-102				
May Comp.	DMI-1832	1.3	<1.7	1.8±0.7
June Comp.	2022	1.1	<1.3	2.4±0.6
July Comp.	2221	1.2	<1.2	2.5±0.7
Aug. Comp.	2470,1	1.0	<5.0	2.0±0.5
Sept. Comp.	2646	1.1	<5.0	1.8±0.5
Annual Mean ± s.d.		1.1±0.1	<5.0	2.1±0.3
D-105				
May Comp.	DMI-1833	1.8	<1.9	2.5±0.5
June Comp.	2023	1.3	<1.3	2.4±0.6
July Comp.	2222	1.2	<1.2	2.7±0.7
Aug. Comp.	2472	1.2	<1.7	3.5±0.8
Sept Comp.	2647	1.2	<1.1	2.4±0.6
Annual Mean ± s.d.		1.3±0.3	<1.9	2.7±0.5

Table 29. Ground water samples, analysis for gross beta. Collection: Monthly.

Location and Date Collected	Lab Code	Gross Beta (pCi/l)	Location and Date Collected	Lab Code	Gross Beta (pCi/l)
D-53			D-54		
Treated Municipal Water			Inlet to Municipal Water Treatment		
1-83	DWW-4258	2.8±0.6	1-83	DWW-4259	3.4±1.1
2-83	4505	2.2±0.7	2-83	4506	2.4±1.2
3-83	4927	2.7±0.6	3-83	4928	3.2±1.1
4-83	5237	2.5±0.6	4-83	5238	3.1±1.0
5-83	5467	3.2±0.6	5-83	5468	3.5±1.1
6-83	6038	2.0±0.6	6-83	6039	5.6±1.3
7-83	6223	2.6±0.6	7-83	6224	3.4±1.1
8-83	6520	2.5±0.6	8-83	6521	2.6±1.0
9-83	6967	2.8±0.6	9-83	6968	3.6±1.0
10-83	7309	2.9±0.6	10-83	7310	3.7±1.0
11-83	7644	3.0±0.6	11-83	7645	2.5±0.9
12-83	8109	3.7±0.7	12-83	8110	3.0±1.0
Annual Mean ± s.d.		2.7±0.4			3.3±0.8
D-55			D-57		
On-Site Well			Bull		
1-25-83	DWW-4109	2.1±0.6	1-25-83	DWW-4110	1.4±0.8
2-22-83	4382	1.8±0.4	2-22-83	4383	1.1±0.5
3-29-83	4853	1.3±0.6	3-29-83	4854	1.5±0.8
4-25-83	5126	1.5±0.5	4-25-83	5127	1.1±0.7
5-31-83	5469	2.4±0.6	5-31-83	5470	2.3±0.8
6-27-83	5762	1.9±0.7	6-27-83	5763	0.9±0.8
7-25-83	6163	1.5±0.6	7-25-83	6164	1.1±0.8
8-31-83	6522	1.5±0.6	8-31-83	6523	1.4±0.8
9-26-83	6826	1.7±0.7	9-26-83	6827	3.9±0.9
10-25-83	7252	1.7±0.5	10-25-83	7253	1.4±0.7
11-28-83	7639	<0.9	11-28-83	7640	1.8±0.7
1-06-84	8111	<0.8	1-06-84	8112	1.7±0.8
Annual Mean ± s.d.		1.7±0.3			1.6±0.8

Table 29. (continued)

Location and Date Collected	Lab Code	Gross Beta (pCi/l)	Location and Date Collected	Lab Code	Gross Beta (pCi/l)
D-58			D-59		
Frantz			Frantz Cottage		
1-25-83	DWW-4111	3.0±1.0	1-25-83	DWW-4112	5.3±1.1
2-22-83	4384	5.9±0.6	2-22-83	4385	4.8±0.6
3-29-83	4855	6.7±1.1	3-29-83	4856	5.3±1.1
4-25-83	5128	4.3±0.8	4-25-83	5129	5.1±1.0
5-31-83	5471	6.7±1.1	5-31-83	5472	6.2±1.1
6-27-83	5764	5.5±1.1	6-17-83	5765	4.4±1.1
7-25-83	6165	4.7±1.0	7-25-83	6166	3.1±0.9
8-31-83	6524,5	5.3±0.7	8-31-83	6526	4.6±1.0
9-26-83	6828	1.2±0.8	9-26-83	6829	4.0±1.0
10-25-83	7254,5	6.2±0.7	10-25-83	7256	5.3±0.9
11-28-83	7641	5.9±1.0	11-28-83	7642	4.0±0.9
1-06-84	8113	3.8±0.9	1-06-84	8114,15	21.5±1.0[b]
Annual Mean ± s.d.		4.9±1.6			6.1±4.9
D-60					
Comp					
1-83	--	ND[a]			
2-22-83	DWW-4386	0.4±0.3			
3-29-83	4857	<0.9			
4-25-83	5130	0.7±0.5			
5-31-83	5473,4	2.5±0.5			
6-27-83	5766	1.0±0.6			
7-25-83	6167	0.9±0.5			
8-31-83	6527	0.7±0.5			
9-26-83	6830	1.1±0.4			
10-25-83	7257	0.5±0.4			
11-28-83	7643	1.3±0.5			
1-06-84	8116	1.4±0.5			
Annual Mean ± s.d.		1.1±0.6			

[a] ND = No data. Pump is shut off during winter.

[b] Mean ± s.d. of three determinations. Analyses for Sr-89 and Sr-90 and gamma-emitting isotopes yielded the following results:

Sr-89	<4.6 pCi/l
Sr-90	2.4±1.3 pCi/l
Co-60	<10 pCi/l
Cs-134,-137	<10 pCi/l

All other gamma-emitting isotopes were below their respective LLDs.

Table 30. Ground water samples, quarterly composites of monthly samples, analysis for gross beta and tritium.

Location and Date Collected	Lab Code	Activity (pCi/l) Gross Beta[a]	Sr-89	Sr-90	H-3
D-53					
Treated Municipal Water					
1st Q, 1983	DWW-4783	2.7±0.6	<10	<2	<330
2nd Q, 1983	5824,5	2.1±0.4	<10	<2	<330
3rd Q, 1983	6899	--	<10	<2	<330
4th Q, 1983	8013	--	<10	<2	<330
Annual Mean ± s.d.		2.4±0.4	<10	<2	<330
D-54					
Inlet to Municipal Water Treatment					
1st Q, 1983	DWW-4784	2.8±1.1	<10	<2	<330
2nd Q, 1983	5826	2.7±1.0	<10	<2	<330
3rd Q, 1983	6900	--	<10	<2	<330
4th Q, 1983	8014	--	<10	<2	<330
Annual Mean ± s.d.		2.8±0.1	<10	<2	<330
D-55					
On-site Well					
1st Q, 1983	DWW-4785	1.7±0.6	<10	<2	<330
2nd Q, 1983	5827	1.5±0.5	<10	<2	<330
3rd Q, 1983	6901	--	<10	<2	<330
4th Q, 1983	8015	--	<10	<2	<330
Annual Mean ± s.d.		1.6±0.1	<10	<2	<330
D-57					
Bull					
1st Q, 1983	DWW-4786	<1.4	<10	<2	<330
2nd Q, 1983	5828	1.8±0.8	<10	<2	<330
3rd Q, 1983	6902,3	--	<10	<2	<330
4th Q, 1983	8016	--	<10	<2	<330
Annual Mean ± s.d.		1.8±0.8	<10	<2	<330

Table 30. (continued)

Location and Date Collected	Lab Code	Activity (pCi/l) Gross Beta[a]	Sr-89	Sr-90	H-3
D-58					
Frantz					
1st Q, 1983	DWW-4787	6.7±1.2	<10	<2	<330
2nd Q, 1983	5829	6.9±1.1	<10	<2	<330
3rd Q, 1983	6904	--	<10	<2	<330
4th Q, 1983	8017	--	<10	<2	<330
Annual Mean ± s.d.		6.8±0.1	<10	<2	<330
D-59					
Frantz Cottage					
1st Q, 1983	DWW-4788	5.0±1.0	<10	<2	<330
2nd Q, 1983	5830	4.9±0.9	<10	<2	<330
3rd Q, 1983	6905	--	<10	<2	<330
4th Q, 1983	8018,19	--	<10	<2	<330
Annual Mean ± s.d.		5.0±0.1	<10	<2	<330
D-60					
Wiley					
1st Q, 1983	DWW-4789	1.0±0.4	<10	<2	<330
2nd Q, 1983	5831	0.8±0.6	<10	<2	<330
3rd Q, 1983	6906	--	<10	<2	<330
4th Q, 1983	8020		<10	<2	<330
Annual Mean ± s.d.		0.9±0.1	<10	<2	<330

[a] Effective July 1983, analysis for gross beta was removed from the program.

Table 31. Vegetation samples (broad leaf), analysis for iodine-131. Collection: Annually.

Location	Date Collected	Lab Code	Activity (pCi/g) wet I-131
Indicator			
D-57	8-03-83	DG-266,7	<0.037
D-58	8-03-83	DG-268	<0.096[a]
D-63	8-03-83	DG-269	<0.024
D-72	8-03-83	DG-270	<0.087[a]
D-93	8-03-83	DG-271	<0.038
D-94	8-03-83	DG-272	<0.068[a]
D-96	8-03-83	DG-273	<0.056
D-101	8-03-83	DG-274	<0.046
D-106	8-03-83	DG-277,8	<0.031
Control			
D-102	8-03-83	DG-275	<0.026
D-105	8-03-83	DG-276	<0.060

[a] LLD are higher than required LLD of 0.060 pCi/g due to a delay in counting the sample.

