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Monticello Nuclear Generating Plant
Operated by Nuclear Management Company, LLC

May 15, 2002

Technical Specification
6.7.C.1

US Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

M2002049

MONTICELLO NUCLEAR GENERATING PLANT
Docket No. 50-263 License No. DPR-22

2001 Annual Radiological Environmental Operating Report

In accordance with the Monticello Technical Specification 6.7.C.1, we are submitting the annual Radiological Environmental Operating Report for the year 2001. Please note Amendment 120 dated 07/24/01 changed our Technical Specification deadline for this report to May 15 of each year.

This letter contains no new NRC commitments, nor does it modify any prior commitments.

Please contact Paul Hartmann at (763) 271-5172 with any questions or comments.

Jeffrey S. Forbes
Site Vice President
Monticello Nuclear Generating Plant

Attachment

c: Regional Administrator–III, NRC
NRR Project Manager, NRC
Resident Inspector, NRC
Minnesota Department of Commerce

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2807 West County Road 75 • Monticello, Minnesota 55362-9637
Telephone: 763-295-5151 • Fax: 763-295-1454

Environmental, Inc.
Midwest Laboratory
an Allegheny Technologies Co.

700 Landwehr Road • Northbrook, IL 60062-2310
ph. (847) 564-0700 • fax (847) 564-4517

XCEL ENERGY CORPORATION

MONTICELLO NUCLEAR GENERATING PLANT
DOCKET NO. 50-263 LICENSE NO. DPR-22

ANNUAL REPORT
TO THE
UNITED STATES NUCLEAR REGULATORY COMMISSION

Radiological Environmental Monitoring Program

January 1 to December 31, 2001

Prepared under Contract by

ENVIRONMENTAL, Inc.
Midwest Laboratory

Project No. 8010

Approved: _____

Bronia Grob, M.S.
Laboratory Manager

PREFACE

The staff of Environmental, Inc., Midwest Laboratory was responsible for the acquisition of data presented in this report. Samples were collected by personnel of the Monticello Nuclear Generating Plant, operated by Nuclear Management Company, LLC for XCEL Energy Corporation. This report was prepared by Environmental, Inc., Midwest Laboratory.

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1.0 INTRODUCTION

This report summarizes and interprets results of the Radiological Environmental Monitoring Program (REMP) conducted by Environmental, Inc., Midwest Laboratory for the Monticello Nuclear Generating Plant, Monticello, Minnesota, during the period January - December, 2001. 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 (Environmental, Inc., Midwest Laboratory, 2002a) available at the Monticello Nuclear Generating Plant, Chemistry and Radiation Protection Department.

Monticello Nuclear Generating Plant is a boiling water reactor with a nominal generating capacity of 620 MWe. It is located on the Mississippi River in Wright County, Minnesota, and operated by Nuclear Management Company, LLC. Initial criticality was achieved on December 10, 1970. Full power was achieved March 5, 1971 and commercial operation began on June 30, 1971.

2.0 SUMMARY

The Radiological Environmental Monitoring Program (REMP) required by the U.S. Nuclear Regulatory Commission (NRC) Technical Specifications and the Offsite Dose Calculation Manual (ODCM) for the Monticello Nuclear Generating Plant is described. Results for the year 2001 are summarized and discussed.

Program findings show background levels of radioactivity in the environmental samples collected in the vicinity of the Monticello Nuclear Generating Plant.

No effect on the environment due to the operation of the Monticello Nuclear Generating Plant is indicated.

3.0 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (REMP)

3.1 Program Design and Data Interpretation

The purpose of the Radiological Environmental Monitoring Program (REMP) at the Monticello Nuclear Generating Plant 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;

(4) Industrial and medical radioactive waste; and

(5) Fallout from nuclear accidents.

In interpreting the data, effects due to the Plant 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 Monticello Plant 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 plant 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 environmental samples collected from the Plant site. The Plant's monitoring program includes analyses for tritium and iodine-131. Most samples are also analyzed for gamma-emitting isotopes with results for the following groups quantified: zirconium-95, cesium-137, cerium-144, beryllium-7, and potassium-40. The first 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). Beryllium-7 is of cosmogenic origin and potassium-40 is a naturally-occurring isotope. They were chosen as calibration monitors and should not be considered as radiological impact indicators.

Program Design and Data Interpretation (continued)

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 final group, manganese-54, iron-59, cobalt-58 and -60, and zinc-65, are activation products and arise from activation of corrosion products. They are typical components of a nuclear power plant's effluents, but are not produced in significant quantities by nuclear detonations.

Other means of distinguishing sources of environmental radiation are employed in interpreting the data. Current radiation levels are compared with previous levels, including those measured before the plant became operational. Results of the Plant'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 Radiological Environmental Monitoring Program (REMP) at the Monticello Plant is summarized in Table 5.1 and briefly reviewed below. Table 5.2 defines the sampling location codes used in Table 5.1 and specifies for each location its type (indicator or control) and its distance, direction, and sector relative to the plant site. To assure that sampling is carried out in a reproducible manner, detailed sampling procedures have been prescribed (Monticello Generating Plant REMP Surveillances, Current Revision). Maps of sampling locations are included in Appendix D.

To monitor the air environment, airborne particulates are collected on membrane filters by continuous pumping at five locations. Also, airborne iodine is collected by continuous pumping through charcoal filters at all of these locations. Filters are changed and counted weekly. Particulate filters are analyzed for gross beta activity and charcoal filters for iodine-131. Quarterly composites of particulate filters from each location are gamma-scanned on a HPGe detector. One of the five locations is a control (M-1), and four are indicators (M-2, M-3, M-4, M-5). One of the indicators is located in the geographical sector expected to be most susceptible to any atmospheric emissions from the Plant (highest D/Q sector).

Ambient gamma radiation is monitored at forty locations, using $CaSO_4$:Dy dosimeters with four sensitive areas at each location: fourteen in an inner ring in the general area of the site boundary, sixteen in the outer ring within 4-5 mile radius, six at special interest locations and four control locations, outside a 10 mile radius from the plant. They are replaced and measured quarterly. An emergency set of TLDs is placed in the field along side of the regular set. The emergency TLDs are returned to EIML quarterly for annealing and repackaging.

Milk samples are collected monthly from three farms (two indicator and one control). There are currently only two milk producers within the indicator area. Milk is collected biweekly during the growing season (May - October), because the milk animals may be on pasture. All samples are analyzed for iodine-131 and gamma-emitting isotopes.

Program Description (continued)

Leafy green vegetables (cabbage) are collected annually from the highest D/Q garden and a control location and analyzed for iodine-131. Corn and potatoes are collected annually only if the field is irrigated by water in which liquid radioactive effluent has been discharged. Analysis is for gamma-emitting isotopes.

The terrestrial environment is also monitored by the quarterly collections of well water from four locations. Samples are analyzed for tritium and gamma-emitting isotopes.

River water is collected weekly at two locations, one upstream of the plant and one downstream. Monthly composites are analyzed for gamma-emitting isotopes. Quarterly composites are analyzed for tritium.

Drinking water is collected weekly from the City of Minneapolis water supply, which is taken from the Mississippi River downstream of the Plant. Monthly composites are analyzed for gross beta, iodine-131, and gamma-emitting isotopes. Quarterly composites are analyzed for tritium.

The aquatic environment is also monitored by semi-annual upstream and downstream collections of fish, invertebrates, and shoreline sediments. Shoreline sediment is also collected semi-annually from one downstream recreational location. All samples are analyzed for gamma-emitting isotopes.

3.3 Program Execution

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

(1) A partial air particulate/air iodine sample was obtained from location M-3 for the week ending 01-31-01, Power was lost for approximately 5 hours during an ice storm.

(2) No air particulate/air iodine sample was available from location M-3 for the week ending 06-13-01, The circuit breaker was tripped.

(3) Invertebrate samples were not available for the upstream and downstream river locations, M-8 and M-9 in May, 2001. Water levels were high due to above average rainfall.

(4) TLD data was not available from location M-02S for the second quarter, 2001. Both the regular and emergency TLDs were lost in the field.

(5) Milk samples were not available from M-28 (Hoglund Farm) from July 28 through December, 2001. Dairy operations have been temporarily discontinued.

Deviations from the program are summarized in Table 5.3.

3.4 Laboratory Procedures

The iodine-131 analyses in milk and drinking water were made using a sensitive radiochemical procedure which involves separation of the iodine using an ion-exchange method and solvent extraction and subsequent beta counting.

All gamma-spectroscopic analyses were performed with an HPGe detector. Levels of iodine-131 in cabbage and natural vegetation were determined by gamma spectroscopy. Concentrations of airborne iodine-131 in charcoal samples were also determined by gamma spectroscopy.

Tritium was determined by a liquid scintillation technique.

Analytical Procedures used by Environmental, Inc. are on file and are available for inspection. Procedures are based on those prescribed by the Health and Safety Laboratory of the U.S. Dep't of Energy, Edition 28, 1997, U.S. Environmental Protection Agency for Measurement of Radioactivity in Drinking Water, 1980, and the U.S. Environmental Protection Agency, EERF, Radiochemical Procedures Manual, 1984.

Environmental, Inc., Midwest Laboratory has a comprehensive quality control/quality assurance program designed to assure the reliability of data obtained. Details of the QA Program are presented elsewhere (Environmental, Inc., Midwest Laboratory, 2000). The QA Program includes participation in Interlaboratory Comparison (crosscheck) Programs. Results obtained in the crosscheck programs are presented in Appendix A.

3.5 Program Modifications

There were no program modifications made during the year 2001.

3.6 Land Use Census

In accordance with the Offsite Dose Calculation Manual, sec. 07.01, a land use census shall be conducted and shall identify the location of the nearest milk animal, the nearest residence, and the nearest garden of greater than 500 ft^2 producing fresh leafy vegetables, in each of the 16 meteorological sectors within a distance of 5 miles. The census shall also identify the locations of all milk animals and all 500 ft^2 or greater gardens producing broad leaf vegetation in each of the meteorological sectors within a distance of three miles. This census shall be conducted at least once per year between the dates of May 1 and October 31. New locations shall be added to the radiation environmental monitoring program within 30 days and sampling locations having lower calculated doses or a lower dose commitment may be deleted from this monitoring program after October 31 of the year in which the land use census was conducted. The 2001 land use census was conducted between August 6 and September 28, 2001. The highest D/Q locations did not change from the 2000 census, Detailed land use census data are contained in the Land Use Census and Critical Receptor Report, Monticello Nuclear Generating Plant, Chemistry and Radiation Protection Department.

4.0 RESULTS AND DISCUSSION

All of the scheduled collections and analyses were made except those listed in Table 5.3.

All results are summarized in Table 5.4 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 for all indicator locations and for all control locations. The locations with the highest mean and range are also shown.

4.1 Atmospheric Nuclear Detonations and Nuclear Accidents

There were no reported accidents at nuclear facilities and no atmospheric nuclear tests conducted in the year 2001. The last reported test was made by the People's Republic of China on October 16, 1980.

4.2 Summary of Preoperational Data

The following constitutes a summary of preoperational studies conducted at the Monticello Nuclear Generating Plant during the years 1968 to 1970, to determine background levels expected in the environment, and provided, where applicable, as a means for comparison with present day levels. Strict comparisons, however, are difficult to make, since background levels of radiation were much higher in these years due to radioactive fallout from the atmosphere. Gross beta measurements in fallout averaged 20,600 pCi/m^2 in 1969 and 12,000 pCi/m^2 in 1970. These levels are reflected throughout the various media tested.

In the air environment, ambient gamma radiation (TLDs) averaged 9.1 mRem/4 weeks during preoperational studies (1970). Gross beta in air particulates in 1969 and 1970 averaged 0.20 pCi/m^3. Present day levels have stabilized at around 0.025 pCi/m^3. Airborne radioiodine remained below detection levels.

In the terrestrial environment of 1968 to 1970, milk, agricultural crops, and soil were monitored. In milk samples, low levels of Cs-137 and Sr-90 were detected. Cs-137 levels averaged 16.7 pCi/L. Soybean crop measurements in 1969 averaged 35.5 pCi/g for gross beta and 0.3 pCi/g for Cs-137. Gross beta measured in soil averaged 51.7 pCi/g . Present day measurements for cesium-137 are below detection levels in milk and agricultural crops.

The aqueous environment was monitored by testing of river water, bottom sediments, fish, aquatic vegetation, and periphyton. Specific location comparison of drinking, river, and well water concentrations for tritium and gross beta are not possible. However, tritium background levels, measured at seven separate locations from 1968 to 1970, averaged 970 pCi/L. Present day environmental samples measure below detection levels. Values for gross beta, measured from 1968 to 1970, averaged 9.8 pCi/L in upstream and downstream Mississippi River water, 4.4 pCi/L for well waters, and 18.6 pCi/L for lake waters. Gamma emitters were below the lower limit of detection (LLD). In shoreline sediments, gross beta background levels in 1970 averaged 49.8 pCi/g for both upstream and downstream samples. Cs-137 activity averaged 0.10 pCi/g for both upstream and downstream samples. Low levels of Cs-137, occasionally observed today can still be attributed to residual activity from atmospheric fallout. Gross beta levels in

4.2 Summary of Preoperational Data (continued)

fish flesh averaged 5.3 pCi/g in 1968 and 1969. Cs-137, measured in 1969 and 1970, averaged 0.044 pCi/g. Gross beta background levels, in 1970, for aquatic vegetation, algae, and periphyton samples measured 86.7 pCi/g, 76.5 pCi/g, and 28.1 pCi/g respectively.

4.3 Program Findings

Results obtained show background levels of radioactivity in the environmental samples collected in the vicinity of the Monticello Nuclear Generating Plant.

Ambient Radiation (TLD's)

Ambient radiation was measured in the general area of the site boundary, at an outer ring 4 - 5 mi. distant from the Plant, at special interest areas and at four control locations. The means were similar for both inner and outer rings (14.3 and 13.7 mRem/91 days, respectively). The mean for special locations was 13.5 mRem/91 days. The mean for control locations was 14.1 mRem/91 days. Dose rates measured at the inner and outer ring locations were similar to those observed from 1985 through 2000 and are tabulated below. No plant effect on ambient gamma radiation is indicated (Figure 5-1).

Year	Inner Ring	Outer Ring
	Dose rate (mRem/91 days)	
1985	12.6	12.8
1986	14.6	14.1
1987	15.4	15.5
1988	14.8	14.7
1989	15.0	15.4
1990	16.1	16.2
1991	15.2	15.8
1992	15.1	15.1
1993	15.6	15.9
1994	14.6	14.0
1995	14.4	13.6
1996	14.0	13.5
1997	13.3	12.8
1998	15.0	14.4
1999	15.1	14.3
2000	15.1	14.5
2001	14.3	13.7

Ambient gamma radiation as measured by thermoluminescent dosimetry.
Average quarterly dose rates, Inner vs. Outer Ring locations

Airborne Particulates

The average annual gross beta concentrations in airborne particulates were almost identical at indicator and control locations (0.027 pCi/m^3 and 0.026 pCi/m^3, respectively) and were similar to levels observed from 1985 through 2000. The results are tabulated below. The data for 1986 does not include the results from May 19 to June 9, 1986, which were influenced by the accident at Chernobyl. (Figure 5-2).

Year	Indicators	Control
	Concentration (pCi/m^3)	
1985	0.025	0.024
1986	0.026	0.026
1987	0.026	0.026
1988	0.030	0.030
1989	0.027	0.026
1990	0.023	0.023
1991	0.024	0.024
1992	0.023	0.023
1993	0.024	0.023
1994	0.023	0.024
1995	0.024	0.025
1996	0.023	0.023
1997	0.023	0.023
1998	0.023	0.023
1999	0.023	0.025
2000	0.027	0.026
2001	0.027	0.026

Average annual gross beta concentrations in airborne particulates.

A spring peak in beta activity had been observed almost annually for many years (Wilson *et al.*, 1969). It had been attributed to fallout of nuclides from the stratosphere (Gold *et al.*, 1964). It was pronounced in 1981, occurred to a lesser degree in 1982, and has not occurred since 1983. The highest averages occur during the months of January and December, and the first and fourth quarters, as seen in 1985 through 2001.

Two pieces of evidence indicate conclusively that the elevated activity observed during the first and fourth quarters was not attributable to the Plant operation. In the first place, elevated activity of similar size occurred simultaneously at both indicator and control locations. Secondly, an identical pattern was observed at the Prairie Island Nuclear Generating Plant, about 100 miles distant from the Monticello Nuclear Generating Plant (XCEL Energy Corp., 2002b).

Gamma spectroscopic analysis of quarterly composites of air particulate filters yielded similar results for indicator and control locations. Beryllium-7, which is produced continuously in the upper atmosphere by cosmic radiation (Arnold and Al-Salih, 1955) was detected in all samples, with an average activity of 0.060 pCi/m^3 for all locations. All other gamma-emitting isotopes were below their respective LLD limits.