Table 32. Vegetation samples (hay and grain), analysis for strontium-90 and gamma-emitting isotopes. Collection: Annually.

Sample Description and Activity (pCi/g wet)				
	Indicator			
Location	D-57	D-58	D-63	D-63
Date Collected	12-06-83	12-06-83	12-06-83	12-06-83
Type	Dried Corn	Hay	Dried Corn	Hay
Lab Code	DVE-201	DVE-213	DVE-202	DVE-214
Sr-90	<0.004	0.204±0.016	<0.005	0.159±0.016
K-40	2.35±0.24	8.08±0.83	2.53±0.13	11.60±1.14
Mn-54	<0.017	<0.053	<0.0071	<0.073
Co-58	<0.018	<0.051	<0.010	<0.073
Co-60	<0.020	<0.079	<0.011	<0.081
Nb-95	<0.019	<0.048	<0.0070	<0.090
Zr-95	<0.030	<0.11	<0.022	<0.15
Ru-103	<0.020	<0.065	<0.0082	<0.071
Ru-106	<0.16	<0.36	<0.079	<0.57
Cs-134	<0.016	<0.060	<0.006	<0.072
Cs-137	<0.016	<0.073	<0.010	<0.074
Ce-141	<0.029	<0.073	<0.017	<0.094
Ce-144	<0.10	<0.28	<0.048	<0.038
Location	D-63	D-72	D-93	D-93
Date Collected	12-06-83	9-19-83	12-06-83	12-06-83
Type	Oats	Soybeans	Dried Corn	Hay
Lab Code	DVE-209,10	DVE-173	DVE-203	DVE-215
Sr-90	0.009±0.008	0.033±0.005	<0.006	0.197±0.016
K-40	5.49±0.51	3.66±0.08	2.91±0.39	9.52±1.0
Mn-54	<0.049	<0.023	<0.033	<0.054
Co-58	<0.056	<0.031	<0.031	<0.073
Co-60	<0.055	<0.022	<0.029	<0.047
Nb-95	<0.063	<0.026	<0.037	<0.053
Zr-95	<0.089	<0.036	<0.057	<0.092
Ru-103	<0.065	<0.028	<0.037	<0.076
Ru-106	<0.47	<0.17	<0.23	<0.53
Cs-134	<0.056	<0.025	<0.029	<0.050
Cs-137	<0.053	<0.028	<0.029	<0.082
Ce-141	<0.10	<0.025	<0.054	<0.103
Ce-144	<0.29	<0.19	<0.17	<0.29

Table 32. (continued)

Sample Description and Activity (pCi/g wet)				
	Indicator			
Location	D-94	D-94	D-96	D-96
Date Collected	12-06-83	12-06-83	12-06-83	12-06-83
Type	Dried Corn	Hay	Dried Corn	Soybeans
Lab Code	DVE-204	DVE-216	DVE-205	DVE-211
Sr-90	<0.006	0.130±0.012	<0.006	0.022±0.007
K-40	2.93±0.47	10.40±0.98	3.73±0.40	14.90±1.02
Mn-54	<0.036	<0.060	<0.024	<0.035
Co-58	<0.040	<0.061	<0.034	<0.045
Co-60	<0.036	<0.073	<0.026	<0.048
Nb-95	<0.049	<0.062	<0.033	<0.052
Zr-95	<0.068	<0.11	<0.058	<0.078
Ru-103	<0.041	<0.051	<0.033	<0.043
Ru-106	<0.32	<0.55	<0.22	<0.29
Cs-134	<0.030	<0.051	<0.023	<0.029
Cs-137	<0.037	<0.060	<0.022	<0.035
Ce-141	<0.064	<0.076	<0.047	<0.065
Ce-144	<0.18	<0.30	<0.14	<0.19
Location	D-96	D-106	D-106	D-16 (Special)
Date Collected	12-06-83	12-06-83	12-06-83	9-19-83
Type	Hay	Dried Corn	Hay	Soybeans
Lab Code	DVE-217	DVE-208	DVE-219	DVE-172
Sr-90	0.300±0.020	<0.006	0.086±0.011	0.019±0.005
K-40	8.04±0.92	3.01±0.47	5.27±0.43	6.23±0.14
Mn-54	<0.050	<0.042	<0.019	<0.051
Co-58	<0.037	<0.042	<0.015	<0.034
Co-60	<0.025	<0.039	<0.019	<0.053
Nb-95	<0.056	<0.051	<0.020	<0.037
Zr-95	<0.071	<0.064	<0.029	<0.072
Ru-103	<0.034	<0.043	<0.020	<0.042
Ru-106	<0.28	<0.28	<0.12	<0.37
Cs-134	<0.033	<0.036	<0.017	<0.048
Cs-137	<0.050	<0.041	0.046±0.013	<0.039
Ce-141	<0.065	<0.064	<0.029	<0.074
Ce-144	<0.037	<0.20	<0.16	<0.31

Table 32. (continued)

Sample Description and Activity (pCi/g wet)			
	Control		
Location	D-106	D-105	D-105
Date Collected	12-06-83	9-20-83	12-06-83
Type	Dried Corn	Soybeans	Dried Corn
Lab Code	DVE-206	DVE-171	DVE-207
Sr-90	<0.006	0.013±0.007	<0.005
K-40	2.88±0.43	7.74±1.10	2.97±0.31
Mn-54	<0.032	<0.045	<0.023
Co-58	<0.038	<0.043	<0.027
Co-60	<0.034	<0.10	<0.024
Nb-95	<0.041	<0.042	<0.032
Zr-95	<0.059	<0.062	<0.044
Ru-103	<0.035	<0.043	<0.029
Ru-106	<0.25	<0.40	<0.18
Cs-134	<0.030	<0.051	<0.019
Cs-137	<0.033	<0.050	<0.021
Ce-141	<0.059	<0.065	<0.047
Ce-144	<0.19	<0.29	<0.14
Location	D-105	D-105	
Date Collected	12-06-83	12-06-83	
Type	Soybeans	Hay	
Lab Code	DVE-212	DVE-218	
Sr-90	0.014±0.007	0.145±0.014	
K-40	13.40±1.01	13.76±0.79	
Mn-54	<0.042	<0.050	
Co-58	<0.053	<0.054	
Co-60	<0.045	<0.042	
Nb-95	<0.062	<0.059	
Zr-95	<0.089	<0.087	
Ru-103	<0.043	<0.045	
Ru-106	<0.33	<0.30	
Cs-134	<0.032	<0.040	
Cs-137	<0.040	<0.059	
Ce-141	<0.069	<0.079	
Ce-144	<0.18	<0.26	

Table 33. Meat and poultry samples, analysis of edible portion for gamma-emitting isotopes. Collection: Annually.

Sample Description and Activity (pCi/g wet)			
		Inside 10 Miles of Plant	
Location	D-94	Bemer	Wasendorf
Date Collected	9-13-83	9-27-83	9-19-83
Type	Chicken	Beef	Pork
Lab Code	DME-30	DME-35	DME-37
K-40	4.19±0.52	2.39±0.50	2.94±0.54
Mn-54	<0.043	<0.020	<0.046
Co-58	<0.046	<0.031	<0.071
Co-60	<0.047	<0.053	<0.050
Nb-95	<0.062	<0.034	<0.064
Zr-95	<0.090	<0.070	<0.095
Ru-103	<0.053	<0.040	<0.063
Ru-106	<0.40	<0.26	<0.41
Cs-134	<0.044	<0.029	<0.037
Cs-137	<0.046	<0.034	<0.040
Ce-141	<0.071	<0.073	<0.10
Ce-144	<0.24	<0.23	<0.26
		Outside 10 Miles of Plant	
Location	D-102	Schwartz	Hoover
Date Collected	9-13-83	9-16-83	9-19-83
Type	Chicken	Beef	Pork
Lab Code	DME-31,32	DME-36	DME-38
K-40	2.32±0.19	1.85±0.32	2.65±0.36
Mn-54	<0.017	<0.033	<0.032
Co-58	<0.019	<0.044	<0.039
Co-60	<0.019	<0.031	<0.025
Nb-95	<0.016	<0.061	<0.055
Zr-95	<0.028	<0.088	<0.077
Ru-103	<0.016	<0.053	<0.050
Ru-106	<0.12	<0.23	<0.29
Cs-134	<0.015	<0.028	<0.025
Cs-137	<0.015	<0.033	<0.030
Ce-141	<0.021	<0.080	<0.073
Ce-144	<0.077	<0.17	<0.17

Table 34. Wildlife sample, analysis for gamma-emitting isotopes.
Collection: Annually.

Sample Description and Activity (pCi/g wet)		
Location	2 miles SW of Plant	3 miles N of Plant
Date Collected	2-15-83	3-26-83
Type	Opossum	Woodchuck
Lab Code	DWL-15	DWL-16
K-40	3.36±0.67	3.48±0.59
Mn-54	<0.052	<0.055
Co-58	<0.089	<0.049
Co-60	<0.053	<0.053
Nb-95	<0.095	<0.095
Zr-95	<0.15	<0.14
Ru-103	<0.088	<0.073
Ru-106	<0.51	<0.54
Cs-134	<0.045	<0.054
Cs-137	<0.062	<0.045
Ce-141	<0.14	<0.11
Ce-144	<0.28	<0.25

Table 35. Soil samples, analysis for strontium-90 and gamma-emitting isotopes. Collection: Tri-annually.

Sample Description and Activity (pCi/g dry)			
	Indicator		
Location	D-15	D-15	D-15
Date Collected	6-15-83	9-21-83	10-06-83
Lab Code	DSO-131	DSO-173	DSO-187,8
Sr-90	0.036±0.014	0.087±0.010	0.075±0.005
K-40	7.75±0.55	8.43±0.72	8.14±0.44
Mn-54	<0.031	<0.043	<0.029
Co-58	<0.084	<0.038	<0.027
Co-60	<0.024	<0.042	<0.028
Nb-95	<0.30	<0.046	<0.027
Zr-95	<0.18	<0.085	<0.048
Ru-103	<0.19	<0.042	<0.025
Ru-106	<0.27	<0.33	<0.22
Cs-134	<0.037	<0.058	<0.043
Cs-137	0.10±0.02	0.30±0.04	0.32±0.02
Ce-141	<0.51	<0.076	<0.042
Ce-144	<0.23	<0.26	<0.018
Location	D-16	D-16	D-16
Date Collected	6-15-83	9-21-83	10-05-83
Lab Code	DSO-132,3	DSO-174	DSO-189
Sr-90	0.057±0.009	0.075±0.009	0.084±0.010
K-40	10.40±0.60	8.04±0.64	8.38±0.59
Mn-54	<0.036	<0.038	<0.029
Co-58	<0.037	<0.036	<0.025
Co-60	<0.038	<0.036	<0.028
Nb-95	<0.050	<0.039	<0.030
Zr-95	<0.072	<0.070	<0.048
Ru-103	<0.049	<0.038	<0.026
Ru-106	<0.32	<0.25	<0.21
Cs-134	<0.044	<0.050	<0.043
Cs-137	0.29±0.02	0.32±0.03	0.33±0.03
Ce-141	<0.048	<0.063	<0.044
Ce-144	<0.17	<0.22	<0.18

Table 35. (continued)

Sample Description and Activity (pCi/g dry)			
	Indicator		
Location	D-57	D-57	D-57
Date Collected	6-15-83	9-21-83	10-05-83
Lab Code	DSO-134	DSO-175	DSO-190
Sr-90	0.026±0.022	0.102±0.009	0.107±0.010
K-40	8.43±1.08	14.73±0.86	11.10±0.92
Mn-54	<0.056	<0.051	<0.064
Co-58	<0.10	<0.032	<0.055
Co-60	<0.045	<0.044	<0.067
Nb-95	<0.24	<0.064	<0.058
Zr-95	<0.19	<0.065	<0.091
Ru-103	<0.14	<0.071	<0.045
Ru-106	<0.42	<0.29	<0.43
Cs-134	<0.092	<0.053	<0.10
Cs-137	0.42±0.04	0.41±0.04	0.19±0.04
Ce-141	<0.30	<0.10	<0.087
Ce-144	<0.32	<0.22	<0.38
Location	D-58	D-58	D-58
Date Collected	6-15-83	9-21-83	10-05-83
Lab Code	DSO-135	DSO-176,7	DSO-191
Sr-90	0.040±0.018	0.096±0.007	0.103±0.009
K-40	10.30±0.87	10.50±0.58	15.20±1.12
Mn-54	<0.063	<0.047	<0.039
Co-58	<0.094	<0.046	<0.044
Co-60	<0.044	<0.048	<0.053
Nb-95	<0.23	<0.050	<0.059
Zr-95	<0.20	<0.073	<0.083
Ru-103	<0.17	<0.046	<0.062
Ru-106	<0.46	<0.35	<0.44
Cs-134	<0.091	<0.075	<0.055
Cs-137	0.29±0.04	0.42±0.03	0.58±0.06
Ce-141	<0.30	<0.086	<0.061
Ce-144	<0.31	<0.29	<0.26

Table 35. (continued)

Sample Description and Activity (pCi/g dry)			
	Indicator		
Location	D-63	D-63	D-63
Date Collected	6-15-83	9-21-83	10-04-83
Lab Code	DSO-136	DSO-178	DSO-192
Sr-90	0.057±0.015	0.177±0.011	0.218±0.013
K-40	14.80±1.21	12.70±0.86	12.20±0.98
Mn-54	<0.061	<0.069	<0.058
Co-58	<0.079	<0.062	<0.060
Co-60	<0.072	<0.055	<0.071
Nb-95	<0.13	<0.073	<0.066
Zr-95	<0.16	<0.11	<0.12
Ru-103	<0.016	<0.066	<0.058
Ru-106	<0.69	<0.44	<0.45
Cs-134	<0.10	<0.11	<0.12
Cs-137	0.26±0.05	0.70±0.05	0.68±0.06
Ce-141	<0.26	<0.12	<0.11
Ce-144	<0.063	<0.40	<0.42
Location	D-72	D-72	D-72
Date Collected	6-15-83	9-20-83	10-04-83
Lab Code	DSO-137	DSO-179	DSO-193
Sr-90	0.077±0.015	0.109±0.010	0.111±0.010
K-40	16.20±1.24	12.40±0.91	11.30±0.85
Mn-54	<0.063	<0.048	<0.049
Co-58	<0.076	<0.051	<0.048
Co-60	<0.067	<0.050	<0.048
Nb-95	<0.12	<0.065	<0.057
Zr-95	<0.15	<0.091	<0.089
Ru-103	<0.15	<0.051	<0.042
Ru-106	<0.64	<0.40	<0.37
Cs-134	<0.10	<0.084	<0.088
Cs-137	0.32±0.06	0.28±0.04	0.27±0.04
Ce-141	<0.25	<0.093	<0.081
Ce-144	<0.56	<0.34	<0.33

Table 35. (continued)

Sample Description and Activity (pCi/g dry)			
	Indicator		
Location	D-93	D-93	D-93
Date Collected	6-15-83	9-20-83	10-04-83
Lab Code	DSO-138	DSO-180	DSO-194
Sr-90	0.107±0.017	0.096±0.10	0.101±0.008
K-40	12.70±0.89	12.20±0.98	12.40±1.02
Mn-54	<0.061	<0.062	<0.069
Co-58	<0.091	<0.064	<0.060
Co-60	<0.046	<0.049	<0.065
Nb-95	<0.14	<0.066	<0.065
Zr-95	<0.15	<0.10	<0.097
Ru-103	<0.18	<0.060	<0.053
Ru-106	<0.42	<0.46	<0.53
Cs-134	<0.090	<0.11	<0.12
Cs-137	0.32±0.04	0.27±0.04	0.29±0.05
Ce-141	<0.31	<0.12	<0.095
Ce-144	<0.40	<0.38	<0.42
Location	D-94	D-94	D-94
Date Collected	6-15-83	9-21-83	10-04-83
Lab Code	DSO-139	DSO-181	DSO-195
Sr-90	0.116±0.017	0.091±0.009	0.117±0.011
K-40	13.00±0.84	12.60±0.85	12.80±0.97
Mn-54	<0.053	<0.045	<0.057
Co-58	<0.088	<0.046	<0.054
Co-60	<0.037	<0.044	<0.057
Nb-95	<0.045	<0.055	<0.050
Zr-95	<0.16	<0.081	<0.085
Ru-103	<0.20	<0.045	<0.051
Ru-106	<0.35	<0.34	<0.47
Cs-134	<0.074	<0.077	<0.10
Cs-137	0.32±0.03	0.40±0.04	0.38±0.04
Ce-141	<0.081	<0.082	<0.086
Ce-144	<0.34	<0.29	<0.37

Table 35. (continued)

Sample Description and Activity (pCi/g dry)			
	Indicator		
Location	D-96	D-96	D-96
Date Collected	6-15-83	9-20-83	10-04-83
Lab Code	DSO-140	DSO-182	DSO-196
Sr-90	0.123±0.014	0.083±0.008	0.102±0.012
K-40	16.80±1.21	11.80±0.92	11.80±0.04
Mn-54	<0.049	<0.055	<0.050
Co-58	<0.078	<0.057	<0.048
Co-60	<0.048	<0.069	<0.040
Nb-95	<0.15	<0.067	<0.048
Zr-95	<0.15	<0.094	<0.088
Ru-103	<0.16	<0.058	<0.041
Ru-106	<0.58	<0.44	<0.38
Cs-134	<0.090	<0.097	<0.089
Cs-137	0.41±0.06	0.27±0.04	0.26±0.02
Ce-141	<0.20	<0.10	<0.077
Ce-144	<0.34	<0.38	<0.33
Location	D-101	D-101	D-101
Date Collected	6-15-83	9-21-83	10-04-83
Lab Code	DSO-141	DSO-183	DSO-197
Sr-90	0.072±0.014	0.109±0.012	0.106±0.017
K-40	11.70±0.93	9.64±0.69	10.70±0.73
Mn-54	<0.046	<0.041	<0.040
Co-58	<0.060	<0.038	<0.038
Co-60	<0.054	<0.039	<0.032
Nb-95	<0.099	<0.043	<0.038
Zr-95	<0.12	<0.065	<0.066
Ru-103	<0.13	<0.038	<0.037
Ru-106	<0.50	<0.27	<0.28
Cs-134	<0.10	<0.062	<0.073
Cs-137	0.41±0.05	0.24±0.03	0.29±0.03
Ce-141	<0.22	<0.070	<0.062
Ce-144	<0.45	<0.25	<0.26