Airborne Iodine

Weekly levels of airborne iodine-131 were below the lower limit of detection (LLD) of 0.07 pCi/m^3in all samples.

Milk

Iodine-131 activity measured below the detection limit of 1.0 pCi/L in all samples. Cesium-137 results were below the LLD level of 15 pCi/L in all samples.

No other gamma-emitting isotopes except naturally-occurring potassium-40, were detected in milk samples. This is consistent with the finding of the National Center for Radiological Health (1968) 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.

In summary, the milk data for 2001 show no radiological effects of the plant operation.

River Water and Drinking Water

Tritium was below the LLD of 330 pCi/L in all samples. Gross beta activity in Minneapolis drinking water averaged 2.5 pCi/L and was similar to average levels observed from 1985 through 2000. Gross beta averages are tabulated below.

Year		Gross Beta (pCi/L)
1985		2.8
1986		2.5
1987		2.4
1988		2.7
1989		2.6
1990		2.2
1991		2.9
1992		2.1
1993		2.6
1994		2.0
1995		2.3
1996		2.1
1997		2.3
1998		2.4
1999		2.2
2000		2.5
2001		2.5

Average annual concentrations; Gross beta in drinking water.

Comparisons with data reported by the USEPA for Minneapolis drinking water samples collected in 1975, 1976, 1977, and 1978 indicate that concentrations of these nuclides are remaining fairly constant and are consistent with drinking water levels in other parts of the country. Gamma-emitting isotopes were below detection limits in all surface water samples. There was no indication of a plant effect.

Well Water

Tritium measured below the LLD level of 330 pCi/L in all samples. All gamma isotopic results were below detection limits. There was no indication of a plant effect.

Crops

Two samples of cabbage were collected in August and analyzed for iodine-131. Levels of I-131 measured below 0.012 pCi/g wet weight in both samples. There was no indication of a plant effect. There were no crops irrigated from the Mississippi River within 5 miles of the plant in 2001; therefore, no corn or potato samples were collected for analysis from irrigated fields.

Fish

Fish samples were collected in May and October. Flesh was separated from the bones and gamma-scanned. Naturally-occurring potassium-40 was found to be similar in upstream and downstream samples (2.77 and 2.87 pCi/g wet weight, respectively). All gamma-emitting isotopes were below their respective LLD levels. There was no indication of any plant effect.

Invertebrates

Two samples were collected in October. The samples were analyzed for gamma-emitting isotopes. All gamma-emitting isotopes were below detection limits. There was no indication of any plant effect.

Shoreline Sediments

Upstream, downstream and downstream recreational area shoreline sediment collections were made in May and October and analyzed for gamma-emitting isotopes. Cesium-137 was detected in five of the six samples collected, averaging 0.051 pCi/g dry weight in downstream samples and 0.030 pCi/g dry weight in one of the two control samples, indicating the influence of fallout deposition. Similar levels of activities and distribution were observed in 1978-2000. The only other gamma-emitting isotopes detected were naturally-occurring beryllium-7 and potassium-40. There was no indication of a plant effect.

5.0 FIGURES AND TABLES

Table 5.1. Sample collection and analysis program, Monticello Nuclear Generating Plant.

Medium	Location No.	Location Codes (and Type)[a]	Collection Type and Frequency[b]	Analysis Type and Frequency[c]
Ambient radiation (TLDs)	40	M-01A - M-14A M-01B - M-16B M-01S - M-06S M-01C - M-04C	C/Q	Ambient gamma
Airborne Particulates	5	M-1(C), M-2, M-3, M-4, M-5	C/W	GB, GS (QC of each location)
Airborne Iodine	5	M-1(C), M-2, M-3, M-4, M-5	C/W	I-131
Milk	3	M-10 (C), M-24, M-28	G/M[d]	I-131, GS
Surface water	2	M-8(C), M-9	G/W	GS(MC), H-3(QC)
Drinking water	1	M-14	G/W	GB(MC), I-131(MC) GS (MC), H-3 (QC)
Well water	4	M-10(C), M-11, M-12, M-27	G/Q	H-3, GS
Edible cultivated crops -				
Corn[e]	1	M-19	G/A	GS
Leafy Vegetable	2	M-27, St. Cloud Farmer's Mkt. (C)	G/A	I-131
Potatoes[e]	1	M-21	G/A	GS
Fish (one species, edible portion)	2	M-8(C), M-9	G/SA	GS
Periphyton or invertebrates	2	M-8(C), M-9	G/SA	GS
Shoreline sediment	3	M-8(C), M-9, M-15	G/SA	GS

[a] Location codes are defined in Table 5.2. Control stations are indicated by (C). All other stations are indicators.

[b] Collection type is coded as follows: C/ = continuous, G/ = grab. Collection frequency is coded as follows: W= weekly, M = monthly, Q = quarterly, SA = semiannually, A = annually.

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

[d] Milk is collected biweekly during the grazing season (May - October), if milch animals are on pasture.

[e] Collected only if the plant discharges radioactive effluent into the river, then only from river irrigated fields.

Table 5.2. Sampling locations, Monticello Nuclear Generating Plant.

Code	Type[a]	Collection Site	Sample Type[b]	Distance and Direction from Reactor
M-1	C	Air Station M-1	AP, AI	11.0 mi @ 307°/NW
M-2		Air Station M-2	AP, AI	0.9 mi @ 137°/SE
M-3		Air Station M-3	AP, AI	0.7 mi @ 104°/ESE
M-4		Air Station M-4	AP, AI	0.9 mi @ 146°/SSE
M-5		Air Station M-5	AP, AI	2.7 mi @ 134°/SE
M-8	C	Upstream of Plant	SW, SS, BO, F	< 1000' upstream of Plant Intake
M-9		Downstream of Plant	SW, SS, BO, F	< 1000' downstream of Plant Discharge
M-10	C	Goenner Farm	M, WW	12.4 mi @ 322°/NW
M-11		City of Monticello	WW	3.4 mi @ 126°/SE
M-12		Plant Well #1	WW	0.2 mi @ 232°/SW
M-14		City of Minneapolis	DW	37.0 mi @ 132°/SE
M-15		Montissippi Park	SS	1.4 mi @ 114°/ESE
M-19		River Irrigated Corn Field[c]		
M-21		River Irrigated Potato Field[c]		
M-24		Weinand Farm	M	4.8 mi @ 178°/S
M-27		Wise residence (Highest D/Q Garden)	VE, WW	0.6 mi @ 198°/SSW
M-28		Hoglund Farm	M	3.6 mi @ 300°/WNW
General Area of the Site Boundary				
M-01A		Sherburne Ave. So.	TLD	0.7 mi @ 01°/N
M-02A		Sherburne Ave. So.	TLD	0.8 mi @ 31°/NNE
M-03A		Sherburne Ave. So.	TLD	1.3 mi @ 55°/NE
M-04A		Biology Station Road	TLD	0.6 mi @ 91°/E
M-05A		Biology Station Road	TLD	0.6 mi @ 118°/ESE
M-06A		Biology Station Road	TLD	0.7 mi @ 130°/SE
M-07A		County Road 75	TLD	0.6 mi @ 148°/SSE
M-08A		County Road 75	TLD	0.6 mi @ 170°/S
M-09A		County Road 75	TLD	0.6 mi @ 192°/SSW
M-10A		County Road 75	TLD	0.5 mi @ 218°/SW
M-11A		County Road 75	TLD	0.4 mi @ 240°/WSW
M-12A		County Road 75	TLD	0.4 mi @ 260°/W
M-13A		North Boundary Road	TLD	0.8 mi @ 324°/NW
M-14A		North Boundary Road	TLD	0.7 mi @ 340°/NNW

Table 5.2. Sampling locations, Monticello Nuclear Generating Plant, (continued).

Code	Type[a]	Collection Site	Sample Type[b]	Distance and Direction from Reactor
Approximately 4 to 5 miles Distant from the Plant				
M-01B		Sherco #1 Air Station	TLD	4.6 mi @ 03°/N
M-02B		County Road 11	TLD	4.4 mi @ 20°/NNE
M-03B		County Road 73 & 81	TLD	4.3 mi @ 53°/NE
M-04B		County Road 73 (196th St.)	TLD	4.3 mi @ 68°/ENE
M-05B		City of Big Lake	TLD	4.4 mi @ 90°/E
M-06B		County Road 14 and 196th St.	TLD	4.4 mi @ 117°/ESE
M-07B		Monte Industrial Drive	TLD	4.4 mi @ 136°/SE
M-08B		Residence, Hwy 25 & Davidson Ave.	TLD	4.7 mi @ 161°/SSE
M-09B		Weinand Farm	TLD	4.8 mi @ 178°/S
M-10B		Reisewitz Farm, Acacia Ave.	TLD	4.2 mi @ 204°/SSW
M-11B		Vanlith Farm, 97th Ave.	TLD	4.0 mi @ 226°/SW
M-12B		Lake Maria State Park	TLD	4.2 mi @ 254°/WSW
M-13B		Bridgewater Station	TLD	4.0 mi @ 270°/W
M-14B		Anderson Residence, Cty Rd. 111	TLD	4.3 mi @ 289°/WNW
M-15B		Red Oak Wild Bird Farm	TLD	4.3 mi @ 309°/NW
M-16B		Sand Plain Research Farm	TLD	4.3 mi @ 341°/NNW
Special Interest Locations				
M-01S		Osowski Fun Market	TLD	0.6 mi @ 234°/SW
M-02S		Edgar Klucas Residence	TLD	1.1 mi @ 143°/SE
M-03S		Big Oaks Park	TLD	1.6 mi @ 102°/ESE
M-04S		Pinewood School	TLD	2.4 mi @ 129°/SE
M-05S		Rivercrest Christian Academy	TLD	3.1 mi @ 118°/ESE
M-06S		Monte Public Works	TLD	2.7 mi @ 134°/SE
M-01C	C	Kirchenbauer Farm	TLD	11.5 mi @ 323°/NW
M-02C	C	County Roads 4 and 15	TLD	11.2 mi @ 47°/NE
M-03C	C	County Rd 19 and Jason Ave.	TLD	13.0 mi @ 100°/E
M-04C	C	Maple Lake Water Tower	TLD	10.3 mi @ 226°/ SW

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

[b] Sample Codes:

AP	Airborne particulates	F	Fish
AI	Airborne Iodine	M	Milk
BS	Bottom (river) sediments	RW	River Water
BO	Bottom organisms	SS	Shoreline Sediments
DW	Drinking Water	VE	Vegetation / vegetables
		WW	Well Water

[c] Collected only if the plant discharges radioactive effluent into the river, then only from river irrigated fields.

Table 5.3. Missed collections and analyses at the Monticello Nuclear Generating Plant.

All required samples were collected and analyzed as scheduled with the following exceptions:

Sample Type	Analysis	Location	Collection Date or Period	Reason for not conducting REMP as required	Plans for Preventing Recurrence
AP/AI	Beta, I-131	M-3	1/31/2001	Partial sample; ~5 hours lost during ice storm.	None required.
BO	Gamma	M-8, M-9	5/16/2001	Seasonal non-availability; high river level due to above average rainfall.	None required.
AP/AI	Beta, I-131	M-3	6/13/2001	Circuit breaker tripped. Could not reset.	Circuit and wiring inspected and updated.
TLD	Ambient Gamma	M-02S	7/3/2001	TLD lost in the field. Power pole moved after sale of residence.	TLD placed on a new post located in the right-of-way area.
MI	Gamma, I-131	M-28	7/25/2001 through Dec., 2001	Hoglund Dairy temporarily out of dairy business.	Hoglund will inform the MNGP upon resumption of operation.

Figure 5-1. Offsite Ambient Radiation (TLDs); Inner Ring versus Outer Ring locations.

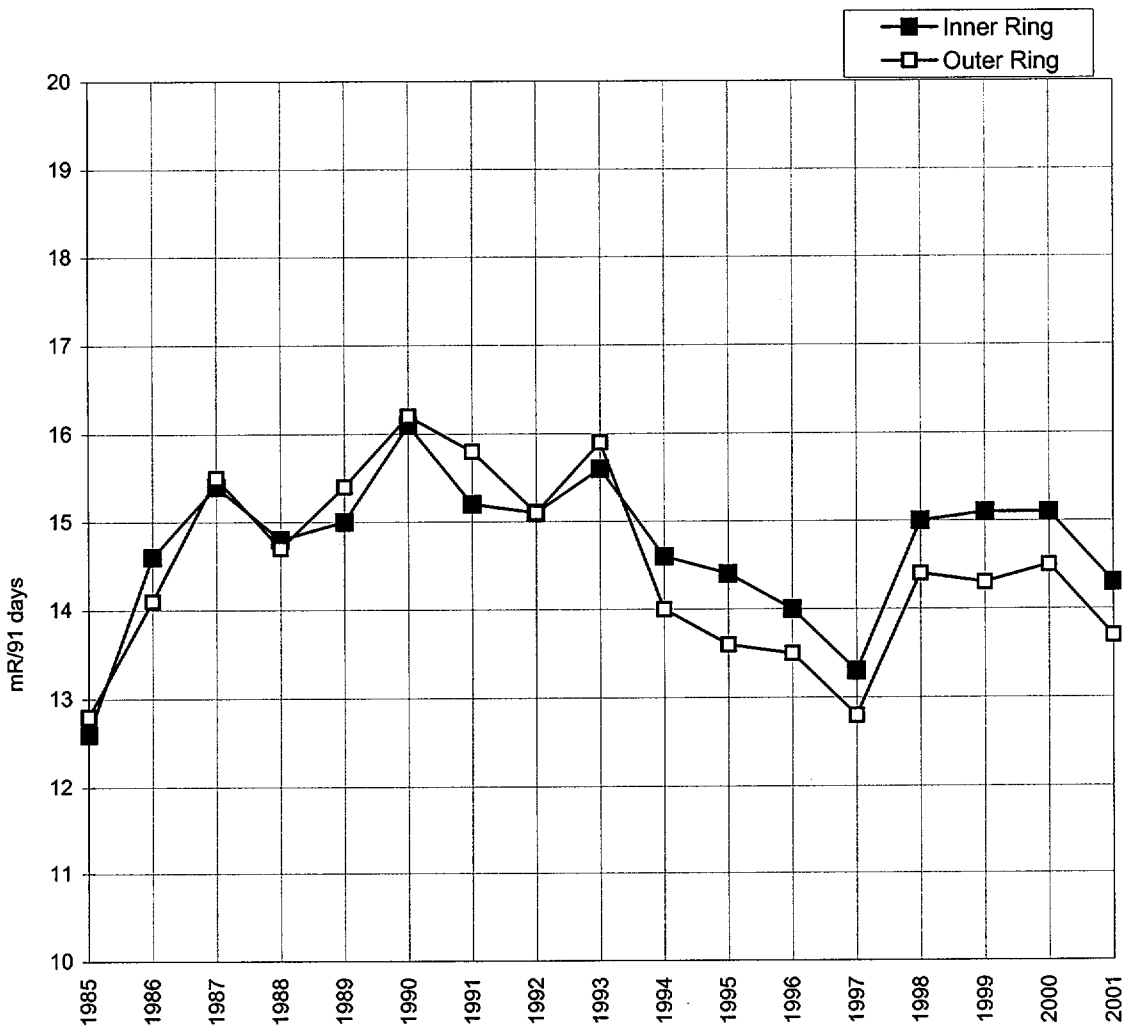

Figure 5-2. Airborne Particulates; analysis for gross beta, average mean of all indicator locations versus control location.