Table 35. (continued)

Sample Description and Activity (pCi/g dry)			
	Indicator		
Location	D-106	D-106	D-106
Date Collected	6-15-83	9-21-83	10-04-83
Lab Code	DSO-145	DSO-186	DSO-201
Sr-90	0.044±0.020	0.072±0.008	0.056±0.016
K-40	13.20±1.21	7.98±0.54	8.34±0.67
Mn-54	<0.055	<0.024	<0.038
Co-58	<0.088	<0.026	<0.032
Co-60	<0.067	<0.023	<0.036
Nb-95	<0.19	<0.030	<0.036
Zr-95	<0.19	<0.042	<0.065
Ru-103	<0.19	<0.027	<0.030
Ru-106	<0.69	<0.20	<0.31
Cs-134	<0.069	<0.040	<0.058
Cs-137	0.39±0.06	0.16±0.02	0.18±0.03
Ce-141	<0.23	<0.049	<0.059
Ce-144	<0.38	<0.17	<0.24

Table 35. (continued)

Sample Description and Activity (pCi/g dry)			
	Control		
Location	D-102	D-102	D-102
Date Collected	6-15-83	9-20-83	9-27-83
Lab Code	DSO-142	DSO-184	DSO-198,9
Sr-90	0.099±0.011	0.061±0.010	0.071±0.010
K-40	11.44±0.75	7.69±0.72	7.86±0.49
Mn-54	<0.037	<0.055	<0.041
Co-58	<0.068	<0.053	<0.045
Co-60	<0.053	<0.043	<0.042
Nb-95	<0.064	<0.055	<0.049
Zr-95	<0.096	<0.090	<0.081
Ru-103	<0.14	<0.055	<0.042
Ru-106	<0.26	<0.41	<0.32
Cs-134	<0.034	<0.084	<0.073
Cs-137	0.52±0.04	0.32±0.04	0.29±0.03
Ce-141	<0.28	<0.10	<0.076
Ce-144	<0.20	<0.32	<0.30
Location	D-105	D-105	D-105
Date Collected	6-15-83	9-21-83	9-27-83
Lab Code	DSO-143	DSO-185	DSO-200
Sr-90	0.104±0.012	0.151±0.011	0.125±0.020
K-40	17.36±0.85	12.50±0.94	12.50±0.89
Mn-54	<0.076	<0.062	<0.054
Co-58	<0.086	<0.056	<0.048
Co-60	<0.070	<0.055	<0.047
Nb-95	<0.13	<0.067	<0.058
Zr-95	<0.17	<0.10	<0.092
Ru-103	<0.17	<0.063	<0.046
Ru-106	<0.39	<0.48	<0.39
Cs-134	<0.074	<0.10	<0.091
Cs-137	0.55±0.04	0.38±0.05	0.36±0.04
Ce-141	<0.28	<0.11	<0.086
Ce-144	<0.66	<0.36	<0.33

Table 36. Surface water samples, analysis for gross beta and gamma-emitting isotopes. Collection: Monthly.

Location	Sample Description and Activity (pCi/l)			
Plant Intake				
Indicator				
D-50	Date Collected	1-24-83	2-22-83	3-29-83	4-25-83
	Lab Code	DSW-4102	DSW-4375	DSW-4846	DSW-5119
	Gross Beta	4.6±0.8	7.6±0.9	4.4±0.7	4.0±0.7
	Mn-54	<15	<15	<15	<15
	Co-58	<15	<15	<15	<15
	Co-60	<15	<15	<15	<15
	Nb-95	<28	<15	<15	<17
	Zr-95	<34	<17	<17	<23
	Cs-134	<15	<15	<15	<15
	Cs-137	<15	<15	<15	<15
	Date Collected	5-31-83	6-27-83	7-25-83	8-31-83
	Lab Code	DSW-5460	DSW-5755	DSW-6156	DSW-6513
	Gross Beta	7.4±0.9	6.5±0.8	4.0±0.8	3.5±0.4
	Mn-54	<15	<15	<15	<15
	Co-58	<15	<15	<15	<15
	Co-60	<15	<15	<15	<15
	Nb-95	<15	<15	<17	<15
	Zr-95	<15	<22	<24	<15
	Cs-134	<15	<15	<15	<15
	Cs-137	<15	<15	<15	<15
	Date Collected	9-26-83	10-25-83	11-28-83	1-06-84
	Lab Code	DSW-6819	DSW-7246	DSW-7632	DSW-8102
	Gross Beta	5.8±0.8	4.9±0.8	6.4±0.8	2.1±0.6
	Mn-54	<15	<15	<15	<15
	Co-58	<15	<15	<15	<15
	Co-60	<15	<15	<15	<15
	Nb-95	<15	<15	<15	<15
	Zr-95	<19	<15	<15	<19
	Cs-134	<15	<15	<15	<15
	Cs-137	<15	<15	<15	<15

Table 36. (continued)

Location	Sample Description and Activity (pCi/l)			
Plant Discharge				
Indicator				
D-51	Date Collected	1-24-83	2-22-83	3-29-83	4-25-83
	Lab Code	DSW-4103	DSW-4376	DSW-4847	DSW-5120
	Gross Beta	3.0±0.7	8.1±0.9	3.5±0.7	4.2±0.8
	Mn-54	<15	<15	<15	<15
	Co-58	<15	<15	<15	<15
	Co-60	<15	<15	<15	<15
	Nb-95	<26	<15	<15	<19
	Zr-95	<25	<15	<15	<27
	Cs-134	<15	<15	<15	<15
	Cs-137	<15	<15	<15	<15
	Date Collected	5-31-83	6-27-83	7-25-83	8-31-83
	Lab Code	DSW-5461	DSW-5756	DSW-6157	DSW-6515
	Gross Beta	4.7±0.7	6.5±0.8	3.3±0.7	11.0±3.0[a]
	Mn-54	<15	<15	<15	<15
	Co-58	<15	<15	<15	<15
	Co-60	<15	<15	<15	<15
	Nb-95	<15	<19	<15	<15
	Zr-95	<15	<25	<15	<15
	Cs-134	<15	<15	<15	<15
	Cs-137	<15	<15	<15	<15
	Date Collected	9-26-83	10-25-83	11-28-83	1-06-84
	Lab Code	DSW-6820	DSW-7247	DSW-7633	DSW-8103,4
	Gross Beta	5.0±0.8	3.4±0.7	3.3±0.7	2.9±0.5
	Mn-54	<15	<15	<15	<15
	Co-58	<15	<15	<15	<15
	Co-60	<15	<15	<15	<15
	Nb-95	<15	<15	<15	<15
	Zr-95	<15	<15	<15	<15
	Cs-134	<15	<15	<15	<15
	Cs-137	<15	<15	<15	<15

[a] Results of the analyses for radiostrontium: Sr-89 < 1.4 pCi/l; Sr-90 < 0.7 pCi/l.

Table 36. (continued)

Location		Sample Description and Activity (pCi/l)			
Cedar Rapids City Park					
Indicator					
D-52	Date Collected	1-24-83	2-22-83	3-29-83	4-25-83
	Lab Code	DSW-4104	DSW-4377	DSW-4848,9	DSW-5121
	Gross Beta	1.7±0.6	7.1±0.8	3.4±0.5	3.7±0.7
	Mn-54	<15	<15	<15	<15
	Co-58	<15	<15	<15	<15
	Co-60	<15	<15	<15	<15
	Nb-95	<15	<15	<15	<15
	Zr-95	<15	<15	<15	<15
	Cs-134	<15	<15	<15	<15
	Cs-137	<15	<15	<15	<15
	Date Collected	5-31-83	6-27-83	7-25-83	8-31-83
	Lab Code	DSW-5462,3	DSW-5757	DSW-6158	DSW-6516
	Gross Beta	6.3±0.5	6.0±0.8	3.6±0.7	3.0±0.5
	Mn-54	<15	<15	<15	<15
	Co-58	<15	<15	<15	<15
	Co-60	<15	<15	<15	<15
	Nb-95	<15	<15	<15	<15
	Zr-95	<15	<24	<22	<15
	Cs-134	<15	<15	<15	<15
	Cs-137	<15	<15	<15	<15
	Date Collected	9-26-83	10-25-83	11-28-83	1-06-84
	Lab Code	DSW-6821,2	DSW-7248	DSW-7634	DSW-8105
	Gross Beta	5.4±0.6	4.5±0.8	4.3±0.7	1.7±0.6
	Mn-54	<15	<15	<15	<15
	Co-58	<15	<15	<15	<15
	Co-60	<15	<15	<15	<15
	Nb-95	<15	<15	<15	<15
	Zr-95	<15	<18	<15	<17
	Cs-134	<15	<15	<15	<15
	Cs-137	<15	<15	<15	<15

Table 36. (continued)

Location	Sample Description and Activity (pCi/l)			
Pleasant Creek				
Indicator				
D-99	Date Collected	1-24-83	2-22-83	3-29-83	4-25-83
	Lab Code	DSW-4107	DSW-4379,80	DSW-4851	DSW-5124
	Gross Beta	6.1±0.8	14.2±0.8[a]	6.0±0.8	5.8±0.8
	Mn-54	<15	<15	<15	<15
	Co-58	<15	<15	<15	<15
	Co-60	<15	<15	<15	<15
	Nb-95	<15	<15	<15	<15
	Zr-95	<17	<15	<19	<15
	Cs-134	<15	<15	<15	<15
	Cs-137	<15	<15	<15	<15
	Date Collected	5-31-83	6-27-83	7-25-83	8-31-83
	Lab Code	DSW-5465	DSW-5759	DSW-1660,61	DSW-6518
	Gross Beta	5.5±0.8	6.2±0.8	6.8±0.6	5.7±0.8
	Mn-54	<15	<15	<15	<15
	Co-58	<15	<15	<15	<15
	Co-60	<15	<15	<15	<15
	Nb-95	<15	<15	<15	<15
	Zr-95	<15	<15	<15	<15
	Cs-134	<15	<15	<15	<15
	Cs-137	<15	<15	<15	<15
	Date Collected	9-26-83	10-25-83	11-28-83	1-06-84
	Lab Code	DSW-6824	DSW-7250	DSW-7636	DSW-8107
	Gross Beta	5.9±0.8	6.2±0.9	6.0±0.8	21.1±3.9[b]
	Mn-54	<15	<15	<15	<15
	Co-58	<15	<15	<15	<15
	Co-60	<15	<15	<15	<15
	Nb-95	<15	<15	<15	<15
	Zr-95	<15	<21	<15	<16
	Cs-134	<15	<15	<15	<15
	Cs-137	<15	<15	<15	<15

[a] Sr-89 = <15.9 pCi/l.
Sr-90 = <1.2 pCi/l.

[b] Mean ± s.d. of duplicate analyses. Results of the analyses for radiostrontium: Sr-89 <2.0 pCi/l; Sr-90 2.1±0.6 pCi/l.

Table 36. (continued)

Location	Sample Description and Activity (pCi/l)			
Park Pond				
Indicator				
D-103	Date Collected	1-24-83	2-22-83	3-29-83	4-25-83
	Lab Code	DSW-4108	DSW-4381	DSW-4852	DSW-5125
	Gross Beta	2.0±0.6	5.3±0.7	4.3±0.7	3.6±0.7
	Mn-54	<15	<15	<15	<15
	Co-58	<15	<15	<15	<15
	Co-60	<15	<15	<15	<15
	Nb-95	<15	<15	<21	<15
	Zr-95	<22	<15	<29	<19
	Cs-134	<15	<15	<15	<15
	Cs-137	<15	<15	<15	<15
	Date Collected	5-31-83	6-27-83	7-25-83	8-31-83
	Lab Code	DSW-5466	DSW-5760,1	DSW-6162	DSW-6519
	Gross Beta	4.8±0.7	2.7±0.6	3.2±0.7	3.3±0.7
	Mn-54	<15	<15	<15	<15
	Co-58	<15	<15	<15	<15
	Co-60	<15	<15	<15	<15
	Nb-95	<15	<15	<15	<15
	Zr-95	<15	<15	<15	<15
	Cs-134	<15	<15	<15	<15
	Cs-137	<15	<15	<15	<15
	Date Collected	9-26-83	10-25-83	11-28-83	1-06-84
	Lab Code	DSW-6825	DSW-7251	DSW-7637,8	DSW-8108
	Gross Beta	4.7±0.8	4.6±0.8	4.7±0.5	2.4±0.6
	Mn-54	<15	<15	<15	<15
	Co-58	<15	<15	<15	<15
	Co-60	<15	<15	<15	<15
	Nb-95	<15	<15	<15	<15
	Zr-95	<15	<15	<15	<17
	Cs-134	<15	<15	<15	<15
	Cs-137	<15	<15	<15	<15

Table 36. (continued)

Location	Sample Description and Activity (pCi/l)			
Lewis Access				
Control				
D-49	Date Collected	1-24-83	2-22-83	3-29-83	4-25-83
	Lab Code	DSW-4101	DSW-4374	DSW-4845	DSW-5118
	Gross Beta	6.2±0.8	7.0±0.8	3.7±0.7	4.4±0.7
	Mn-54	<15	<15	<15	<15
	Co-58	<20	<15	<15	<15
	Co-60	<15	<15	<15	<15
	Nb-95	<28	<15	<15	<15
	Zr-95	<37	<19	<22	<15
	Cs-134	<15	<15	<15	<15
	Cs-137	<15	<15	<15	<15
	Date Collected	5-31-83	6-27-83	7-25-83	8-31-83
	Lab Code	DSW-5459	DSW-5754	DSW-6155	DSW-6512
	Gross Beta	6.4±0.8	3.9±0.7	3.3±0.7	3.7±0.5
	Mn-54	<15	<15	<15	<15
	Co-58	<15	<15	<15	<15
	Co-60	<15	<15	<15	<15
	Nb-95	<15	<15	<17	<15
	Zr-95	<19	<23	<24	<15
	Cs-134	<15	<15	<15	<15
	Cs-137	<15	<15	<15	<15
	Date Collected	9-26-83	10-25-83	11-28-83	1-06-84
	Lab Code	DSW-6818	DSW-7245	DSW-7631	DSW-8101
	Gross Beta	4.5±0.7	4.2±0.8	4.6±0.7	2.9±0.7
	Mn-54	<15	<15	<15	<15
	Co-58	<15	<15	<15	<15
	Co-60	<15	<15	<15	<15
	Nb-95	<15	<15	<15	<17
	Zr-95	<15	<15	<17	<21
	Cs-134	<15	<15	<15	<15
	Cs-137	<15	<15	<15	<15

Table 36. (continued)

Location	Sample Description and Activity (pCi/l)			
Farm Pond				
Control				
D-73	Date Collected	1-24-83	2-22-83	3-29-83	4-25-83
	Lab Code	DSW-4105,6	DSW-4378	DSW-4850	DSW-5122,3
	Gross Beta	1.8±0.4	2.1±0.6	1.7±0.6	3.0±0.5
	Mn-54	<15	<15	<15	<15
	Co-58	<17	<15	<15	<15
	Co-60	<15	<15	<15	<15
	Nb-95	<25	<15	<15	<15
	Zr-95	<32	<15	<15	<15
	Cs-134	<15	<15	<15	<15
	Cs-137	<15	<15	<15	<15
	Date Collected	5-31-83	6-27-83	7-25-83	8-31-83
	Lab Code	DSW-5464	DSW-5758	DSW-6159	DSW-6517
	Gross Beta	1.4±0.5	1.5±0.5	2.0±0.6	1.6±0.6
	Mn-54	<15	<15	<15	<15
	Co-58	<15	<15	<15	<15
	Co-60	<15	<15	<15	<15
	Nb-95	<15	<15	<15	<15
	Zr-95	<15	<19	<15	<19
	Cs-134	<15	<15	<15	<15
	Cs-137	<15	<15	<15	<15
	Date Collected	9-26-83	10-25-83	11-28-83	1-06-84
	Lab Code	DSW-6823	DSW-7249	DSW-7635	DSW-8106
	Gross Beta	3.8±0.7	2.1±0.6	1.4±0.6	1.6±0.6
	Mn-54	<15	<15	<15	<15
	Co-58	<15	<15	<15	<15
	Co-60	<15	<15	<15	<15
	Nb-95	<15	<15	<15	<15
	Zr-95	<15	<15	<15	<15
	Cs-134	<15	<15	<15	<15
	Cs-137	<15	<15	<15	<15

Table 37. Surface water samples, quarterly composites of monthly samples, analysis for gross beta, tritium, strontium-89, and strontium-90.

Location and Period Collected	Lab Code	Activity (pCi/l)			
		Gross Beta[a]	H-3	Sr-89	Sr-90
Indicator					
D-50					
1st Q, 1983	DSW-4778	3.7±0.7	<330	<1.5	0.6±0.3
2nd Q, 1983	5820	2.9±0.7	<330	<2.2	<1.1
3rd Q, 1983	6895	--	<330	<2.2	<1.3
4th Q, 1983	8006	--	<330	<2.2	<1.0
Annual Mean ± s.d.					
D-51					
1st Q, 1983	DSW-4779	3.6±0.7	<330	<1.5	0.5±0.4
2nd Q, 1983	5821	3.4±0.7	<330	<2.0	<0.9
3rd Q, 1983	6896	--	<330	<1.4	0.8±0.5
4th Q, 1983	8007,8	--	<330	<2.0	<0.9
Annual Mean ± s.d.					
D-52					
1st Q, 1983	DSW-4780,1	3.9±0.5	<330	<1.5	<0.4
2nd Q, 1983	5822	3.5±0.7	<330	<2.2	<1.1
3rd Q, 1983	6897	--	<330	<1.4	0.6±0.5
4th Q, 1983	8009	--	<330	<2.4	<1.2
Annual Mean ± s.d.					
D-99					
1st Q, 1983	DSW-4782	4.6±0.8	<330	<1.6	1.1±0.4
2nd Q, 1983	5823	5.1±0.8	<330	<2.6	1.1±0.8
3rd Q, 1983	6898	--	<330	<1.4	1.3±0.5
4th Q, 1983	8011	--	<330	<2.0	2.0±0.7
Annual Mean ± s.d.					
D-103					
1st Q, 1983	DSW-7439	NA[b]	<330	<26.2	<1.0
2nd Q, 1983	7441	NA[b]	<330	<8.0	<1.0
3rd Q, 1983	7443		<330	<2.3	<1.1
4th Q, 1983	8012	--	<330	<2.4	<1.2
Annual Mean ± s.d.					