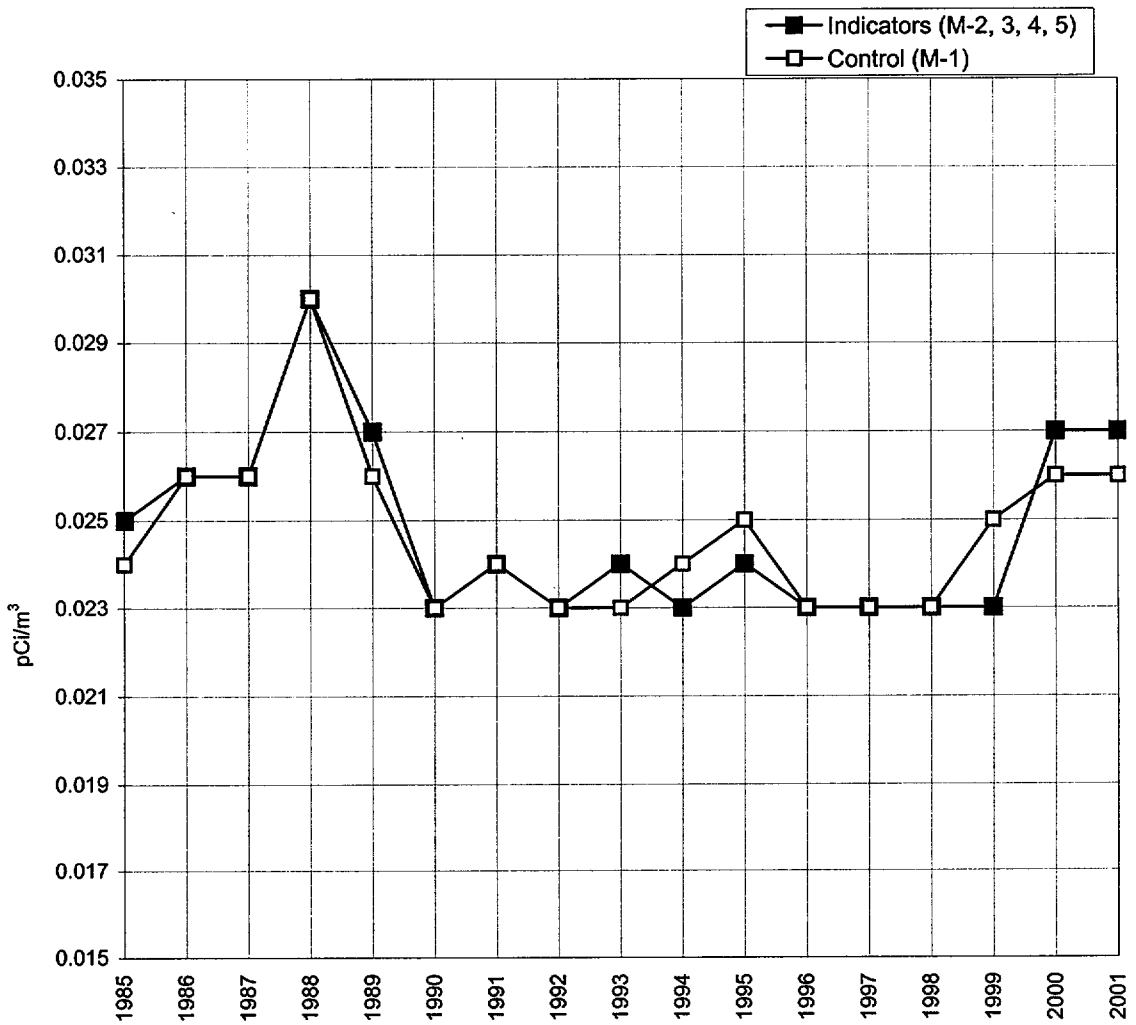

Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility	Monticello Nuclear Generating Plant	Docket No.	50-263
Location of Facility	Wright, Minnesota	Reporting Period	January-December, 2001
	(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		Control Locations Mean (F)[c] Range[c]	Number Non-Routine Results[e]
				Location[d]	Mean (F)[c] Range[c]		
TLD (Inner Ring, General Area at Site Boundary) mRem/91 days)	Gamma 56	3.0	14.3 (56/56) (10.8-17.7)	M-12A,County Road 75 0.4 mi @ 260°/W	16.0 (4 /4) (12.5-17.7)	(See Control below.)	0
TLD (Outer Ring, 4-5 mi. distant) mRem/91 days)	Gamma 64	3.0	13.7 (64/64) (9.5-17.2)	M-09B, Weinand Farm 4.8 mi @ 178°/S	15.0 (4 /4) (11.1-17.2)	(See Control below.)	0
TLD (Special Interest Areas) mRem/91 days)	Gamma 23	3.0	13.5 (23/23) (10.0-17.7)	M-06S, Monticello P.W. 2.7 mi @ 134°/SE	15.4 (4 /4) (12.5-17.7)	(See Control below.)	0
TLD (Control) mRem/91 days)	Gamma 16	3.0	None	M-03C, County Rd.19 & Jason, 13.0 mi. @ 100°/E	16.0 (4/4) (15.1-17.0)	14.1 (16/16) (11.6-16.6)	0
Airborne Particulates (pCi/m^3)	GB 259	0.005	0.027 (206/207) (0.010-0.058)	M-5, Air Station 2.7 mi @ 134°/SE	0.027 (51 /51) (0.011-0.055)	0.026 (52/52) (0.012-0.057)	0
	GS 20						
	Be-7	0.015	0.060 (16/16) (0.041-0.081)	M-5, Air Station 2.7 mi @ 134°/SE	0.066 (4/4) (0.055-0.078)	0.062 (4/4) (0.045-0.081)	0
	Mn-54	0.0013	< LLD	-	-	< LLD	0
	Co-58	0.0011	< LLD	-	-	< LLD	0
	Co-60	0.0010	< LLD	-	-	< LLD	0
	Zn-65	0.0015	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.0019	< LLD	-	-	< LLD	0
	Ru-103	0.0015	< LLD	-	-	< LLD	0
	Ru-106	0.0081	< LLD	-	-	< LLD	0
	Cs-134	0.0008	< LLD	-	-	< LLD	0
	Cs-137	0.0009	< LLD	-	-	< LLD	0
	Ba-La-140	0.0020	< LLD	-	-	< LLD	0
	Ce-141	0.0019	< LLD	-	-	< LLD	0
	Ce-144	0.0056	< LLD	-	-	< LLD	0
Airborne Iodine (pCi/m^3)	I-131 259	0.07	< LLD	-	-	< LLD	0

Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility	Monticello Nuclear Generating Plant	Docket No.	50-263
Location of Facility	Wright, Minnesota	Reporting Period	January-December, 2001
	(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		Control Locations Mean (F)[c] Range[c]	Number Non-Routine Results[e]
				Location[d]	Mean (F)[c] Range[c]		
Milk (pCi/L)	I-131 50	1.0	< LLD	-	-	< LLD	0
	GS 50						
	K-40	200	1374 (30/30) (1220-1563)	M-24, Weinand Farm 4.8 mi @ 178°/S	1379 (20 /20) (1220-1563)	1361 (20/20) (1102-1487)	0
	Cs-134	15	< LLD	-	-	< LLD	0
	Cs-137	15	< LLD	-	-	< LLD	0
	Ba-La-140	15	< LLD	-	-	< LLD	0
River Water (pCi/L)	H-3 8	330	< LLD	-	-	< LLD	0
	GS 24						
	Mn-54	15	< LLD	-	-	< LLD	0
	Fe-59	30	< LLD	-	-	< LLD	0
	Co-58	15	< LLD	-	-	< LLD	0
	Co-60	15	< LLD	-	-	< LLD	0
	Zn-65	30	< LLD	-	-	< LLD	0
	Zr-Nb-95	15	< LLD	-	-	< LLD	0
	Cs-134	15	< LLD	-	-	< LLD	0
	Cs-137	18	< LLD	-	-	< LLD	0
	Ba-La-140	15	< LLD	-	-	< LLD	0
	Ce-144	46	< LLD	-	-	< LLD	0

Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility	Monticello Nuclear Generating Plant	Docket No.	50-263
Location of Facility	Wright, Minnesota	Reporting Period	January-December, 2001
	(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		Control Locations Mean (F)[c] Range[c]	Number Non-Routine Results[e]
				Location[d]	Mean (F)[c] Range[c]		
Drinking Water (pCi/L)	GB 12	1.0	2.5 (12/12) (1.6-3.3)	M-14, Minneapolis 37.0 mi. @ 132° /SE	2.5 (12/12) (1.6-3.3)	None	0
	I-131 12	1.0	< LLD	-	-	None	0
	H-3 4	330	< LLD	-	-	None	0
	GS 12						
	Mn-54	15	< LLD	-	-	None	0
	Fe-59	30	< LLD	-	-	None	0
	Co-58	15	< LLD	-	-	None	0
	Co-60	15	< LLD	-	-	None	0
	Zn-65	30	< LLD	-	-	None	0
	Zr-Nb-95	15	< LLD	-	-	None	0
	Cs-134	10	< LLD	-	-	None	0
	Cs-137	18	< LLD	-	-	None	0
	Ba-La-140	15	< LLD	-	-	None	0
	Ce-144	50	< LLD	-	-	None	0
Well Water (pCi/L)	H-3 16	330	< LLD	-	-	< LLD	0
	GS 16						
	Mn-54	15	< LLD	-	-	< LLD	0
	Fe-59	30	< LLD	-	-	< LLD	0
	Co-58	15	< LLD	-	-	< LLD	0
	Co-60	15	< LLD	-	-	< LLD	0
	Zn-65	30	< LLD	-	-	< LLD	0
	Zr-Nb-95	15	< LLD	-	-	< LLD	0
	Cs-134	10	< LLD	-	-	< LLD	0
	Cs-137	18	< LLD	-	-	< LLD	0
	Ba-La-140	15	< LLD	-	-	< LLD	0
	Ce-144	61	< LLD	-	-	< LLD	0
Crops - Cabbage (pCi/gwet)	I-131 2	0.013	< LLD	-	-	< LLD	0

Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility	Monticello Nuclear Generating Plant	Docket No.	50-263
Location of Facility	Wright, Minnesota	Reporting Period	January-December, 2001
	(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		Control Locations Mean (F)[c] Range[c]	Number Non-Routine Results[e]
				Location[d]	Mean (F)[c] Range[c]		
Fish	GS 4						
(pCi/g wet)	K-40	0.10	2.77 (2/2) (2.68-2.85)	M-8, < 1000' Upstream from Plant Intake	2.87 (2/2) (2.75-2.99)	2.87 (2/2) (2.75-2.99)	0
	Mn-54	0.018	< LLD	-	-	< LLD	0
	Fe-59	0.063	< LLD	-	-	< LLD	0
	Co-58	0.013	< LLD	-	-	< LLD	0
	Co-60	0.018	< LLD	-	-	< LLD	0
	Zn-65	0.027	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.049	< LLD	-	-	< LLD	0
	Cs-134	0.019	< LLD	-	-	< LLD	0
	Cs-137	0.017	0.024 (1/2)	M-9, < 1000' Downstream from Plant Discharge	0.024 (1/2) -	< LLD -	0 -
	Ba-La-140	0.10	< LLD	-	-	< LLD	0
	Ce-144	0.11	< LLD	-	-	< LLD	0
Invertebrates	GS 2						
(pCi/g wet)	Be-7	2.99	< LLD	-	-	< LLD	0
	K-40	7.65	< LLD	-	-	< LLD	0
	Mn-54	0.27	< LLD	-	-	< LLD	0
	Fe-59	0.34	< LLD	-	-	< LLD	0
	Co-58	0.34	< LLD	-	-	< LLD	0
	Co-60	0.35	< LLD	-	-	< LLD	0
	Zn-65	0.61	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.27	< LLD	-	-	< LLD	0
	Cs-134	0.31	< LLD	-	-	< LLD	0
	Cs-137	0.18	< LLD	-	-	< LLD	0
	Ba-La-140	0.53	< LLD	-	-	< LLD	0
	Ce-144	1.50	< LLD	-	-	< LLD	0

Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility	Monticello Nuclear Generating Plant	Docket No.	50-263
Location of Facility	Wright, Minnesota	Reporting Period	January-December, 2001
	(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		Control Locations Mean (F)[c] Range[c]	Number Non-Routine Results[e]
				Location[d]	Mean (F)[c] Range[c]		
Shoreline Sediments (pCi/g dry)	GS 6						
	Be-7	0.26	< LLD	M-8, Upstream < 1000' from Intake	0.39 (1/2)	0.39 (1/2)	0
	K-40	0.10	10.81 (4/4) (10.39-11.23)	Indicators, M-9, M-15, identical means	10.81 (4/4) (10.39-11.23)	9.41 (2/2) (8.83-9.99)	0
	Mn-54	0.030	< LLD	-	-	< LLD	0
	Co-58	0.030	< LLD	-	-	< LLD	0
	Co-60	0.023	< LLD	-	-	< LLD	0
	Zn-65	0.062	< LLD	-	-	< LLD	0
	Nb-95	0.034	< LLD	-	-	< LLD	0
	Zr-95	0.050	< LLD	-	-	< LLD	0
	Ru-103	0.034	< LLD	-	-	< LLD	0
	Ru-106	0.21	< LLD	-	-	< LLD	0
	Cs-134	0.035	< LLD	-	-	< LLD	0
	Cs-137	0.019	0.051 (4/4) (0.039-0.068)	M-15, Montissippi Park 1.4 mi. @ 114°/ ESE	0.062 (2/2) (0.055-0.068)	0.030 (1/2)	0
	Ba-La-140	0.064	< LLD	-	-	< LLD	0
	Ce-144	0.11	< LLD	-	-	< LLD	0

[a] GB = gross beta, GS = gamma scan.

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

[c] Mean and range are based on detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (F).

[d] Locations are specified: (1) by name, and/or station code (Table 2) and (2) by distance (miles) and direction relative to reactor site.

[e] Non-routine results are those which exceed ten times the control station value. If no control station value is available, the result is considered non-routine if it exceeds ten time the typical preoperational value for the medium or location.

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Environmental, Inc.
Midwest Laboratory
an Allegheny Technologies Co.

700 Landwehr Road • Northbrook, IL 60062-2310
(847) 564-0700 fax (847) 564-4517

APPENDIX A

INTERLABORATORY COMPARISON PROGRAM RESULTS

NOTE: Environmental, Inc., Midwest Laboratory participates in intercomparison studies administered by Environmental Resources Associates, and serves as a replacement for studies conducted previously by the U.S. EPA Environmental Monitoring Systems Laboratory, Las Vegas, Nevada. Results are reported in Appendix A. TLD Intercomparison results, in-house spikes, blanks, duplicates and mixed analyte performance evaluation program results are also reported. Appendix A is updated four times a year; the complete Appendix is included in March, June, September and December monthly progress reports only.

January, 2001 through December, 2001

Appendix A

Interlaboratory Comparison Program Results

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

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

The results in Table A-1 were obtained through participation in the environmental sample crosscheck program for milk, water and air filters during the past twelve months. Data for previous years is available upon request.

This program was conducted by the U.S. Environmental Protection Agency Office of Research and Development National Exposure Research Laboratory Characterization Research Division-Las Vegas, Nevada.

The results in Table A-2 were obtained for Thermoluminescent Dosimeters (TLDs), via various International Intercomparisons of Environmental Dosimeters under the sponsorships listed in Table A-2. Results of crosscheck testing with Teledyne Brown Engineering are also listed.

Table A-3 lists results of the analyses on in-house "spiked" samples for the past twelve months. All samples are prepared using NIST traceable sources. Data for previous years available upon request.

Table A-4 lists results of the analyses on in-house "blank" samples for the past twelve months. Data for previous years available upon request.

Table A-5 list results of the in-house "duplicate" program for the past twelve months. Acceptance is based on the difference of the results being less than the sum of the errors. Data for previous years available upon request.

The results in Table A-6 were obtained through participation in the Mixed Analyte Performance Evaluation Program.

The results in Table A-7 were obtained through participation in the Environmental Measurement Laboratory Quality Assessment Program.

Attachment A lists acceptance criteria for "spiked" samples.

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

ATTACHMENT A

ACCEPTANCE CRITERIA FOR "SPIKED" SAMPLES

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

Analysis	Level	One Standard Deviation for single determinations
Gamma Emitters	5 to 100 pCi/liter or kg > 100 pCi/liter or kg	5.0 pCi/liter 5% of known value
Strontium-89[b]	5 to 50 pCi/liter or kg > 50 pCi/liter or kg	5.0 pCi/liter 10% of known value
Strontium-90[b]	2 to 30 pCi/liter or kg > 30 pCi/liter or kg	5.0 pCi/liter 10% of known value
Potassium-40	> 0.1 g/liter or kg	5% of known value
Gross alpha	20 pCi/liter > 20 pCi/liter	5.0 pCi/liter 25% of known value
Gross beta	100 pCi/liter > 100 pCi/liter	5.0 pCi/liter 5% of known value
Tritium	4,000 pCi/liter > 4,000 pCi/liter	1s = (pCi/liter) = 169.85 x (known)$^{0.0933}$ 10% of known value
Radium-226,-228	0.1 pCi/liter	15% of known value
Plutonium	0.1 pCi/liter, gram, or sample	10% of known value
Iodine-131, Iodine-129[b]	55 pCi/liter > 55 pCi/liter	6.0 pCi/liter 10% of known value
Uranium-238, Nickel-63[b] Technetium-99[b]	35 pCi/liter > 35 pCi/liter	6.0 pCi/liter 15% of known value
Iron-55[b]	50 to 100 pCi/liter > 100 pCi/liter	10 pCi/liter 10% of known value
Others[b]	–	20% of known value

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

[b] Laboratory limit.

Table A-1. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA)[a].

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[b] Laboratory result[c]	ERA Result[d]	Control Limits
STW-897	WATER	Jan, 2001	Gr. Alpha	31.9 ± 2.1	45.7 ± 11.4	25.9 - 65.5
STW-897	WATER	Jan, 2001	Gr. Beta	25.3 ± 2.7	16.7 ± 5.0	8.0 - 25.4
STW-900	WATER	Feb, 2001	I-131	27.2 ± 0.8	28.3 ± 3.0	23.1 - 33.5
STW-902	WATER	Feb, 2001	Ra-226	4.0 ± 0.1	4.7 ± 0.7	3.4 - 5.9
STW-902	WATER	Feb, 2001	Ra-228	13.8 ± 0.4	14.4 ± 3.6	8.2 - 20.6
STW-902	WATER	Feb, 2001	Uranium	17.0 ± 0.3	20.4 ± 3.0	15.2 - 25.6
STW-903	WATER	Mar, 2001	H-3	17,400.0 ± 69.7	17,800.0 ± 1,780.0	14,700. - 20,900.0
STW-917	WATER	Apr, 2001	Gr. Alpha	57.4 ± 3.5	56.0 ± 14.0	31.8 - 80.2
STW-917	WATER	Apr, 2001	Ra-226	13.5 ± 0.4	17.7 ± 2.7	13.1 - 22.3
STW-917	WATER	Apr, 2001	Ra-228	10.1 ± 0.6	8.1 ± 2.0	4.6 - 11.6
STW-917	WATER	Apr, 2001	Uranium	14.2 ± 0.2	15.6 ± 3.0	10.4 - 20.8
STW-918	WATER	Apr, 2001	Co-60	27.9 ± 1.4	26.4 ± 5.0	17.7 - 35.1
STW-918	WATER	Apr, 2001	Cs-134	16.0 ± 0.4	16.9 ± 5.0	8.2 - 25.6
STW-918	WATER	Apr, 2001	Cs-137	195.4 ± 1.5	186.0 ± 9.3	170.0 - 202.0
STW-918	WATER	Apr, 2001	Gr. Beta	340.0 ± 51.0	343.0 ± 1.7	252.0 - 428.0
STW-918	WATER	Apr, 2001	Sr-89	62.8 ± 5.7	64.1 ± 5.0	55.5 - 72.8
STW-918	WATER	Apr, 2001	Sr-90	34.2 ± 1.6	33.8 ± 5.0	25.1 - 42.5
STW-919	WATER	Jun, 2001	Ba-133	37.8 ± 1.2	36.0 ± 5.0	27.3 - 44.7
STW-919	WATER	Jun, 2001	Co-60	49.9 ± 0.7	46.8 ± 5.0	38.1 - 55.5
STW-919	WATER	Jun, 2001	Cs-134	16.0 ± 1.4	15.9 ± 5.0	7.2 - 24.6
STW-919	WATER	Jun, 2001	Cs-137	208.0 ± 1.7	197.0 ± 9.9	180.0 - 214.0
STW-919	WATER	Jun, 2001	Zn-65	37.8 ± 0.7	36.2 ± 5.0	27.5 - 44.9
STW-920	WATER	Jun, 2001	Ra-226	14.6 ± 0.4	15.4 ± 2.3	11.4 - 19.4
STW-920	WATER	Jun, 2001	Ra-228	6.2 ± 0.2	4.5 ± 1.1	2.6 - 6.5
STW-920	WATER	Jun, 2001	Uranium	49.0 ± 1.0	55.7 ± 5.6	46.1 - 65.3
STW-921	WATER	Jul, 2001	Sr-89	19.8 ± 1.5	31.2 ± 5.0	22.5 - 39.9
Delay in processing may have attributed to deviation. Result of reanalysis; Sr-89, 35.3 ± 4.4 pCi/L. Sr-90, 25.0 ± 2.8 pCi/L.						
STW-921	WATER	Jul, 2001	Sr-90	26.3 ± 1.1	25.9 ± 5.0	17.2 - 34.6
STW-922	WATER	Jul, 2001	Gr. Alpha	23.3 ± 1.9	17.8 ± 5.0	9.1 - 26.5
STW-922	WATER	Jul, 2001	Gr. Beta	48.5 ± 4.6	53.0 ± 10.0	35.7 - 70.3
STW-924	WATER	Aug, 2001	H-3	2,680.0 ± 41.9	2,730.0 ± 356.0	2,110.0 - 3,350.0
STW-931	WATER	Sep, 2001	Ra-226	10.9 ± 0.2	10.8 ± 1.6	8.0 - 13.6
STW-931	WATER	Sep, 2001	Ra-228	9.7 ± 1.1	9.0 ± 2.2	5.1 - 12.8
STW-931	WATER	Sep, 2001	Uranium	11.2 ± 0.1	13.1 ± 3.0	7.9 - 18.3
STW-932	WATER	Oct, 2001	I-131	7.7 ± 0.3	7.7 ± 2.0	4.2 - 11.2
STW-933	WATER	Oct, 2001	Gr. Alpha	82.2 ± 4.0	97.5 ± 24.4	55.3 - 140.0
STW-933	WATER	Oct, 2001	Ra-226	9.5 ± 1.2	10.8 ± 1.6	8.0 - 13.6

Table A-1. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA)[a].

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[b]		
				Laboratory result[c]	ERA Result[d]	Control Limits
STW-933	WATER	Oct, 2001	Ra-228	17.0 ± 0.8	15.6 ± 3.9	8.9 - 22.4
STW-933	WATER	Oct, 2001	Uranium	32.2 ± 1.4	37.2 ± 3.7	30.7 - 43.6
STW-934	WATER	Oct, 2001	Co-60	82.4 ± 0.9	78.4 ± 5.0	69.7 - 87.1
STW-934	WATER	Oct, 2001	Cs-134	52.2 ± 1.3	54.1 ± 5.0	45.4 - 62.8
STW-934	WATER	Oct, 2001	Cs-137	39.4 ± 0.6	37.9 ± 5.0	26.3 - 43.7
STW-934	WATER	Oct, 2001	Gr. Beta	166.0 ± 7.1	192.0 ± 28.8	142.0 - 242.0
STW-934	WATER	Oct, 2001	Sr-89	12.8 ± 0.8	16.7 ± 5.0	8.0 - 25.4
STW-934	WATER	Oct, 2001	Sr-90	6.8 ± 0.7	7.7 ± 5.0	-1.0 - 16.4
STW-935	WATER	Oct, 2001	Gr. Alpha	63.5 ± 2.5	64.0 ± 16.0	36.5 - 91.5
STW-935	WATER	Oct, 2001	Gr. Beta	26.0 ± 1.2	21.5 ± 5.0	12.8 - 30.2
STW-938	WATER	Nov, 2001	Ba-133	66.7 ± 1.2	69.3 ± 6.9	57.5 - 81.1
STW-938	WATER	Nov, 2001	Co-60	59.3 ± 0.6	59.7 ± 5.0	51.0 - 68.4
STW-938	WATER	Nov, 2001	Cs-134	86.7 ± 1.5	93.9 ± 5.0	85.2 - 103.0
STW-938	WATER	Nov, 2001	Cs-137	45.0 ± 1.0	42.0 ± 5.0	33.3 - 50.7
STW-938	WATER	Nov, 2001	Zn-65	80.7 ± 0.6	77.3 ± 7.7	63.9 - 90.7

[a] Results obtained by Environmental, Inc., Midwest Laboratory as a participant in the environmental samples crosscheck program operated by Environmental Resources Associates (ERA).

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

[c] Unless otherwise indicated, the laboratory result is given as the mean ± standard deviation for three determinations.

[d] Results are presented as the known values, expected laboratory precision (1 sigma, 1 determination) and control limits as provided by ERA.

Table A-2. Crosscheck program results; Thermoluminescent Dosimeters. (TLDs).

Lab Code	TLD Type	Date	Measurement	mR Known Value	mR Lab result ± 2 Sigma	mR Control Limits
Teledyne Brown Engineering						
2000-1	LiF-100 Chips	Mar, 2000	Reader 1, #1	17.8	14.4 ± 0.2	12.46 - 23.14
2000-1	LiF-100 Chips	Mar, 2000	Reader 1, #2	35.5	32.4 ± 0.1	24.85 - 46.15
2000-1	LiF-100 Chips	Mar, 2000	Reader 1, #3	62.2	61.8 ± 0.9	43.54 - 80.86
Teledyne Brown Engineering						
2000-2	$CaSO_4$: Dy Cards	Mar, 2000	Reader 1, #1	17.8	21.3 ± 0.3	12.46 - 23.14
2000-2	$CaSO_4$: Dy Cards	Mar, 2000	Reader 1, #2	35.5	40.1 ± 1.9	24.85 - 46.15
2000-2	$CaSO_4$: Dy Cards	Mar, 2000	Reader 1, #3	62.2	69.9 ± 3.5	43.54 - 80.86
Chips and cards irradiated by Teledyne Brown Engineering, Westwood, New Jersey, in March of 2000.						
12th International Intercomparison						
022-1	$CaSO_4$: Dy Cards	Jun, 2000	Field	161.0	184.9 ± 1.9	112.70 - 209.30
022-1	$CaSO_4$: Dy Cards	Jun, 2000	Field 1	548.0	502.2 ± 1.7	383.60 - 712.40
022-1	$CaSO_4$: Dy Cards	Jun, 2000	Field 2	391.0	412.0 ± 2.9	273.70 - 508.30
022-1	$CaSO_4$: Dy Cards	Jun, 2000	Field 3	623.0	643.2 ± 2.9	436.10 - 809.90
022-1	$CaSO_4$: Dy Cards	Jun, 2000	Lab, 1	391.0	442.8 ± 2.5	273.70 - 508.30
Environmental, Inc.						
2001-1	$CaSO_4$: Dy Cards	Dec, 2001	Reader 1, #1	4.0	3.7 ± 0.1	2.79 - 5.17
2001-1	$CaSO_4$: Dy Cards	Dec, 2001	Reader 1, #1	4.0	3.4 ± 0.1	2.79 - 5.17
2001-1	$CaSO_4$: Dy Cards	Dec, 2001	Reader 1, #2	7.1	7.9 ± 0.2	4.95 - 9.19
2001-1	$CaSO_4$: Dy Cards	Dec, 2001	Reader 1, #2	7.1	7.6 ± 0.3	4.95 - 9.19
2001-1	$CaSO_4$: Dy Cards	Dec, 2001	Reader 1, #3	15.9	18.6 ± 0.4	11.13 - 20.67
2001-1	$CaSO_4$: Dy Cards	Dec, 2001	Reader 1, #3	15.9	19.6 ± 0.1	11.13 - 20.67
2001-1	$CaSO_4$: Dy Cards	Dec, 2001	Reader 1, #4	63.6	78.2 ± 1.2	44.53 - 82.69
2001-1	$CaSO_4$: Dy Cards	Dec, 2001	Reader 1, #4	63.6	79.9 ± 2.5	44.53 - 82.69

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

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[a] Laboratory results 2s, n=1[b]	Known Activity	Control[c] Limits
SPAP-477	Air Filter	Jan, 2001	Cs-137	1.76 ± 0.02	1.68	1.01 - 2.35
SPW-479	Water	Jan, 2001	H-3	54702.00 ± 644.00	54549.00	43639.20 - 65458.80
SPW-481	Water	Jan, 2001	Gr. Alpha	58.08 ± 2.79	69.14	34.57 - 103.71
SPW-481	Water	Jan, 2001	Gr. Beta	213.83 ± 3.07	220.26	198.23 - 242.29
SPW-482	Water	Jan, 2001	Gr. Alpha	51.77 ± 2.18	69.14	34.57 - 103.71
SPW-482	Water	Jan, 2001	Gr. Beta	202.48 ± 2.98	220.26	198.23 - 242.29
SPW-483	Water	Jan, 2001	Ra-226	20.11 ± 0.34	20.86	14.60 - 27.12
SPW-483	Water	Jan, 2001	Ra-228	10.55 ± 2.02	19.43	13.60 - 25.26
Sample was lost during analysis. Insufficient sample available to perform reanalysis.						
SPW-485	Water	Jan, 2001	Co-60	33.53 ± 3.40	31.13	21.13 - 41.13
SPW-485	Water	Jan, 2001	Cs-134	32.80 ± 2.54	30.81	20.81 - 40.81
SPW-485	Water	Jan, 2001	Cs-137	42.10 ± 5.60	36.00	26.00 - 46.00
SPW-485	Water	Jan, 2001	Sr-90	154.34 ± 3.49	137.66	110.13 - 165.19
SPAP-754	Air Filter	Jan, 2001	Gr. Beta	8.53 ± 0.02	7.88	-2.12 - 17.88
SPW-1037	Water	Feb, 2001	U-233/4	3.74 ± 0.10	4.17	2.50 - 5.84
SPW-1037	Water	Feb, 2001	U-238	3.81 ± 0.10	4.17	-7.83 - 16.17
SPW-1224	Water	Feb, 2001	Ra-226	21.25 ± 0.50	20.68	14.48 - 26.88
SPW-1224	Water	Feb, 2001	Ra-228	21.76 ± 2.65	19.27	13.49 - 25.05
SPW-1225	Water	Feb, 2001	Gr. Alpha	71.87 ± 3.07	69.14	34.57 - 103.71
SPW-1225	Water	Feb, 2001	Gr. Beta	36.30 ± 1.47	28.75	18.75 - 38.75
SPW-1272	Water	Feb, 2001	I-131	56.82 ± 0.71	63.05	50.44 - 75.66
SPW-1272	Water	Feb, 2001	I-131(g)	65.69 ± 10.21	63.05	53.05 - 73.05
SPVE-1274	Vegetation	Feb, 2001	I-131(g)	0.78 ± 0.05	0.76	0.45 - 1.06
SPCH-1276	Charcoal	Feb, 2001	I-131(g)	1.57 ± 0.05	1.58	0.95 - 2.21
SPMI-1270	Milk	Mar, 2001	Cs-134	31.89 ± 4.71	29.77	19.77 - 39.77
SPMI-1270	Milk	Mar, 2001	Cs-137	46.61 ± 8.81	35.90	25.90 - 45.90
The Cs-137 spike is suspect; A new cesium spike has been prepared. Reference to SPMI-3232.						
SPMI-1270	Milk	Mar, 2001	I-131(g)	81.92 ± 10.80	81.95	71.95 - 91.95
SPU-2901	Urine	Mar, 2001	H-3	51512.00 ± 1369.00	50189.00	40151.20 - 60226.80
SPW-2161	Water	Mar, 2001	Ra-228	29.92 ± 5.13	31.75	22.23 - 41.28
SPU-3128	Urine	Apr, 2001	H-3	2065.00 ± 408.00	2008.00	1317.37 - 2698.63
SPW-3129	Water	Apr, 2001	Gr. Alpha	37.94 ± 2.42	34.57	17.29 - 51.86

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

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[a]		
				Laboratory results 2s, n=1[b]	Known Activity	Control[c] Limits
SPW-3129	Water	Apr, 2001	Gr. Beta	117.83 ± 2.37	109.46	98.51 - 120.41
SPAP-3508	Air Filter	Apr, 2001	Gr. Beta	0.80 ± 0.01	0.78	-9.22 - 10.78
SPMI-3232	Milk	Apr, 2001	Cs-134	32.69 ± 6.50	33.96	23.96 - 43.96
SPMI-3232	Milk	Apr, 2001	Cs-137	44.20 ± 9.08	35.79	25.79 - 45.79
SPMI-3232	Milk	Apr, 2001	I-131	48.05 ± 0.90	56.68	45.34 - 68.02
SPMI-3232	Milk	Apr, 2001	I-131(g)	55.64 ± 11.39	56.68	46.68 - 66.68
SPMI-3232	Milk	Apr, 2001	Sr-90	143.77 ± 3.04	136.82	109.46 - 164.18
SPSO-3356	Soil	Apr, 2001	Co-60	18.49 ± 0.21	19.57	9.57 - 29.57
SPSO-3356	Soil	Apr, 2001	Cs-137	18.71 ± 0.24	16.61	6.61 - 26.61
SPAP-3359	Air Filter	Apr, 2001	Cs-137	1.80 ± 0.01	1.67	1.00 - 2.34
SPW-3376	Water	Apr, 2001	Co-60	48.17 ± 4.85	45.19	35.19 - 55.19
SPW-3376	Water	Apr, 2001	Cs-134	37.14 ± 3.90	33.96	23.96 - 43.96
SPW-3376	Water	Apr, 2001	Sr-90	159.84 ± 3.42	136.82	109.46 - 164.18
SPW-3377	Water	Apr, 2001	I-131	68.60 ± 2.63	85.02	68.02 - 102.02
SPW-3129/1	Water	May, 2001	Gr. Alpha	37.94 ± 2.42	34.57	17.29 - 51.86
SPW-3129/1	Water	May, 2001	Gr. Beta	117.83 ± 2.37	109.46	98.51 - 120.41
SPW-3129/2	Water	Jun, 2001	Gr. Alpha	34.42 ± 2.14	34.57	17.29 - 51.86
SPW-3129/2	Water	Jun, 2001	Gr. Beta	119.99 ± 2.45	109.46	98.51 - 120.41
SPVE-3303	Vegetation	Jun, 2001	I-131(g)	0.81 ± 0.03	0.86	0.51 - 1.20
SPSO-5701	Soil	Jul, 2001	Co-60	17.42 ± 0.19	19.05	9.05 - 29.05
SPSO-5701	Soil	Jul, 2001	Cs-137	16.03 ± 0.22	16.52	6.52 - 26.52
SPW-5779	Water	Jul, 2001	Co-60	250.05 ± 18.63	233.26	209.93 - 256.59
SPW-5779	Water	Jul, 2001	Cs-137	178.68 ± 19.89	175.91	158.32 - 193.50
SPW-5779	Water	Jul, 2001	Sr-90	72.12 ± 2.24	68.12	54.50 - 81.74
SPF-5781	Fish	Jul, 2001	Co-60	1.87 ± 0.08	1.79	1.07 - 2.51
SPF-5781	Fish	Jul, 2001	Cs-137	1.43 ± 0.07	1.39	0.83 - 1.95
SPW-5937	Water	Jul, 2001	H-3	51177.00 ± 631.00	50189.00	40151.20 - 60226.80
SPW-59441	Water	Jul, 2001	Ra-226	36.62 ± 1.74	34.46	24.12 - 44.80
SPW-59441	Water	Jul, 2001	Ra-228	41.46 ± 6.44	36.06	25.24 - 46.88
SPAP-5703	Air Filter	Jul, 2001	Cs-137	1.81 ± 0.02	1.67	1.00 - 2.34
SPW-3129/3	Water	Jul, 2001	Gr. Alpha	35.31 ± 3.04	34.75	17.38 - 52.13