Table 37. (continued)

Location and Period Collected	Lab Code	Activity (pCi/l)			
		Gross Beta[a]	H-3	Sr-89	Sr-90
Control					
D-49					
1st Q, 1983	DSW-4777	4.5±0.8	<330	<1.5	0.3±0.3
2nd Q, 1983	3819	3.4±0.8	<330	<2.2	<1.1
3rd Q, 1983	6894	--	<330	<2.3	0.9±0.8
4th Q, 1983	8005	--	<330	<2.0	<0.9
Annual Mean ± s.d.					
D-73					
1st Q, 1983	DSW-7437,8	NA[b]	<330	<22.8	<0.8
2nd Q, 1983	7440	NA[b]	<330	<7.4	<0.9
3rd Q, 1983	7442	--	<330	<2.4	<1.1
4th Q, 1983	8010	--	<330	<2.1	<1.0
Annual Mean ± s.d.					

[a] Effective July 1983, analysis for gross beta was removed from the program.
[b] NA = Not analyzed; analysis not required for locations D-73 and D-103.

Table 38. Fish samples, analysis of edible portion for gamma-emitting isotopes. Collection: semi-annually.

Sample Description and Activity (pCi/g wet)			
	Indicator		
	Downstream D-61		
Date Collected	5-18-83	5-18-83	5-18-83
Type	Carp	River Carpsucker	Quilback
Lab Code	DF-180	DF-181	DF-182
K-40	3.81±0.53	2.30±0.41	3.30±0.77
Mn-54	<0.046	<0.019	<0.078
Co-58	<0.049	<0.015	<0.089
Co-60	<0.038	<0.019	<0.064
Nb-95	<0.065	<0.028	<0.050
Zr-95	<0.094	<0.034	<0.10
Ru-103	<0.046	<0.025	<0.085
Ru-106	<0.31	<0.12	<0.43
Cs-134	<0.038	<0.019	<0.047
Cs-137	<0.038	<0.020	<0.064
Ce-141	<0.062	<0.040	<0.15
Ce-144	<0.19	<0.14	<0.39

Date Collected	11-02-83	11-02-83	11-02-83	11-17-83
Type	Shorthead Redhorse	Carp	River Carpsucker	River Carpsucker
Lab Code	DF-296	DF-297	DF-298,9	DF-300[a]
K-40	2.72±0.37	2.17±0.30	2.48±0.20	2.61±0.34
Mn-54	<0.032	<0.025	<0.021	<0.025
Co-58	<0.028	<0.025	<0.022	<0.037
Co-60	<0.027	<0.023	<0.025	<0.035
Nb-95	<0.029	<0.020	<0.017	<0.034
Zr-95	<0.047	<0.034	<0.034	<0.044
Ru-103	<0.025	<0.020	<0.017	<0.041
Ru-106	<0.20	<0.20	<0.16	<0.24
Cs-134	<0.026	<0.024	<0.018	<0.023
Cs-137	<0.023	<0.022	<0.022	<0.027
Ce-141	<0.035	<0.030	<0.027	<0.063
Ce-144	<0.15	<0.14	<0.11	<0.16

[a] Extra sampling; split with Hygiene Lab.

Table 38. (continued)

Sample Description and Activity (pCi/g wet)				
	Control			
	Upstream D-49			
Date Collected	5-18-83	5-18-83	5-18-83	11-01-83
Type	Bigmouth Buffalo	Carp	River Carpsucker	Bigmouth Buffalo
Lab Code	DF-176,7	DF-178	DF-179	DF-293
K-40	3.14±0.32	3.66±0.57	4.10±0.56	2.58±0.43
Mn-54	<0.031	<0.044	<0.046	<0.026
Co-58	<0.032	<0.045	<0.048	<0.017
Co-60	<0.033	<0.037	<0.053	<0.035
Nb-95	<0.034	<0.057	<0.061	<0.036
Zr-95	<0.054	<0.083	<0.082	<0.058
Ru-103	<0.031	<0.053	<0.048	<0.028
Ru-106	<0.25	<0.38	<0.34	<0.20
Cs-134	<0.025	<0.034	<0.037	<0.037
Cs-137	<0.029	<0.041	<0.038	<0.027
Ce-141	<0.045	<0.068	<0.067	<0.043
Ce-144	<0.13	<0.20	<0.19	<0.18

Date Collected	11-01-83	11-01-83	11-17-83	11-17-83
Type	Carp	River Carpsucker	Carp	Bigmouth Buffalo
Lab Code	DF-294	DF-295	DF-301	DF-302
K-40	2.39±0.32	3.04±0.54	2.67±0.32	2.97±0.42
Mn-54	<0.025	<0.033	<0.020	<0.029
Co-58	<0.018	<0.044	<0.027	<0.041
Co-60	<0.026	<0.044	<0.027	<0.036
Nb-95	<0.019	<0.046	<0.037	<0.045
Zr-95	<0.037	<0.082	<0.059	<0.055
Ru-103	<0.022	<0.042	<0.035	<0.050
Ru-106	<0.17	<0.29	<0.19	<0.20
Cs-134	<0.024	<0.042	<0.022	<0.030
Cs-137	<0.026	<0.046	<0.022	<0.033
Ce-141	<0.030	<0.052	<0.056	<0.068
Ce-144	<0.14	<0.20	<0.15	<0.18

Table 39. Periphyton samples, analysis for gamma-emitting isotopes. Collection: Quarterly.

Sample Description and Activity (pCi/g wet)		
	Indicator	
	Downstream D-61	
Date Collected	2-14-83	5-19-83
Lab Code	DBO-19	DBO-21
K-40	6.02±4.50	12.90±2.68
Mn-54	<0.40	<0.39
Co-58	<0.47	<0.40
Co-60	<0.40	<0.40
Nb-95	<0.29	<0.49
Zr-95	<1.00	<0.71
Ru-103	<0.70	<0.34
Ru-106	<2.63	<0.30
Cs-134	<0.26	<0.31
Cs-137	<0.31	<0.36
Ce-141	<0.90	<0.46
Ce-144	<1.86	<1.35
Date Collected	8-04-83	11-03-83
Lab Code	DBO-27	DBO-33
K-40	12.38±14.00	6.76±2.10
Mn-54	<1.71	<0.15
Co-58	<1.86	<0.12
Co-60	<2.48	<0.19
Nb-95	<2.17	<0.14
Zr-95	<6.67	<0.25
Ru-103	<4.18	<0.12
Ru-106	<14.26	<1.71
Cs-134	<1.70	<0.23
Cs-137	<1.55	<0.26
Ce-141	<7.75	<0.23
Ce-144	<8.52	<0.99

Note: High LLD values were due to very small amount of sample available for analyses.

Table 39. (continued)

Sample Description and Activity (pCi/g wet)		
	Control	
	Upstream D-49	
Date Collected	2-14-83	5-19-83
Lab Code	DBO-18	DBO-20
K-40	<13.64	22.30±4.64
Mn-54	<0.50	<0.65
Co-58	<1.05	<0.81
Co-60	<0.64	<0.61
Nb-95	<0.76	<0.95
Zr-95	<1.16	<0.61
Ru-103	<0.88	<0.95
Ru-106	<1.55	<1.43
Cs-134	<0.42	<0.74
Cs-137	<0.67	<5.9
Ce-141	<1.26	<0.97
Ce-144	<2.79	<2.63
Date Collected	8-04-83	11-03-83
Lab Code	DBO-26	DBO-32
K-40	8.31±4.20	<6.98
Mn-54	<0.36	<0.40
Co-58	<0.44	<0.34
Co-60	<0.33	<0.34
Nb-95	<0.62	<0.33
Zr-95	<1.05	<0.84
Ru-103	<0.93	<0.45
Ru-106	<4.30	<4.05
Cs-134	<0.47	<0.34
Cs-137	<0.43	<0.48
Ce-141	<1.53	<0.71
Ce-144	<2.02	<1.86

Note: High LLD values were due to very small amount of sample available for analysis.

Table 40. River sediment samples, analysis for strontium-90 and gamma-emitting isotopes. Collection: Semi-annually.