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

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/L[a]		
				Laboratory results 2s, n=1[b]	Known Activity	Control[c] Limits
SPW-3129/3	Water	Jul, 2001	Gr. Beta	113.28 ± 3.65	109.46	98.51 - 120.41
SPMI-6145	Milk	Jul, 2001	Cs-137	188.45 ± 19.10	175.91	158.32 - 193.50
SPW-6604	Water	Jul, 2001	Gr. Alpha	35.36 ± 1.94	34.57	17.29 - 51.86
SPW-6604	Water	Jul, 2001	Gr. Beta	112.56 ± 2.46	108.82	97.94 - 119.70
SPW-9008	Water	Oct, 2001	H-3	48285.00 ± 606.10	50189.00	40151.20 - 60226.80
SPAP-9010	Air Filter	Oct, 2001	Cs-137	1.91 ± 0.01	1.67	1.00 - 2.34
SPW-10723	Water	Dec, 2001	U-233/4	40.12 ± 1.09	41.73	25.04 - 58.42
SPW-10723	Water	Dec, 2001	U-238	40.16 ± 1.09	41.73	29.21 - 54.25
SPAP-11550	Air Filter	Dec, 2001	Gr. Beta	1.58 ± 0.02	1.56	-8.44 - 11.56
SPW-11757	Water	Dec, 2001	Co-60	43.82 ± 3.14	41.36	31.36 - 51.36
SPW-11757	Water	Dec, 2001	Cs-134	24.11 ± 2.42	22.59	12.59 - 32.59
SPW-11757	Water	Dec, 2001	Cs-137	52.11 ± 4.40	50.89	40.89 - 60.89
SPMI-11759	Milk	Dec, 2001	Cs-134	28.03 ± 2.64	27.10	17.10 - 37.10
SPMI-11759	Milk	Dec, 2001	Cs-137	54.59 ± 5.08	50.89	40.89 - 60.89
SPF-11761	Fish	Dec, 2001	Cs-134	0.94 ± 0.02	0.90	0.54 - 1.26
SPF-11761	Fish	Dec, 2001	Cs-137	1.43 ± 0.04	1.43	0.86 - 2.00

[a] All results are in pCi/L, except for elemental potassium (K) in milk, which are in mg/L.; air filter samples, which are in pCi/Filter; and food products, which are in pCi/kg.
[b] Results are based on single determinations.
[c] Control limits are based on Attachment A, Page A2 of this report.

NOTE: For fish, Jello is used for the spike matrix. For vegetation, coleslaw is used for the spike matrix.

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

Lab Code	Sample Type	Sample Date	Analysis	Concentration pCi/L[a]. Laboratory results (4.66 Sigma) LLD	Laboratory results (4.66 Sigma) Activity[b]	Acceptance Criteria (4.66 Sigma)
SPAP-478	AIR FILTER	Jan 2001	Co-60	< 1.12		<100.0
SPAP-478	AIR FILTER	Jan 2001	Cs-134	< 1.66		<100.0
SPAP-478	AIR FILTER	Jan 2001	Cs-137	< 2.46		<100.0
SPW-480	WATER	Jan 2001	H-3	< 162.00	-1.86 ± 80.40	<200.0
SPW-484	WATER	Jan 2001	Gr. Alpha	< 0.68		<1.0
SPW-484	WATER	Jan 2001	Gr. Beta	< 1.35		<3.2
SPW-484	WATER	Jan 2001	Ra-226	< 0.02	0.03 ± 0.01	<1.0
SPW-484	WATER	Jan 2001	Ra-228	< 0.97	0.43 ± 0.50	<2.0
SPW-486	WATER	Jan 2001	Co-60	< 2.68		<10.0
SPW-486	WATER	Jan 2001	Cs-134	< 3.46		<10.0
SPW-486	WATER	Jan 2001	Cs-137	< 5.43		<10.0
SPW-486	WATER	Jan 2001	Sr-90	< 0.65	0.06 ± 0.31	<1.0
SPAP-755	AIR FILTER	Jan 2001	Gr. Beta	< 1.60	0.16 ± 0.90	<3.2
SPW-1038	WATER	Feb 2001	U-238	< 0.03		<1.0
SPW-1038	WATER	Feb 2001	U-238	< 0.00		<1.0
SPW-1223	WATER	Feb 2001	Gr. Alpha	< 0.46		<1.0
SPW-1223	WATER	Feb 2001	Gr. Beta	< 1.50		<3.2
SPW-1223	WATER	Feb 2001	Ra-226	< 0.02	0.03 ± 0.01	<1.0
SPW-1223	WATER	Feb 2001	Ra-228	< 0.95	0.45 ± 0.49	<2.0
SPMI-1268	MILK	Feb 2001	Cs-134	< 5.86		<10.0
SPMI-1268	MILK	Feb 2001	Cs-137	< 3.02		<10.0
SPMI-1268	MILK	Feb 2001	I-131(g)	< 7.46		<20.0
SPW-1271	WATER	Feb 2001	Co-60	< 1.06		<10.0
SPW-1271	WATER	Feb 2001	Cs-134	< 2.61		<10.0
SPW-1271	WATER	Feb 2001	Cs-137	< 2.37		<10.0
SPVE-1273	VEGETATION	Feb 2001	Cs-134	< 10.04		<100.0
SPVE-1273	VEGETATION	Feb 2001	Cs-137	< 6.00		<100.0
SPCH-1275	CHARCOAL CANISTER	Feb 2001	I-131(g)	< 0.01		<9.6
SPW-2164	WATER	Mar 2001	Ra-226	< 0.02	0.05 ± 0.01	<1.0
SPU-3126	URINE	Apr 2001	H-3	< 642.00	-66.00 ± 335.00	<200.0

2.0 ml. sample volume.

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

Lab Code	Sample Type	Sample Date	Analysis	Concentration pCi/L[a]. Laboratory results (4.66 Sigma) LLD	Laboratory results (4.66 Sigma) Activity[b]	Acceptance Criteria (4.66 Sigma)
SPDW-3130	WATER	Apr 2001	Gr. Alpha	< 0.54	0.04 ± 0.38	<1.0
SPDW-3130	WATER	Apr 2001	Gr. Beta	< 1.46	0.67 ± 1.04	<3.2
SPMI-3233	MILK	Apr 2001	Cs-137	< 2.66		<10.0
SPMI-3233	MILK	Apr 2001	I-131	< 0.26	-0.06 ± 0.14	<0.5
SPMI-3233	MILK	Apr 2001	I-131(g)	< 3.91		<20.0
SPMI-3233	MILK	Apr 2001	Sr-89	< 0.79	-0.32 ± 0.79	<5.0
SPMI-3233	MILK	Apr 2001	Sr-90		1.18 ± 0.35	<1.0
Low levels of Sr-90 are still detected in the environment. A concentration of (1-5 pCi/L) in milk is not unusual.						
SPSO-3357	SOIL	Apr 2001	Cs-134	< 14.77		<100.0
SPSO-3357	SOIL	Apr 2001	Cs-137	< 11.72		<100.0
SPAP-3358	AIR FILTER	Apr 2001	Cs-137	< 0.55		<100.0
SPW-3375	WATER	Apr 2001	Co-60	< 2.90		<10.0
SPW-3375	WATER	Apr 2001	Cs-134	< 3.71		<10.0
SPW-3375	WATER	Apr 2001	I-131(g)	< 0.39	0.02 ± 0.22	<20.0
SPW-3375	WATER	Apr 2001	Sr-90	< 0.56	0.05 ± 0.27	<1.0
SPDW-3130	WATER	May 2001	Gr. Alpha	< 0.45	0.15 ± 0.34	<1.0
SPDW-3130	WATER	May 2001	Gr. Beta	< 1.26	0.34 ± 0.95	<3.2
SPDW-3130	WATER	Jun 2001	Gr. Alpha	< 0.44	0.09 ± 0.32	<1.0
SPDW-3130	WATER	Jun 2001	Gr. Beta	< 1.46	0.66 ± 1.04	<3.2
SPVE-3304	VEGETATION	Jun 2001	Co-60	< 7.06		<100.0
SPVE-3304	VEGETATION	Jun 2001	Cs-134	< 11.56		<100.0
SPVE-3304	VEGETATION	Jun 2001	Cs-137	< 8.30		<100.0
SPSO-5702	SOIL	Jul 2001	Co-60	< 12.80		<100.0
SPSO-5702	SOIL	Jul 2001	Cs-134	< 13.96		<100.0
SPSO-5702	SOIL	Jul 2001	Cs-137	< 8.10		<100.0
SPAP-5704	AIR FILTER	Jul 2001	Co-60	< 0.79		<100.0
SPAP-5704	AIR FILTER	Jul 2001	Cs-134	< 0.84		<100.0
SPAP-5704	AIR FILTER	Jul 2001	Cs-137	< 0.60		<100.0
SPW-5780	WATER	Jul 2001	Co-60	< 1.86		<10.0
SPW-5780	WATER	Jul 2001	Cs-134	< 2.46		<10.0
SPW-5780	WATER	Jul 2001	Cs-137	< 3.77		<10.0

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

Lab Code	Sample Type	Sample Date	Analysis	Concentration pCi/L[a]. Laboratory results (4.66 Sigma) LLD	Activity[b]	Acceptance Criteria (4.66 Sigma)
SPF-5782	FISH	Jul 2001	Co-60	< 5.64		<100.0
SPF-5782	FISH	Jul 2001	Cs-134	< 7.51		<100.0
SPW-5938	WATER	Jul 2001	H-3	< 163.22	-16.21 ± 85.07	<200.0
SPW-59451	WATER	Jul 2001	Ra-226	< 0.01	0.04 ± 0.01	<1.0
SPW-59451	WATER	Jul 2001	Ra-228	< 0.77	0.70 ± 0.44	<2.0
SPDW-3130	WATER	Jul 2001	Gr. Alpha	< 0.54	0.36 ± 0.40	<1.0
SPDW-3130	WATER	Jul 2001	Gr. Beta	< 2.27	-0.78 ± 1.35	<3.2
SPMI-6146	MILK	Jul 2001	Sr-90	< 0.50	1.09 ± 0.36	<1.0
Low levels of Sr-90 are still detected in the environment. A concentration of (1-5 pCi/L) in milk is not unusual.						
SPW-6605	WATER	Jul 2001	Gr. Beta	< 1.34	0.55 ± 1.01	<3.2
SPW-9009	WATER	Oct 2001	H-3	< 160.00	-56.70 ± 76.50	<200.0
SPAP-9011	AIR FILTER	Oct 2001	Co-60	< 0.76		<100.0
SPAP-9011	AIR FILTER	Oct 2001	Cs-137	< 0.58		<100.0
SPW-5780	WATER	Oct 2001	Sr-90	< 0.54	0.36 ± 0.30	<1.0
SPW-10724	WATER	Dec 2001	U-238	< 0.13	0.04 ± 0.10	<1.0
SPAP-11549	AIR FILTER	Dec 2001	Gr. Beta	< 0.00	0.01 ± 0.00	<3.2
SPW-11756	WATER	Dec 2001	Cs-137	< 2.62		<10.0
SPMI-11758	MILK	Dec 2001	Cs-137	< 4.00		<10.0
SPMI-11758	MILK	Dec 2001	I-131(g)	< 16.57		<20.0
SPF-11760	FISH	Dec 2001	Cs-137	< 7.96		<100.0

[a] Liquid sample results are reported in pCi/Liter, air filter sample results are in pCi/filter, charcoal sample results are in pCi/charcoal, and solid sample results are in pCi/kilogram.
[b] The activity reported is the net activity result.

Table A-5. In-house "duplicate" samples.

Lab Codes	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
AP-10675, 10676	Jan, 2001	Be-7	0.06 ± 0.02	0.06 ± 0.02	0.06 ± 0.01
AP-10803, 10804	Jan, 2001	Be-7	0.04 ± 0.01	0.04 ± 0.01	0.04 ± 0.01
AP-10833, 10834	Jan, 2001	Be-7	0.04 ± 0.01	0.04 ± 0.01	0.04 ± 0.01
WW-51, 52	Jan, 2001	H-3	362.60 ± 94.70	417.20 ± 96.80	389.90 ± 67.71
MI-72, 73	Jan, 2001	K-40	1,566.90 ± 196.80	1,372.40 ± 152.50	1,469.65 ± 124.49
MI-96, 97	Jan, 2001	K-40	1,418.30 ± 117.80	1,545.70 ± 162.50	1,482.00 ± 100.35
U-858, 859	Jan, 2001	Gr. Beta	2.17 ± 2.47	4.23 ± 2.74	3.20 ± 1.84
MI-389, 390	Jan, 2001	K-40	1,489.20 ± 141.10	1,463.30 ± 168.20	1,476.25 ± 109.77
DW-879, 880	Jan, 2001	Gr. Beta	2.63 ± 0.52	2.37 ± 0.50	2.50 ± 0.36
SWU-813, 814	Jan, 2001	Gr. Beta	2.48 ± 0.58	2.46 ± 0.63	2.47 ± 0.43
MI-708, 709	Feb, 2001	K-40	1,179.40 ± 103.00	1,280.40 ± 90.26	1,229.90 ± 68.48
MI-740, 741	Feb, 2001	I-131	0.01 ± 0.26	-0.12 ± 0.26	-0.05 ± 0.18
MI-740, 741	Feb, 2001	K-40	1,434.00 ± 156.50	1,435.00 ± 126.10	1,434.50 ± 100.49
MI-789, 790	Feb, 2001	K-40	1,584.30 ± 158.80	1,390.70 ± 136.50	1,487.50 ± 104.70
DW-901, 902	Feb, 2001	Gr. Beta	4.67 ± 1.08	5.54 ± 1.13	5.11 ± 0.78
SWU-1544, 1545	Feb, 2001	Gr. Beta	3.13 ± 0.63	2.33 ± 0.52	2.73 ± 0.41
DW-1426, 1427	Feb, 2001	Gr. Beta	2.05 ± 0.92	2.34 ± 0.93	2.20 ± 0.65
DW-1426, 1427	Feb, 2001	H-3	42.60 ± 94.23	131.31 ± 95.34	86.96 ± 67.02
WW-1476, 1477	Feb, 2001	H-3	53.06 ± 65.79	53.06 ± 93.03	53.06 ± 56.97
MI-1523, 1524	Mar, 2001	I-131	-0.01 ± 0.20	-0.10 ± 0.37	-0.06 ± 0.21
MI-1523, 1524	Mar, 2001	K-40	1,396.00 ± 184.80	1,576.00 ± 184.90	1,486.00 ± 130.71
MI-1572, 1573	Mar, 2001	K-40	1,499.20 ± 113.30	1,326.00 ± 118.80	1,412.60 ± 82.08
MI-1572, 1573	Mar, 2001	Sr-90	1.65 ± 0.44	1.51 ± 0.52	1.58 ± 0.34
SW-1648, 1649	Mar, 2001	K-40	297.80 ± 67.20	344.80 ± 82.30	321.30 ± 53.13
MI-1800, 1801	Mar, 2001	K-40	1,425.80 ± 183.30	1,372.20 ± 119.70	1,399.00 ± 109.46
SW-1779, 1780	Mar, 2001	Gr. Alpha	2.22 ± 0.73	2.14 ± 0.69	2.18 ± 0.50
SW-1779, 1780	Mar, 2001	Gr. Beta	6.28 ± 0.74	6.62 ± 0.70	6.45 ± 0.51
MI-1447, 1448	Mar, 2001	I-131	-0.65 ± 0.27	0.13 ± 0.55	-0.26 ± 0.31
MI-1447, 1448	Mar, 2001	K-40	1,496.20 ± 155.40	1,413.40 ± 169.60	1,454.80 ± 115.01
WW-2115, 2116	Mar, 2001	H-3	540.04 ± 111.84	500.85 ± 110.46	520.44 ± 78.59
SW-1698, 1699	Mar, 2001	Gr. Beta	6.07 ± 1.75	5.57 ± 1.85	5.82 ± 1.27
DW-2272, 2273	Mar, 2001	Gr. Beta	2.10 ± 0.86	1.63 ± 0.83	1.87 ± 0.60
WW-2356, 2357	Mar, 2001	Gr. Beta	1.22 ± 0.50	1.32 ± 0.47	1.27 ± 0.35
AP-2812, 2813	Mar, 2001	Be-7	0.07 ± 0.02	0.05 ± 0.01	0.06 ± 0.01
AP-2812, 2813	Mar, 2001	Be-7	0.07 ± 0.02	0.05 ± 0.01	0.06 ± 0.01
LW-2217, 2218	Mar, 2001	Gr. Beta	1.85 ± 0.51	2.23 ± 0.55	2.04 ± 0.37

Table A-5. In-house "duplicate" samples.

Lab Codes	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
AP-2833, 2834	Mar, 2001	Be-7	0.04 ± 0.01	0.06 ± 0.02	0.05 ± 0.01
AP-3038, 3039	Mar, 2001	Be-7	0.07 ± 0.02	0.07 ± 0.02	0.07 ± 0.01
AP-3038, 3039	Mar, 2001	Be-7	0.06 ± 0.02	0.07 ± 0.01	0.07 ± 0.01
DW-2398, 2399	Mar, 2001	Gr. Beta	1.58 ± 0.89	1.81 ± 0.88	1.69 ± 0.63
LW-2467, 2468	Mar, 2001	Gr. Beta	2.52 ± 0.53	2.42 ± 0.53	2.47 ± 0.37
MI-2446, 2447	Apr, 2001	K-40	1,285.40 ± 177.10	1,376.00 ± 175.90	1,330.70 ± 124.81
AP-3017, 3018	Apr, 2001	Be-7	0.05 ± 0.01	0.05 ± 0.01	0.05 ± 0.00
SW-2423, 2424	Apr, 2001	K-40	255.60 ± 59.80	268.40 ± 65.40	262.00 ± 44.31
BS-3103, 3104	Apr, 2001	Gr. Beta	7.99 ± 1.80	8.17 ± 1.73	8.08 ± 1.25
SWU-3239, 3240	Apr, 2001	Gr. Beta	3.30 ± 0.60	4.30 ± 0.74	3.80 ± 0.48
SS-3322, 3323	Apr, 2001	K-40	15.99 ± 1.08	15.59 ± 1.01	15.79 ± 0.74
W-3990, 3991	Apr, 2001	Sr-89	91.35 ± 18.94	85.29 ± 23.99	88.32 ± 15.28
BS-4347, 4348	Apr, 2001	K-40	3,982.40 ± 489.60	3,255.80 ± 450.10	3,619.10 ± 332.53
BS-4347, 4348	Apr, 2001	K-40	3.26 ± 0.45	3.98 ± 0.49	3.62 ± 0.33
MI-3364, 3365	May, 2001	K-40	1,325.90 ± 160.20	1,453.20 ± 163.00	1,389.55 ± 114.27
SO-3385, 3386	May, 2001	Gr. Alpha	6.51 ± 3.09	9.01 ± 3.44	7.76 ± 2.31
SO-3385, 3386	May, 2001	Gr. Beta	24.63 ± 3.15	28.17 ± 3.12	26.40 ± 2.22
SO-3385, 3386	May, 2001	K-40	19.17 ± 1.08	17.94 ± 0.76	18.56 ± 0.66
CL-4068, 4069	May, 2001	K-40	1.09 ± 0.27	1.13 ± 0.23	1.11 ± 0.18
MI-3475, 3476	May, 2001	Gr. Beta	1,297.10 ± 114.60	1,433.60 ± 156.60	1,365.35 ± 97.03
WW-3545, 3546	May, 2001	Gr. Beta	1.57 ± 0.55	1.36 ± 0.53	1.47 ± 0.38
MI-3681, 3682	May, 2001	K-40	1,417.20 ± 125.70	1,496.20 ± 124.50	1,456.70 ± 88.46
SW-3702, 3703	May, 2001	Gr. Alpha	4.51 ± 1.66	3.22 ± 1.55	3.87 ± 1.13
SW-3702, 3703	May, 2001	Gr. Beta	8.74 ± 1.36	7.11 ± 1.38	7.93 ± 0.97
BS-4021, 4022	May, 2001	Cs-137	224.30 ± 30.20	205.90 ± 43.00	215.10 ± 26.27
BS-4021, 4022	May, 2001	H-3	842.00 ± 47.00	860.00 ± 48.00	851.00 ± 33.59
BS-4021, 4022	May, 2001	K-40	21,117.00 ± 953.00	21,629.00 ± 1,357.00	21,373.00 ± 829.10
BS-4021, 4022	May, 2001	Pu-238	80.30 ± 36.50	59.50 ± 22.00	69.90 ± 21.31
BS-4021, 4022	May, 2001	Pu-239/40	49.40 ± 31.80	41.10 ± 19.60	45.25 ± 18.68
BS-4021, 4022	May, 2001	Ra-226	7,436.00 ± 577.90	9,126.00 ± 751.90	8,281.00 ± 474.16
BS-4021, 4022	May, 2001	Sr-90	10.60 ± 2.71	16.80 ± 3.22	13.70 ± 2.10
F-3813, 3814	May, 2001	K-40	2.10 ± 0.17	2.30 ± 0.26	2.20 ± 0.16
G-4158, 4159	May, 2001	Be-7	0.37 ± 0.13	0.41 ± 0.14	0.39 ± 0.10
SO-4179, 4180	May, 2001	Ac-228	0.45 ± 0.13	0.52 ± 0.14	0.49 ± 0.10
SO-4179, 4180	May, 2001	Bi-214	0.31 ± 0.06	0.41 ± 0.06	0.36 ± 0.04
SO-4179, 4180	May, 2001	Cs-137	0.46 ± 0.05	0.47 ± 0.04	0.47 ± 0.03

Table A-5. In-house "duplicate" samples.

Lab Codes	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
SO-4179, 4180	May, 2001	Gr. Beta	26.65 ± 2.63	24.68 ± 2.52	25.67 ± 1.82
SO-4179, 4180	May, 2001	K-40	16.35 ± 0.86	16.05 ± 0.82	16.20 ± 0.59
SO-4179, 4180	May, 2001	Pb-212	0.35 ± 0.04	0.43 ± 0.05	0.39 ± 0.03
SO-4179, 4180	May, 2001	Ra-226	0.56 ± 0.98	1.03 ± 0.31	0.79 ± 0.51
SO-4179, 4180	May, 2001	Tl-208	0.14 ± 0.03	0.17 ± 0.03	0.15 ± 0.02
BS-4233, 4234	May, 2001	Cs-137	0.03 ± 0.01	0.03 ± 0.02	0.03 ± 0.01
BS-4233, 4234	May, 2001	K-40	8.18 ± 0.48	7.80 ± 0.58	7.99 ± 0.38
SWU-4376, 4377	May, 2001	Gr. Beta	2.58 ± 0.55	2.94 ± 0.58	2.76 ± 0.40
DW-4449, 4450	May, 2001	Gr. Beta	2.83 ± 0.55	3.74 ± 0.65	3.29 ± 0.43
DW-4397, 4398	May, 2001	Gr. Beta	9.13 ± 1.26	10.20 ± 1.34	9.66 ± 0.92
MI-4114, 4115	May, 2001	K-40	1,325.90 ± 118.80	1,394.70 ± 133.10	1,360.30 ± 89.20
F-4284, 4285	May, 2001	K-40	2.23 ± 0.32	2.12 ± 0.35	2.18 ± 0.24
DW-4326, 4327	Jun, 2001	Gr. Beta	2.60 ± 0.97	1.47 ± 0.83	2.04 ± 0.64
MI-4470, 4471	Jun, 2001	K-40	1,514.50 ± 116.60	1,456.80 ± 130.90	1,485.65 ± 87.65
SW-4493, 4494	Jun, 2001	Gr. Beta	4.05 ± 1.23	4.64 ± 1.32	4.35 ± 0.90
BS-4725, 4726	Jun, 2001	Co-60	112.00 ± 24.30	84.50 ± 8.70	98.25 ± 12.91
BS-4725, 4726	Jun, 2001	Cs-137	3,083.10 ± 100.10	3,094.80 ± 35.30	3,088.95 ± 53.07
BS-4725, 4726	Jun, 2001	K-40	8,143.70 ± 640.40	8,083.80 ± 225.10	8,113.75 ± 339.40
MI-4775, 4776	Jun, 2001	K-40	1,362.20 ± 71.80	1,363.90 ± 73.40	1,363.05 ± 51.34
WW-5110, 5111	Jun, 2001	H-3	1,173.50 ± 129.10	1,046.80 ± 125.20	1,110.15 ± 89.92
G-5085, 5086	Jun, 2001	Be-7	0.89 ± 0.17	1.14 ± 0.39	1.02 ± 0.21
G-5085, 5086	Jun, 2001	K-40	5.13 ± 0.39	5.22 ± 0.70	5.17 ± 0.40
MI-5259, 5260	Jun, 2001	K-40	1,529.70 ± 122.70	1,406.20 ± 123.80	1,467.95 ± 87.15
MI-5259, 5260	Jun, 2001	Sr-90	1.69 ± 0.42	1.71 ± 0.44	1.70 ± 0.30
SWU-5422, 5423	Jun, 2001	Gr. Beta	2.59 ± 0.54	1.91 ± 0.52	2.25 ± 0.37
VE-5401, 5402	Jun, 2001	Gr. Beta	8.12 ± 0.24	8.88 ± 0.26	8.50 ± 0.18
VE-5401, 5402	Jun, 2001	K-40	6.55 ± 0.52	6.26 ± 0.65	6.40 ± 0.42
AP-5830, 5831	Jun, 2001	Be-7	0.08 ± 0.01	0.08 ± 0.01	0.08 ± 0.01
SW-5557, 5558	Jun, 2001	Gr. Beta	5.43 ± 1.70	5.96 ± 1.56	5.70 ± 1.15
AP-5851, 5852	Jun, 2001	Be-7	0.07 ± 0.02	0.07 ± 0.02	0.07 ± 0.01
SW-5636, 5637	Jun, 2001	Gr. Beta	4.75 ± 1.38	4.18 ± 1.34	4.47 ± 0.96
LW-5681, 5682	Jun, 2001	Gr. Beta	2.42 ± 0.37	2.18 ± 0.34	2.30 ± 0.25
G-5535, 5536	Jul, 2001	Be-7	0.99 ± 0.29	0.97 ± 0.54	0.98 ± 0.31
G-5535, 5536	Jul, 2001	Gr. Beta	7.62 ± 0.12	7.72 ± 0.12	7.67 ± 0.08
G-5535, 5536	Jul, 2001	K-40	7.26 ± 1.03	7.64 ± 0.93	7.45 ± 0.69
AP-5788, 5789	Jul, 2001	Be-7	0.08 ± 0.02	0.07 ± 0.02	0.08 ± 0.01

Table A-5. In-house "duplicate" samples.

Lab Codes	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
AP-5872, 5873	Jul, 2001	Be-7	0.07 ± 0.02	0.08 ± 0.02	0.07 ± 0.01
AP-5893, 5894	Jul, 2001	Be-7	0.08 ± 0.02	0.08 ± 0.01	0.08 ± 0.01
AP-5809, 5810	Jul, 2001	Be-7	0.07 ± 0.02	0.06 ± 0.01	0.06 ± 0.01
SW-5724, 5725	Jul, 2001	Gr. Alpha	2.95 ± 0.70	2.89 ± 0.60	2.92 ± 0.46
SW-5724, 5725	Jul, 2001	Gr. Beta	8.79 ± 0.71	8.21 ± 0.65	8.50 ± 0.48
SW-5767, 5768	Jul, 2001	I-131	0.79 ± 0.31	0.61 ± 0.26	0.70 ± 0.20
LW-5920, 5921	Jul, 2001	Gr. Beta	3.06 ± 0.64	3.15 ± 0.58	3.11 ± 0.43
SO-6172, 6173	Jul, 2001	Cs-137	0.30 ± 0.05	0.32 ± 0.04	0.31 ± 0.03
SO-6172, 6173	Jul, 2001	K-40	18.20 ± 1.08	17.55 ± 0.82	17.88 ± 0.68
SO-6172, 6173	Jul, 2001	Sr-90	0.03 ± 0.01	0.05 ± 0.02	0.04 ± 0.01
MI-6353, 6354	Jul, 2001	K-40	966.35 ± 82.28	986.31 ± 91.91	976.33 ± 61.68
SW-6376, 6377	Jul, 2001	I-131	0.58 ± 0.16	0.81 ± 0.17	0.70 ± 0.12
VE-6424, 6425	Jul, 2001	Gr. Beta	2.52 ± 0.05	2.49 ± 0.05	2.51 ± 0.03
VE-6424, 6425	Jul, 2001	K-40	3.04 ± 0.26	3.12 ± 0.37	3.08 ± 0.23
MI-6445, 6446	Jul, 2001	K-40	1,407.40 ± 97.10	1,442.20 ± 189.60	1,424.80 ± 106.51
LW-6489, 6490	Jul, 2001	Gr. Beta	2.61 ± 0.57	2.79 ± 0.54	2.70 ± 0.39
MI-6533, 6534	Jul, 2001	K-40	1,498.60 ± 113.90	1,375.50 ± 129.60	1,437.05 ± 86.27
DW-6835, 6836	Jul, 2001	Gr. Beta	2.01 ± 0.59	2.36 ± 0.63	2.19 ± 0.43
MI-6693, 6694	Aug, 2001	K-40	1,294.30 ± 118.70	1,417.30 ± 176.50	1,355.80 ± 106.35
MI-6693, 6694	Aug, 2001	Sr-90	1.47 ± 0.42	1.23 ± 0.41	1.35 ± 0.29
WW-6952, 6953	Aug, 2001	Gr. Beta	5.49 ± 0.69	5.80 ± 0.69	5.64 ± 0.49
MI-6906, 6907	Aug, 2001	K-40	1,613.80 ± 218.50	1,532.70 ± 135.80	1,573.25 ± 128.63
VE-6973, 6974	Aug, 2001	K-40	4.21 ± 0.24	4.29 ± 0.64	4.25 ± 0.34
LW-7851, 7852	Aug, 2001	Gr. Beta	2.20 ± 0.48	2.12 ± 0.42	2.16 ± 0.32
MI-7001, 7002	Aug, 2001	K-40	1,453.80 ± 148.10	1,285.30 ± 190.50	1,369.55 ± 120.65
MI-7073, 7074	Aug, 2001	K-40	1,217.30 ± 80.83	1,218.30 ± 99.13	1,217.80 ± 63.95
LW-7145, 7146	Aug, 2001	Gr. Beta	2.77 ± 0.53	3.60 ± 0.59	3.19 ± 0.39
MI-7221, 7222	Aug, 2001	K-40	1,192.90 ± 95.40	1,388.90 ± 132.70	1,290.90 ± 81.72
MI-7221, 7222	Aug, 2001	Sr-90	2.10 ± 0.48	1.72 ± 0.47	1.91 ± 0.34
SWU-7527, 7528	Aug, 2001	Gr. Beta	17.51 ± 3.06	20.36 ± 3.31	18.93 ± 2.25
VE-7485, 7486	Aug, 2001	K-40	2.12 ± 0.47	2.47 ± 0.34	2.30 ± 0.29
DW-7506, 7507	Aug, 2001	Gr. Beta	4.25 ± 1.18	4.13 ± 1.12	4.19 ± 0.81
MI-7622, 7623	Sep, 2001	K-40	1,340.10 ± 111.10	1,290.80 ± 116.50	1,315.45 ± 80.49
MI-7664, 7665	Sep, 2001	K-40	1,408.10 ± 102.70	1,396.90 ± 114.30	1,402.50 ± 76.83
MI-7876, 7877	Sep, 2001	K-40	1,416.40 ± 192.30	1,318.00 ± 155.50	1,367.20 ± 123.65
G-7960, 7961	Sep, 2001	Be-7	1.27 ± 0.21	1.25 ± 0.25	1.26 ± 0.16

Table A-5. In-house "duplicate" samples.