Sample Description and Activity (pCi/g dry)		
		Indicator
Location	D-50	D-50
Date Collected	5-19-83	11-02-83
Lab Code	DBS-124	DBS-197
Sr-90	0.007±0.005	<0.010
K-40	9.31±1.02	7.31±0.92
Mn-54	<0.051	<0.054
Co-58	<0.056	<0.056
Co-60	<0.047	<0.071
Nb-95	<0.067	<0.038
Zr-95	<0.11	<0.091
Ru-103	<0.064	<0.037
Ru-106	<0.45	<0.50
Cs-134	<0.064	<0.066
Cs-137	<0.058	<0.053
Ce-141	<0.071	<0.081
Ce-144	<0.22	<0.34
Location	D-51	D-51
Date Collected	5-19-83	11-02-83
Lab Code	DBS-125	DBS-198
Sr-90	<0.010	<0.010
K-40	9.10±0.99	6.99±0.48
Mn-54	<0.058	<0.021
Co-58	<0.052	<0.025
Co-60	<0.061	<0.020
Nb-95	<0.079	<0.038
Zr-95	<0.12	<0.047
Ru-103	<0.076	<0.032
Ru-106	<0.60	<0.16
Cs-134	<0.074	<0.027
Cs-137	<0.068	<0.019
Ce-141	<0.084	<0.061
Ce-144	<0.27	<0.14

Table 40. (continued)

Sample Description and Activity (pCi/g dry)			
	Indicator		
Location	D-61		D-61
Date Collected	5-19-83		11-02-83
Lab Code	DBS-126		DBS-199,200
Sr-90	0.015±0.007		<0.007
K-40	9.99±0.76		6.78±0.43
Mn-54	<0.031		<0.022
Co-58	<0.025		<0.031
Co-60	<0.036		<0.025
Nb-95	<0.042		<0.035
Zr-95	<0.042		<0.052
Ru-103	<0.050		<0.035
Ru-106	<0.31		<0.19
Cs-134	<0.022		<0.028
Cs-137	<0.033		<0.020
Ce-141	<0.074		<0.057
Ce-144	<0.16		<0.15
	Control		
Location	D-49	D-49	D-49
Date Collected	5-19-83	11-02-83	11-17-83
Lab Code	DBS-122,3	DBS-196	DBS-204[a]
Sr-90	0.011±0.006	<0.008	<0.007
K-40	9.80±0.58	6.29±0.48	10.40±0.79
Mn-54	<0.023	<0.024	<0.028
Co-58	<0.031	<0.030	<0.038
Co-60	<0.028	<0.022	<0.028
Nb-95	<0.031	<0.042	<0.056
Zr-95	<0.053	<0.057	<0.058
Ru-103	<0.047	<0.032	<0.055
Ru-106	<0.28	<0.18	<0.26
Cs-134	<0.036	<0.033	<0.036
Cs-137	<0.034	<0.022	<0.032
Ce-141	<0.042	<0.069	<0.057
Ce-144	<0.15	<0.15	<0.16

[a] Extra sample; split with Hygiene Lab.

Table 41. Precipitation samples, analysis for gross beta and tritium. Collection: Monthly.

Collection Date	Lab Code	pCi/l	
		Gross Beta	H-3
January, 1983	DP-172	12.8±2.6	<300
February, 1983	183	8.0±2.0	<300
March, 1983	199	17.8±1.9	<300
April, 1983	216	2.3±0.4	<300
May, 1983	229	8.7±0.8	<300
June, 1983	240	32.4±1.8	<300
July, 1983	261	6.8±0.8	<300
August, 1983	276	9.4±1.0	<300
September, 1983	288	6.4±0.7	<300
October, 1983	314	3.6±0.5	<300
November, 1983	326	3.1±0.5	<300
December, 1983	343	28.0±1.8	<300
Mean ± s.d.		11.6±9.7	<300

Appendix A

Crosscheck Program Results

Appendix A

Crosscheck Program Results

Teledyne Isotopes Midwest Laboratories (formerly Hazleton Environmental Sciences) has participated in interlaboratory comparison (crosscheck) programs since the formulation of its quality control program in December 1971. These programs are operated by agencies which supply environmental-type samples (e.g., milk or water) containing concentrations of radionuclides known to the issuing agency but not to participant laboratories. The purpose of such a program is to provide an independent check on the laboratory's analytical procedures and to alert it to any possible problems.

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

The results in Table A-1 were obtained through participation in the environmental sample crosscheck program for milk and water samples during the period 1980 through 1983. This program has been conducted by the U. S. Environmental Protection Agency Intercomparison and Calibration Section, Quality Assurance Branch, Environmental Monitoring and Support Laboratory, Las Vegas, Nevada.

The results in Table A-2 were obtained for thermoluminescent dosimeters (TLD's) during the period 1976, 1977, 1979, 1980, and 1981 through participation in the Second, Third, Fourth, and Fifth International Intercomparison of Environmental Dosimeters under the sponsorships listed in Table A-2.

Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Teledyne Isotopes Midwest Laboratory results for milk and water samples, 1980 through 1983[a].

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TIML Result ±2σ[c]	EPA Result ±3σ, n=1[d]
STW-206	Water	Jan. 1980	Gross Alpha	19.0±2.0	30.0±8.0
			Gross Beta	48.0±2.0	45.0±5.0
STW-208	Water	Jan. 1980	Sr-89	6.1±1.2	10.0±0.5
			Sr-90	23.9±1.1	25.5±1.5
STW-209	Water	Feb. 1980	Cr-51	112±14	101±5.0
			Co-60	12.7±2.3	11±5.0
			Zn-65	29.7±2.3	25±5.0
			Ru-106	71.7±1.5	51±5
			Cs-134	12.0±2.0	10±5.0
			Cs-137	30.0±2.7	30±5.0
STW-210	Water	Feb. 1980	H-3	1800±120	1750±340
STW-211	Water	March 1980	Ra-226	15.7±0.2	16.0±2.4
			Ra-228	3.5±0.3	2.6±0.4
STM-217	Milk	May 1980	Sr-89	4.4±2.6[g]	5±5
			Sr-90	10.0±1.0	12±1.5
STW-221	Water	June 1980	Ra-226	2.0±0.0	1.7±0.8
			Ra-228	1.6±0.1	1.7±0.8
STW-223	Water	July 1980	Gross Alpha	31±3.0	38±5.0
			Gross Beta	44±4	35±5.0
STW-224	Water	July 1980	Cs-137	33.9±0.4	35±5.0
			Ba-140	<12	0
			K-40	1350±60	1550±78
			I-131	<5.0	0
STW-225	Water	Aug. 1980	H-3	1280±50	1210±329
STW-226	Water	Sept. 1980	Sr-89	22±1.2	24±8.6
			Sr-90	12±0.6	15±2.6
STW-228	Water	Sept. 1980	Gross Alpha	NA[e]	32.0±8.0
			Gross Beta	22.5±0.0	21.0±5.0
STW-235	Water	Dec. 1980	H-3	2420±30	2240±604

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TIML Result ±2σ[c]	EPA Result ±3σ, n=1[d]
STW-237	Water	Jan. 1981	Sr-89	13.0±1.0	16±8.7
			Sr-90	24.0±0.6	34±2.9
STM-239	Milk	Jan. 1981	Sr-89	<210	0
			Sr-90	15.7±2.6	20±3.0
			I-131	30.9±4.8	26±10.0
			Cs-137	46.9±2.9	43±9.0
			Ba-140	<21	0
			K-40	1330±53	1550±134
STW-240	Water	Jan. 1981	Gross alpha	7.3±2.0	9±5.0
			Gross beta	41.0±3.1	44±5.0
STW-243	Water	Mar. 1981	Ra-226	3.5±0.06	3.4±0.5
			Ra-228	6.5±2.3	7.3±1.1
STW-245	Water	Apr. 1981	H-3	3210±115	2710±355
STW-249	Water	May 1981	Sr-89	51±3.6	36±8.7
			Sr-90	22.7±0.6	22±2.6
STW-251	Water	May 1981	Gross alpha	24.0±5.3	21±5.2
			Gross beta	16.1±1.9	14±5.0
STW-252	Water	Jun. 1981	H-3	2140±95	1950±596
STW-255	Water	Jul. 1981	Gross alpha	20±1.5	22±9.5
			Gross beta	13.0±2.0	15±8.7
STW-259	Water	Sep. 1981	Sr-89	16.1±1.0	23±5
			Sr-90	10.3±0.9	11±1.5
STW-265	Water	Oct. 1981	Gross alpha	71.2±19.1	80±20
			Gross beta	123.3±16.6	111±5.6
			Sr-89	14.9±2.0	21±5
			Sr-90	13.1±1.7	14.4±1.5
			Ra-226	13.0±2.0	12.7±1.9
STW-269	Water	Dec. 1981	H-3	2516±181	2700±355

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TIML Result ±2σ[c]	EPA Result ±3σ, n=1[d]
STW-270	Water	Jan. 1982	Sr-89	24.3±2.0	21.0±5.0
			Sr-90	9.4±0.5	12.0±1.5
STW-273	Water	Jan. 1982	I-131	8.6±0.6	8.4±1.5
STW-275	Water	Feb. 1982	H-3	1580±147	1820±342
STW-276	Water	Feb. 1982	Cr-51	<61	0
			Co-60	26.0±3.7	20±5
			Zn-65	<13	15±5
			Ru-106	<46	20±5
			Cs-134	26.8±0.7	22±5
			Cs-137	29.7±1.4	23±5
STW-277	Water	Mar. 1982	Ra-226	11.9±1.9	11.6±1.7
STW-278	Water	Mar. 1982	Gross alpha	15.6±1.9	19±5
			Gross beta	19.2±0.4	19±5
STW-280	Water	Apr. 1982	H-3	2690±80	2860±360
STW-281	Water	Apr. 1982	Gross alpha	75±7.9	85±21
			Gross beta	114.1±5.9	106±5.3
			Sr-89	17.4±1.8	24±5
			Sr-90	10.5±0.6	12±1.5
			Ra-226	11.4±2.0	10.9±1.5
			Co-60	<4.6	0
STW-284	Water	May 1982	Gross alpha	31.5±6.5	27.5±7
			Gross beta	25.9±3.4	29±5
STW-285	Water	June 1982	H-3	1970±1408	1830±340
STW-286	Water	June 1982	Ra-226	12.6±1.5	13.4±3.5
			Ra-228	11.1±2.5	8.7±2.3
STW-287	Water	June 1982	I-131	6.5±0.3	4.4±0.7
STW-290	Water	Aug. 1982	H-3	3210±140	2890±619
STW-291	Water	Aug. 1982	I-131	94.6±2.5	87±15

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TIML Result ±2σ[c]	EPA Result ±3σ, n=1[d]
STW-292	Water	Sept 1982	Sr-89	22.7±3.8	24.5±8.7
			Sr-90	10.9±0.3	14.5±2.6
STW-296	Water	Oct. 1982	Co-60	20.0±1.0	20±8.7
			Zn-65	32.3±5.1	24±8.7
			Cs-134	15.3±1.5	19.0±8.7
			Cs-137	21.0±1.7	20.0±8.7
STW-297	Water	Oct. 1982	H-3	2470±20	2560±612
STW-298	Water	Oct. 1982	Gross alpha	32±30	55±24
			Gross beta	81.7±6.1	81±8.7
			Sr-89	<2	0
			Sr-90	14.1±0.9	17.2±2.6
			Cs-134	<2	1.8±8.7
			Cs-137	22.7±0.6	20±8.7
			Ra-226	13.6±0.3	12.5±3.2
			Ra-228	3.9±1.0	3.6±0.9
STW-301	Water	Nov. 1982	Gross alpha	12.0±1.0	19.0±8.7
			Gross beta	34.0±2.7	24.0±8.7
STW-302	Water	Dec. 1982	I-131	40.0±0.0	37.0±10
STW-303	Water	Dec. 1982	H-3	1940±20	1990±345
STW-304	Water	Dec. 1982	Ra-226	11.7±0.6	11.0±1.7
			Ra-228	<3	0
STW-306	Water	Jan. 1983	Sr-89	20.0±8.7	29.2±5
			Sr-90	21.7±8.4	17.2±1.5
STW-307	Water	Jan. 1983	Gross alpha	29.0±4.09	29.0±13
			Gross beta	29.3±0.6	31.0±8.7
STM-309	Milk	Feb. 1983	Sr-89	35±2.0	37±8.7
			Sr-90	13.7±0.6	18±2.6
			I-131	55.7±3.2	55±10.4
			Cs-137	29±1.0	26±8.7
			Ba-140	<27	0
			K-40	1637±5.8	1512±131

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TIML Result ±2 [c]	EPA Result ±3 , n=1[d]
STW-310	Water	Feb. 1983	H-3	2470±80	2560±612
STW-311	Water	March 1983	Ra-226	11.9±1.3	12.7±3.3
			Ra-228	<2.7	0
STW-312	Water	March 1983	Gross alpha	31.6±4.59	31±13.4
			Gross beta	27.0±2.0	28±8.7
STW-313	Water	April 1983	H-3	3240±80	3330±627
STW-316	Water	May 1983	Gross alpha	94±7	64±19.9
			Gross beta	133±5	149±12.4
			Sr-89	19±1	24±8.7
			Sr-90	12±1	13±2.6
			Ra-226	7.9±0.4	8.5±2.25
			Co-60	30±2	30±8.7
			Cs-134	27±2	33±8.7
			Cs-137	29±1	27±8.7
STW-317	Water	May 1983	Sr-89	59.7±2.1	57±8.7
			Sr-90	33.7±1.5	38±3.3
STW-318[f]	Water	May 1983	Gross alpha	12.8±1.5	11±8.7
			Gross beta	49.4±3.9	57±8.7
STM-320	Milk	June 1983	Sr-89	20±0	25±8.7
			Sr-90	10±1	16±2.6
			I-131	30±1	30±10.4
			Cs-137	52±2	47±8.7
			K	1553±57	1486±129
STW-321	Water	June 1983	H-3	1470±89	1529±583
STW-322	Water	June 1983	Ra-226	4.3±0.2	4.8±1.24
			Ra-228	<2.5	0
STW-323	Water	July 1983	Gross alpha	3±1	7±8.7
			Gross beta	21±0	22±8.7
STW-324	Water	August 1983	I-131	13.3±0.6	14±10.4

Table A-1. (continued)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TIML Result ±2σ[c]	EPA Result ±3σ, n=1[d]
STAF-326	Air filter	August 1983	Gross beta	42±2	36±8.7
			Sr-90	14±2	10±2.6
			Cs-137	19±1	15±8.7
STW-328	Water	Sept. 1983	Gross alpha	2.3±0.6	5±8.7
			Gross beta	10.7±1.2	9±8.7
STW-329	Water	Sept. 1983	Ra-226	3.0±0.2	3.1±0.81
			Ra-228	3.2±0.7	2.0±0.52
STW-331	Water	Oct. 1983	H-3	1303±32	1210±570
STW-335	Water	Dec. 1983	I-131	19.6±1.9	20±10.4

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

[b] All results are in pCi/l, except for elemental potassium (K) data which are in mg/l.

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

[d] USEPA results are presented as the known values ± control limits of 3σ for n=1.

[e] NA = Not analyzed.

[f] Analyzed but not reported to the EPA.

[g] Results after calculations corrected (error in calculations when reported to EPA).

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

Lab Code	TLD Type	Measurement	mR: Teledyne Result ±2σ [a]	mR: Known Value	mR: Average ±2σ [d] (all participants)
2nd International Intercomparison[b]					
115-2[b]	CaF_2:Mn Bulb	Gamma-Field	17.0±1.9	17.1[c]	16.4±7.7
		Gamma-Lab	20.8±4.1	21.3[c]	18.8±7.6
3rd International Intercomparison[e]					
115-3[e]	CaF_2:Mn Bulb	Gamma-Field	30.7±3.2	34.9±4.8[f]	31.5±3.0
		Gamma-Lab	89.6±6.4	91.7±14.6[f]	86.2±24.0
4th International Intercomparison[g]					
115-4[g]	CaF_2:Mn Bulb	Gamma-Field	14.1±1.1	14.1±1.4[f]	16.09.0
		Gamma-Lab (Low)	9.3±1.3	12.2±2.4[f]	12.0±7.6
		Gamma-Lab (High)	40.4±1.4	45.8±9.2[f]	43.9±13.2
5th International Intercomparison[h]					
115-5A[h]	CaF_2:Mn Bulb	Gamma-Field	31.4±1.8	30.0±6.0[i]	30.2±14.6
		Gamma-Lab at beginning	77.4±5.8	75.2±7.6[i]	75.8±40.4
		Gamma-Lab at the end	96.6±5.8	88.4±8.8[i]	90.7±31.2

Table A-2. (Continued)

Lab Code	TLD Type	Measurement	mR: Teledyne Result ±2σ[a]	mR: Known Value	mR: Average ± 2σ[d] (all participants)
115-58[h]	LiF-100 Chips	Gamma-Field	30.3±4.8	30.0±6[i]	30.2±14.6
		Gamma-Lab at beginning	81.1±7.4	75.2±7.6[i]	75.8±40.4
		Gamma-Lab at the end	85.4±11.7	88.4±8.8[i]	90.7±131.2

[a]Lab result given is the mean ±2σ standard deviations of three determinations.
[b]Second International Intercomparison of Environmental Dosimeters conducted in April of 1976 by the Health and Safety Laboratory (GASL), New York, New York, and the School of Public Health of the University of Texas, Houston, Texas.
[c]Value determined by sponsor of the intercomparison using continuously operated pressurized ion chamber.
[d]Mean ±2σ standard deviations of results obtained by all laboratories participating in the program.
[e]Third International Intercomparison of Environmental Dosimeters conducted in summer of 1977 by Oak Ridge National Laboratory and the School of Public Health of the University of Texas, Houston, Texas.
[f]Value ±2σ standard deviations as determined by sponsor of the intercomparison using continuously operated pressurized ion chamber.
[g]Fourth International Intercomparison of Environmental Dosimeters conducted in summer of 1979 by the School of Public Health of the University of Texas, Houston, Texas.
[h]Fifth International Intercomparison of Environmental Dosimeter conducted in fall of 1980 at Idaho Falls, Idaho and sponsored by the School of Public Health of the University of Texas, Houston, Texas and Environmental Measurements Laboratory, New York, New York, U.S. Department of Energy.
[i]Value determined by sponsor of the intercomparison using continuously operated pressurized ion chamber.

Appendix B

Data Reporting Conventions

Data Reporting Conventions

1.0. All activities are decay corrected to collection time.

2.0. Single Measurements

Each single measurement is reported as follows:

$$x \pm s$$

where x = value of the measurement;

s = 2σ counting uncertainty (corresponding to the 95% confidence level).

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

$$< L \ .$$

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

3.0. Duplicate Analyses

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

Reported result: $x \pm s$

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

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

3.2. Individual results: $< L_1$
$< L_2$

Reported result: $< L$

where L = lower of L_1 and L_2

3.3. Individual results: $x \pm s$
$< L$

Reported result: $x \pm s$ if $x \leq L$;
$< L$ 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 deviations of a set of n numbers $x_1, x_2, \ldots x_n$ are defined as follows:

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

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

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

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

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

4.5. In rounding off, the following rules are followed:

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

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

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