Lab Codes	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
G-7960, 7961	Sep, 2001	K-40	5.21 ± 0.57	5.70 ± 0.63	5.45 ± 0.43
F-8011, 8012	Sep, 2001	Cs-137	0.06 ± 0.02	0.04 ± 0.02	0.05 ± 0.01
F-8011, 8012	Sep, 2001	Gr. Beta	3.68 ± 0.12	3.50 ± 0.11	3.59 ± 0.08
F-8011, 8012	Sep, 2001	K-40	3.47 ± 0.49	3.38 ± 0.47	3.43 ± 0.34
MI-8149, 8150	Sep, 2001	K-40	1,551.70 ± 118.00	1,489.90 ± 123.60	1,520.80 ± 85.44
MI-8343, 8344	Sep, 2001	K-40	1,550.30 ± 170.60	1,368.10 ± 126.70	1,459.20 ± 106.25
VE-8319, 8320	Sep, 2001	Gr. Beta	3.37 ± 0.10	3.42 ± 0.11	3.39 ± 0.07
VE-8319, 8320	Sep, 2001	K-40	2.14 ± 0.46	2.24 ± 0.37	2.19 ± 0.29
AP-9069, 9070	Sep, 2001	Be-7	0.07 ± 0.02	0.07 ± 0.01	0.07 ± 0.01
AP-9566, 9567	Sep, 2001	Be-7	0.08 ± 0.02	0.09 ± 0.03	0.09 ± 0.02
VE-8700, 8701	Oct, 2001	Be-7	0.24 ± 0.10	0.19 ± 0.10	0.22 ± 0.07
VE-8700, 8701	Oct, 2001	K-40	2.03 ± 0.24	2.03 ± 0.21	2.03 ± 0.16
VE-8700, 8701	Oct, 2001	Sr-90	0.01 ± 0.00	0.01 ± 0.00	0.01 ± 0.00
AP-9048, 9049	Oct, 2001	Be-7	0.07 ± 0.01	0.07 ± 0.00	0.07 ± 0.01
DW-8636, 8637	Oct, 2001	Gr. Beta	4.74 ± 1.06	5.08 ± 1.21	4.91 ± 0.80
DW-8615, 8616	Oct, 2001	Gr. Beta	4.65 ± 0.58	4.28 ± 0.54	4.47 ± 0.40
AP-9090, 9091	Oct, 2001	Be-7	0.07 ± 0.01	0.07 ± 0.01	0.07 ± 0.01
AP-9166, 9167	Oct, 2001	Be-7	0.08 ± 0.02	0.08 ± 0.02	0.08 ± 0.01
AP-9187, 9188	Oct, 2001	Be-7	0.07 ± 0.01	0.05 ± 0.01	0.06 ± 0.01
VE-10562, 10563	Oct, 2001	Be-7	309.90 ± 158.80	348.30 ± 168.10	329.10 ± 115.62
VE-10562, 10563	Oct, 2001	K-40	6,407.10 ± 620.70	6,057.50 ± 660.40	6,232.30 ± 453.15
WW-8636, 8637	Oct, 2001	Gr. Beta	5.08 ± 1.20	4.74 ± 1.06	4.91 ± 0.80
DW-8894, 8895	Oct, 2001	Gr. Beta	4.28 ± 0.89	3.40 ± 0.90	3.84 ± 0.63
MI-9232, 9233	Oct, 2001	K-40	1,440.70 ± 46.60	1,424.80 ± 76.40	1,432.75 ± 44.75
VE-9518, 9519	Oct, 2001	K-40	1.91 ± 0.22	1.97 ± 0.39	1.94 ± 0.22
WW-10257, 10258	Nov, 2001	H-3	755.90 ± 102.50	684.70 ± 99.90	720.30 ± 71.57
VE-10333, 10334	Nov, 2001	Be-7	0.68 ± 0.26	0.99 ± 0.26	0.84 ± 0.18
VE-10333, 10334	Nov, 2001	K-40	6.10 ± 0.72	5.83 ± 0.72	5.97 ± 0.51
MI-10588, 10589	Nov, 2001	K-40	1,428.40 ± 114.70	1,445.50 ± 129.40	1,436.95 ± 86.46
DW-10688, 10689	Nov, 2001	Gr. Beta	3.49 ± 0.91	2.36 ± 0.76	2.93 ± 0.60
WW-10905, 10906	Dec, 2001	H-3	233.90 ± 90.60	226.30 ± 90.20	230.10 ± 63.92
SS-10953, 10954	Dec, 2001	Ac-228	1.10 ± 0.25	0.91 ± 0.16	1.00 ± 0.15
SS-10953, 10954	Dec, 2001	Bi-214	0.69 ± 0.08	0.75 ± 0.08	0.72 ± 0.06
SS-10953, 10954	Dec, 2001	Co-58	0.21 ± 0.05	0.18 ± 0.04	0.19 ± 0.03
SS-10953, 10954	Dec, 2001	Co-60	0.93 ± 0.06	0.94 ± 0.06	0.93 ± 0.04
SS-10953, 10954	Dec, 2001	Cs-137	0.13 ± 0.03	0.16 ± 0.03	0.14 ± 0.02

Table A-5. In-house "duplicate" samples.

Lab Codes	Sample Date	Analysis	Concentration in pCi/L[a] First Result	Second Result	Averaged Result
SS-10953, 10954	Dec, 2001	K-40	9.91 ± 0.83	8.36 ± 0.80	9.13 ± 0.57
SS-10953, 10954	Dec, 2001	Pb-212	0.94 ± 0.05	0.91 ± 0.06	0.92 ± 0.04
SS-10953, 10954	Dec, 2001	Pb-214	0.83 ± 0.08	0.82 ± 0.07	0.83 ± 0.05
SS-10953, 10954	Dec, 2001	Ra-226	1.76 ± 0.37	1.67 ± 0.37	1.72 ± 0.26
SS-10953, 10954	Dec, 2001	Tl-208	0.34 ± 0.05	0.31 ± 0.05	0.32 ± 0.04
MI-11033, 11034	Dec, 2001	K-40	1,339.80 ± 128.70	1,435.80 ± 117.30	1,387.80 ± 87.07
MI-11033, 11034	Dec, 2001	Sr-90	1.31 ± 0.41	1.38 ± 0.37	1.35 ± 0.28
AP-11888, 11889	Dec, 2001	Be-7	0.06 ± 0.02	0.06 ± 0.02	0.06 ± 0.01

Duplicate analyses are performed on every twentieth sample received in-house. Results are not listed for those analyses with activities that measure below the LLD.

[a] Results are reported in units of pCi/L, except for elemental potassium (K) in milk (mg/L), air filters (pCi/Filter), food products and vegetation (pCi/g), soil and sediments (pCi/kg).

Table A-6. Department of Energy's Mixed Analyte Performance Evaluation Program (MAPEP)[a].

Lab Code	Sample Type	Date Collected	Analysis	Concentration[b] Laboratory result[c]	MAPEP Result[d] 1s, N=1	Control Limits
STSO-923	SOIL	Jan, 2001	Am-241			0.0 - 2.6
Included in the testing series as a "false positive". No activity expected. Result of analysis; < 0.8 Bq/L.						
STSO-923	SOIL	Jan, 2001	Co-57	100.2 ± 3.5	103.0 ± 10.3	72.1 - 133.9
STSO-923	SOIL	Jan, 2001	Co-60	1,285.1 ± 5.3	1,270.0 ± 127.0	889.0 - 1,651.0
STSO-923	SOIL	Jan, 2001	Cs-134	81.1 ± 1.8	91.1 ± 9.1	63.8 - 118.4
STSO-923	SOIL	Jan, 2001	Cs-137	1,210.6 ± 6.6	1,240.0 ± 124.0	868.0 - 1,612.0
STSO-923	SOIL	Jan, 2001	K-40	732.6 ± 21.2	652.0 ± 65.2	456.4 - 847.6
STSO-923	SOIL	Jan, 2001	Mn-54	212.6 ± 6.7	203.0 ± 20.3	142.1 - 263.9
STSO-923	SOIL	Jan, 2001	Pu-238	110.7 ± 7.2	115.0 ± 11.5	80.5 - 149.5
STSO-923	SOIL	Jan, 2001	Pu-239/40	79.6 ± 5.9	83.4 ± 8.3	58.4 - 108.4
STSO-923	SOIL	Jan, 2001	Sr-90	159.8 ± 9.5	209.0 ± 20.9	146.3 - 271.7
STSO-923	SOIL	Jan, 2001	U-233/4	45.0 ± 3.9	60.0 ± 6.0	42.0 - 78.0
STSO-923	SOIL	Jan, 2001	U-238	165.6 ± 7.4	191.0 ± 19.1	133.7 - 248.3
STSO-923	SOIL	Jan, 2001	Zn-65	428.5 ± 10.9	382.0 ± 38.2	267.4 - 496.6

[a] Results obtained by Environmental, Inc., Midwest Laboratory as a participant in the Department of Energy's Mixed Analyte Performance Evaluation Program, Idaho Operations office, Idaho Falls, Idaho.

[b] All results are in Bq/kg or Bq/L as requested by the Department of Energy.

[c] MAPEP results are presented as the known values and expected laboratory precision (1 sigma, 1 determination) and control limits as defined by the MAPEP.

Table A-7. Environmental Measurements Laboratory Quality Assessment Program (EML)[a].

Lab Code	Sample Type	Date Collected	Analysis	Concentration [b] Laboratory result	EML Result[c]	Control Limits[d]
STSO-904	SOIL	Mar, 2001	Ac-228	45.60 ± 4.0	42.70	0.80 - 1.50
STSO-904	SOIL	Mar, 2001	Am-241	14.40 ± 0.5	14.80	0.63 - 2.64
STSO-904	SOIL	Mar, 2001	Bi-212	53.20 ± 3.1	42.00	0.45 - 1.23
	Naturally-occurring radium and thorium daughters are present in the shield background, and a probable cause of the higher bias seen for isotopes of lead and bismuth.					
STSO-904	SOIL	Mar, 2001	Bi-214	42.10 ± 7.7	32.60	0.78 - 1.50
STSO-904	SOIL	Mar, 2001	Cs-137	1,772.60 ± 79.8	1,740.00	0.80 - 1.29
STSO-904	SOIL	Mar, 2001	K-40	583.80 ± 52.6	468.00	0.80 - 1.37
STSO-904	SOIL	Mar, 2001	Pb-212	46.60 ± 8.5	41.50	0.74 - 1.36
STSO-904	SOIL	Mar, 2001	Pb-214	45.30 ± 8.6	34.30	0.76 - 1.53
STSO-904	SOIL	Mar, 2001	Pu-239/40	26.00 ± 0.8	25.60	0.71 - 1.33
STSO-904	SOIL	Mar, 2001	Sr-90	55.60 ± 2.2	69.00	0.61 - 3.91
STW-905	WATER	Mar, 2001	Am-241	2.15 ± 0.1	1.67	0.76 - 1.48
STW-905	WATER	Mar, 2001	Co-60	97.00 ± 0.8	98.20	0.80 - 1.20
STW-905	WATER	Mar, 2001	Cs-137	70.10 ± 4.0	73.00	0.80 - 1.20
STW-905	WATER	Mar, 2001	H-3	76.50 ± 5.5	79.30	0.74 - 2.29
STW-905	WATER	Mar, 2001	Pu-238	1.69 ± 0.1	1.58	0.74 - 1.22
STW-905	WATER	Mar, 2001	Pu-239/40	1.69 ± 0.1	1.64	0.75 - 1.26
STW-905	WATER	Mar, 2001	Sr-90	3.85 ± 0.1	4.40	0.64 - 1.50
STW-905	WATER	Mar, 2001	U-233/4	0.90 ± 0.1	1.04	0.80 - 1.40
STW-905	WATER	Mar, 2001	U-238	0.88 ± 0.1	1.04	0.80 - 1.29
STW-906	WATER	Mar, 2001	Gr. Alpha	1,724.60 ± 141.7	1,900.00	0.58 - 1.26
STW-906	WATER	Mar, 2001	Gr. Beta	1,246.40 ± 31.1	1,297.00	0.56 - 1.50
STAP-907	AIR FILTER	Mar, 2001	Am-241	0.47 ± 0.0	0.49	0.69 - 2.40
STAP-907	AIR FILTER	Mar, 2001	Co-60	20.11 ± 0.2	19.44	0.79 - 1.30
STAP-907	AIR FILTER	Mar, 2001	Cs-134	2.71 ± 0.2	2.83	0.74 - 1.21
STAP-907	AIR FILTER	Mar, 2001	Cs-137	9.86 ± 0.2	8.76	0.78 - 1.35
STAP-907	AIR FILTER	Mar, 2001	Mn-54	7.25 ± 0.2	6.52	0.80 - 1.36
STAP-907	AIR FILTER	Mar, 2001	Pu-238	0.23 ± 0.0	0.22	0.66 - 1.35
STAP-907	AIR FILTER	Mar, 2001	Pu-239/40	0.12 ± 0.0	0.14	0.69 - 1.29

Table A-7. Environmental Measurements Laboratory Quality Assessment Program (EML)[a].

Lab Code	Sample Type	Date Collected	Analysis	Concentration [b]		
				Laboratory result	EML Result[c]	Control Limits[d]
STAP-907	AIR FILTER	Mar, 2001	Sr-90	7.41 ± 0.2	7.10	0.55 - 2.05
STAP-907	AIR FILTER	Mar, 2001	U-233/4	0.05 ± 0.0	0.05	0.80 - 1.92
STAP-907	AIR FILTER	Mar, 2001	U-238	0.05 ± 0.0	0.05	0.80 - 1.59
STAP-908	AIR FILTER	Mar, 2001	Gr. Alpha	2.66 ± 0.0	3.97	0.57 - 1.47
STAP-908	AIR FILTER	Mar, 2001	Gr. Beta	2.30 ± 0.0	2.58	0.76 - 1.52
STVE-909	VEGETATION	Mar, 2001	Am-241	6.10 ± 0.2	6.17	0.72 - 2.34
STVE-909	VEGETATION	Mar, 2001	Cm-244	3.50 ± 0.5	3.69	0.61 - 1.61
STVE-909	VEGETATION	Mar, 2001	Co-60	28.50 ± 2.1	30.40	0.75 - 1.51
STVE-909	VEGETATION	Mar, 2001	Cs-137	795.50 ± 76.4	842.00	0.80 - 1.37
STVE-909	VEGETATION	Mar, 2001	K-40	592.60 ± 42.5	603.00	0.78 - 1.43
STVE-909	VEGETATION	Mar, 2001	Pu-239/40	8.50 ± 0.6	9.58	0.67 - 1.49
STVE-909	VEGETATION	Mar, 2001	Sr-90	1,239.60 ± 130.0	1,330.00	0.52 - 1.23
STW-925	WATER	Sep, 2001	Am-241	0.70 ± 0.1	0.76	0.76 - 1.48
STW-925	WATER	Sep, 2001	Co-60	206.70 ± 4.7	209.00	0.80 - 1.20
STW-925	WATER	Sep, 2001	Cs-137	46.60 ± 0.8	45.13	0.80 - 1.24
STW-925	WATER	Sep, 2001	H-3	254.10 ± 3.6	207.00	0.74 - 2.29
STW-925	WATER	Sep, 2001	Ni-63	50.90 ± 3.0	45.25	0.70 - 1.30
STW-925	WATER	Sep, 2001	Pu-238	1.10 ± 0.1	1.09	0.74 - 1.22
STW-925	WATER	Sep, 2001	Pu-239/40	1.60 ± 0.1	1.63	0.75 - 1.26
STW-925	WATER	Sep, 2001	Sr-90	4.10 ± 0.3	3.73	0.64 - 1.50
STW-925	WATER	Sep, 2001	Uranium	2.20 ± 0.2	2.37	0.73 - 1.37
STW-926	WATER	Sep, 2001	Gr. Alpha	1,220.00 ± 32.0	1,150.00	0.58 - 1.26
STW-926	WATER	Sep, 2001	Gr. Beta	8,461.00 ± 206.0	7,970.00	0.56 - 1.50
STSO-927	SOIL	Sep, 2001	Ac-228	68.10 ± 1.4	59.57	0.80 - 1.50
STSO-927	SOIL	Sep, 2001	Am-241	5.20 ± 1.3	4.43	0.63 - 2.64
STSO-927	SOIL	Sep, 2001	Bi-212	65.10 ± 1.6	62.07	0.45 - 1.23
STSO-927	SOIL	Sep, 2001	Bi-214	47.30 ± 4.7	36.90	0.78 - 1.50
STSO-927	SOIL	Sep, 2001	Cs-137	659.20 ± 10.8	612.33	0.80 - 1.29
STSO-927	SOIL	Sep, 2001	K-40	737.70 ± 16.6	623.33	0.80 - 1.37

Table A-7. Environmental Measurements Laboratory Quality Assessment Program (EML)[a].

Lab Code	Sample Type	Date Collected	Analysis	Concentration [b] Laboratory result	EML Result[c]	Control Limits[d]
STSO-927	SOIL	Sep, 2001	Pb-212	64.70 ± 3.8	58.33	0.74 - 1.36
STSO-927	SOIL	Sep, 2001	Pb-214	53.70 ± 7.7	39.67	0.76 - 1.53
STSO-927	SOIL	Sep, 2001	Pu-239/40	9.30 ± 2.9	8.95	0.71 - 1.33
STSO-927	SOIL	Sep, 2001	Sr-90	27.40 ± 6.3	30.60	0.61 - 3.91
STSO-927	SOIL	Sep, 2001	Uranium	155.60 ± 7.8	194.23	0.62 - 1.35
STVE-928	VEGETATION	Sep, 2001	Am-241	7.00 ± 0.3	6.92	0.72 - 2.34
STVE-928	VEGETATION	Sep, 2001	Cm-244	4.30 ± 0.8	4.31	0.61 - 1.61
STVE-928	VEGETATION	Sep, 2001	Co-60	40.20 ± 0.9	35.30	0.75 - 1.51
STVE-928	VEGETATION	Sep, 2001	Cs-137	1,184.00 ± 2.8	1,030.00	0.80 - 1.37
STVE-928	VEGETATION	Sep, 2001	K-40	1,023.00 ± 44.1	898.67	0.78 - 1.43
STVE-928	VEGETATION	Sep, 2001	Pu-239/40	8.90 ± 1.4	11.02	0.67 - 1.49
STVE-928	VEGETATION	Sep, 2001	Sr-90	1,364.00 ± 18.4	1,612.80	0.52 - 1.23
STAP-929	AIR FILTER	Sep, 2001	Am-241	0.09 ± 30.0	0.09	0.69 - 2.40
STAP-929	AIR FILTER	Sep, 2001	Co-60	16.90 ± 0.3	17.50	0.79 - 1.30
STAP-929	AIR FILTER	Sep, 2001	Cs-134	11.80 ± 0.2	12.95	0.74 - 1.21
STAP-929	AIR FILTER	Sep, 2001	Cs-137	18.30 ± 0.3	17.10	0.78 - 1.35
STAP-929	AIR FILTER	Sep, 2001	Mn-54	85.40 ± 1.3	81.15	0.80 - 1.36
STAP-929	AIR FILTER	Sep, 2001	Pu-238	0.05 ± 0.0	0.07	0.66 - 1.35
STAP-929	AIR FILTER	Sep, 2001	Pu-239/40	0.22 ± 0.0	0.23	0.69 - 1.29
STAP-929	AIR FILTER	Sep, 2001	Sr-90	3.11 ± 0.1	3.48	0.55 - 2.05
STAP-929	AIR FILTER	Sep, 2001	Uranium	0.24 ± 0.1	0.22	0.80 - 2.54
STAP-930	AIR FILTER	Sep, 2001	Gr. Alpha	6.30 ± 0.1	5.36	0.57 - 1.47
STAP-930	AIR FILTER	Sep, 2001	Gr. Beta	13.80 ± 0.1	12.77	0.76 - 1.52

[a] The Environmental Measurements Laboratory provides the following nuclear species : Air Filters, Soil, Vegetation and Water.
[b] Results are reported in Bq/L with the following exceptions: Air Filter results are reported in Bq/Filter, Soil results are reported in Bq/Kg, Vegetation results are reported in Bq/Kg.
[c] The EML result listed is the mean of replicate determinations for each nuclide±the standard error of the mean.
[d] Control limits are reported by EML as the ratio of Reported Value / EML value.

APPENDIX B

DATA REPORTING CONVENTIONS

Data Reporting Conventions

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

2.0. Single Measurements

Each single measurement is reported as follows: $x \pm s$

where: x = value of the measurement;

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

In cases where the activity is less than the lower limit of detection L, it is reported as: <L,

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

3.0. Duplicate analyses

3.1 Individual results: For two analysis results; $x_1 \pm s_1$ and $x_2 \pm s_2$

Reported result: $x \pm s$; where $x = (1/2)(x_1 + x_2)$ and $s = (1/2)\sqrt{s_1^2 + s_2^2}$

3.2. Individual results: $<L_1$, $<L_2$ Reported result: <L, where L = lower of L_1 and L_2

3.3. Individual results: $x \pm s$, <L Reported result: $x \pm s$ if $x \geq L$; <L otherwise.

4.0. Computation of Averages and Standard Deviations

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

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

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

4.3 If all 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 number following those to be retained is less than 5, the number is dropped, and the retained number s are kept unchanged. As an example, 11.443 is rounded off to 11.44.

4.5.2. If the number following those to be retained is equal to or greater than 5, the number is dropped and the last retained number is raised by 1. As an example, 11.445 is rounded off to 11.45.

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 (pCi/m^3)		Water (pCi/L)
Gross alpha	1×10^{-3}	Strontium-89	8,000
Gross beta	1	Strontium-90	500
Iodine-131[b]	2.8×10^{-1}	Cesium-137	1,000
		Barium-140	8,000
		Iodine-131	1,000
		Potassium-40[c]	4,000
		Gross alpha	2
		Gross beta	10
		Tritium	1×10^6

a Taken from Table 2 of Appendix B to Code of Federal Regulations Title 10, Part 20, and appropriate footnotes. Concentrations may be averaged over a period not greater than one year.

b Value adjusted by a factor of 700 to reduce the dose resulting from the air-grass-cow-milk-child pathway.

c A natural radionuclide.

APPENDIX D

Sampling Location Maps

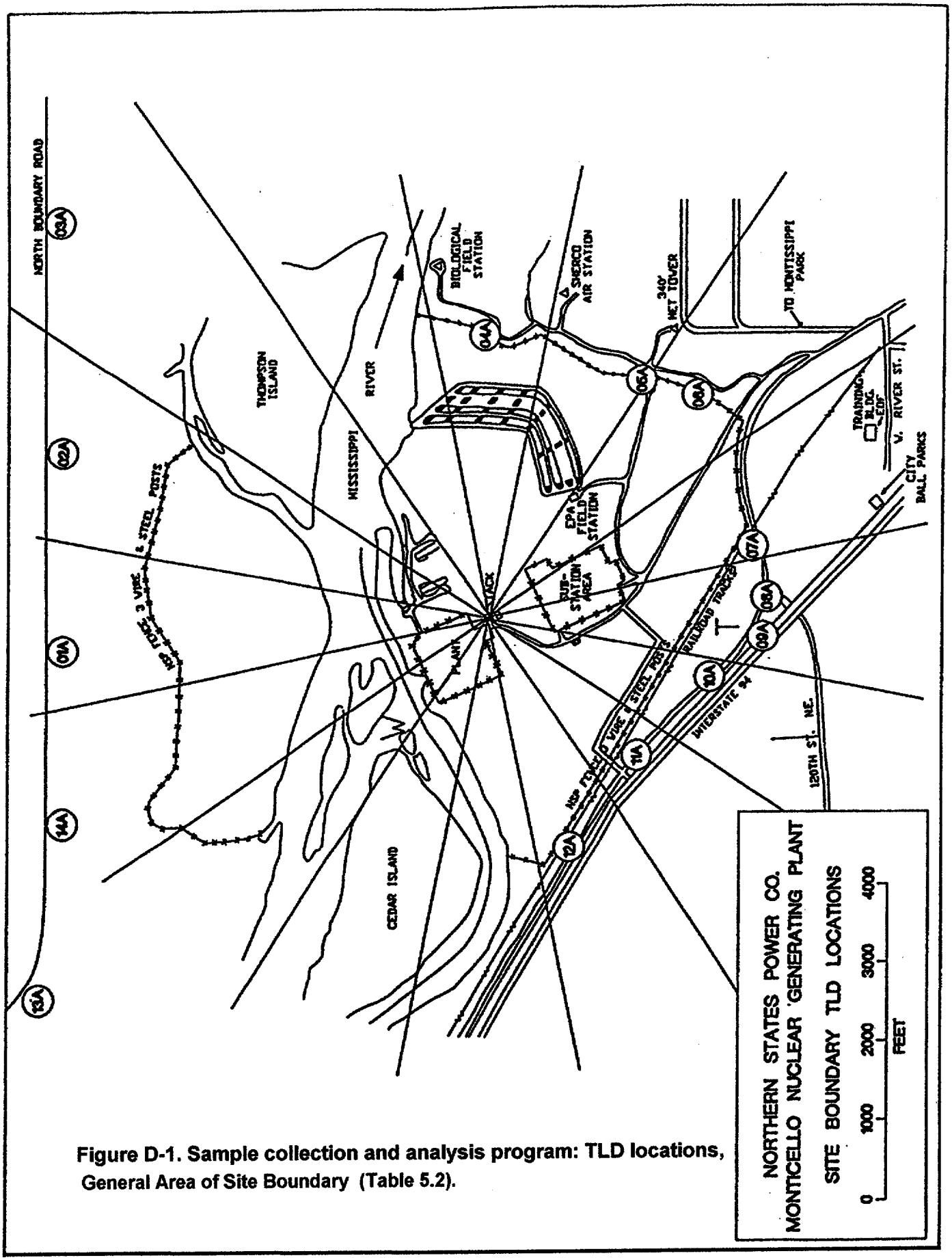

Figure D-1. Sample collection and analysis program: TLD locations, General Area of Site Boundary (Table 5.2).

MONTI CAD M00523

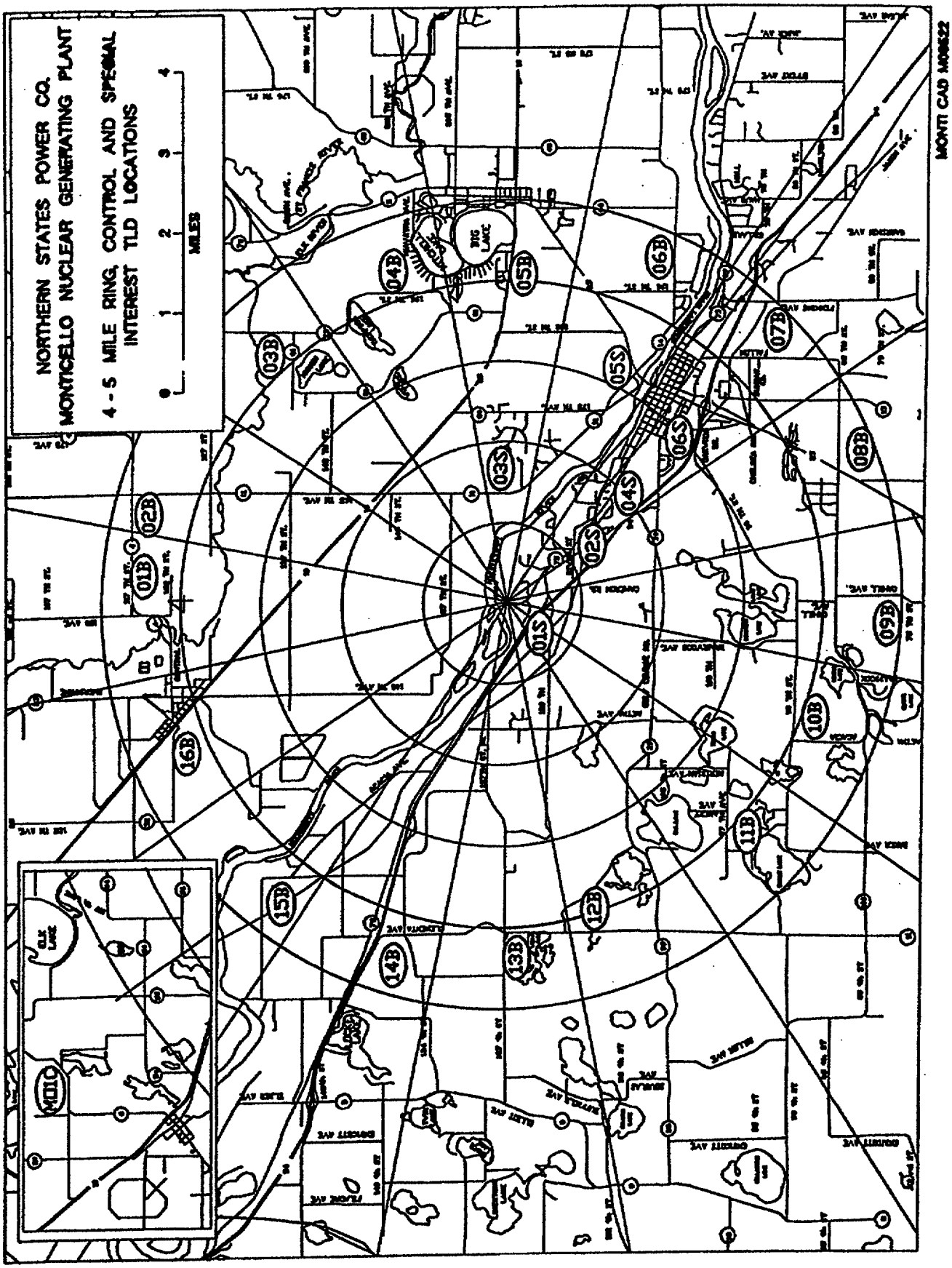

Figure D-2. Sample Collection and Analysis program:TLD locations, 4-5 miles distant from the Plant, Control and Special Interest locations (Table 5.2).

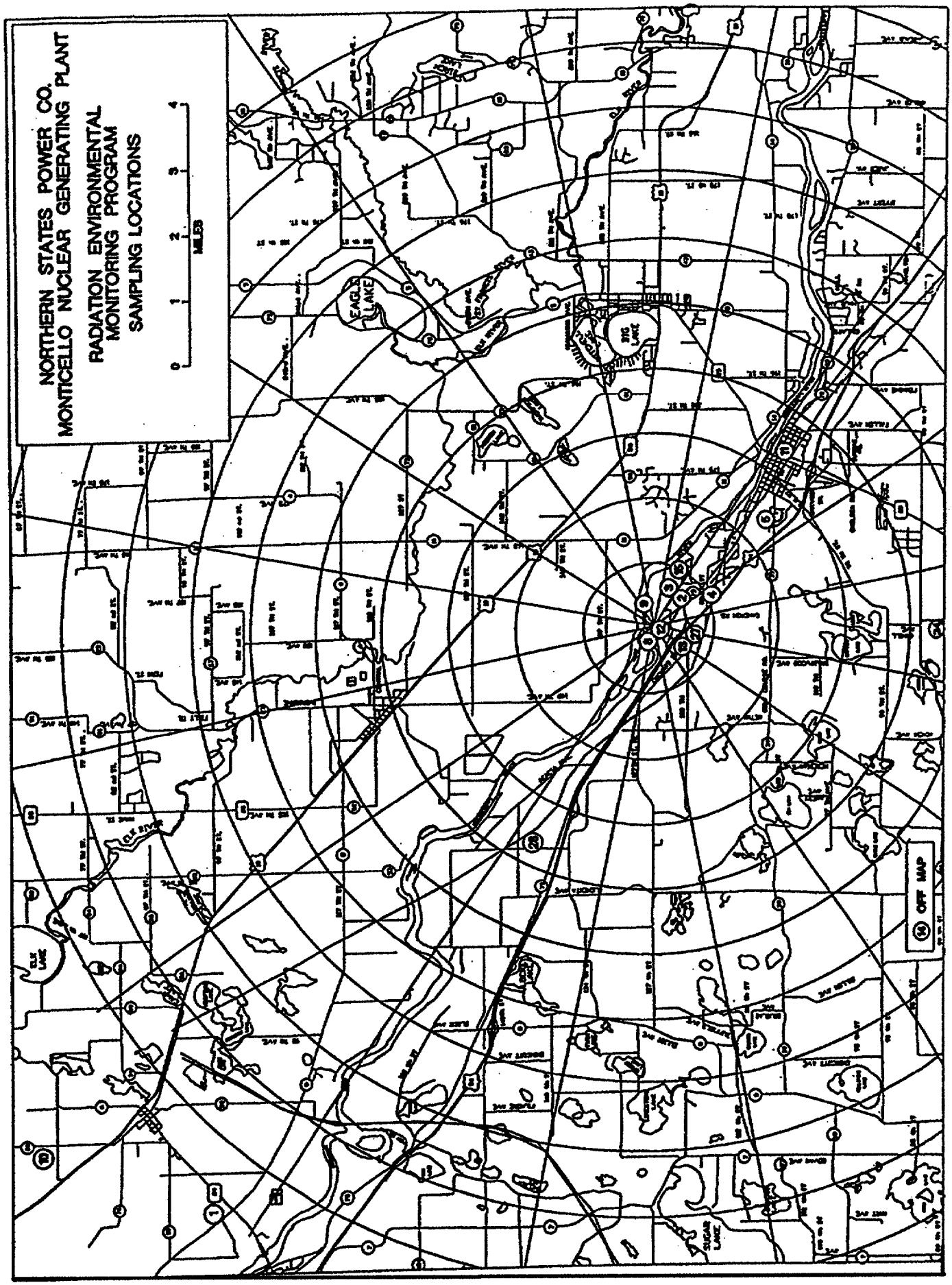

Figure D-3. Sample Collection and analysis program: Radiation Environmental Monitoring Program, Sampling locations (Table 5.2).