



April 11, 2008

L-MT-08-028  
Technical Specification 5.6.1

U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, DC 20555

Monticello Nuclear Generating Plant  
Docket 50-263  
License No. DPR-22

2007 Annual Radiological Environmental Operating Report

In accordance with the Monticello Nuclear Generating Plant Technical Specification 5.6.1, the Nuclear Management Company, LLC is submitting the Annual Radiological Environmental Operating Report for the year 2007.

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



For T O'Connor

Timothy J. O'Connor  
Site Vice President, Monticello Nuclear Generating Plant  
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Enclosure

cc: Administrator, Region III, USNRC  
Project Manager, Monticello, USNRC  
Resident Inspector, Monticello, USNRC  
Minnesota Department of Commerce

**ENCLOSURE 1**

**ANNUAL REPORT TO THE UNITED STATES NUCLEAR REGULATORY  
COMMISSION, RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM,  
JANUARY 1 TO DECEMBER 31, 2007**

**58 pages follow**



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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, 2007

Prepared under Contract by

ENVIRONMENTAL, Inc.  
Midwest Laboratory

Project No. 8010

Approved:

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## 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, 2007. 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, 2007a) available at the Monticello Nuclear Generating Plant, Chemistry and Radiation Protection Department.

The 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 2007 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. 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.

## Program Design and Data Interpretation (continued)

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 REMF 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 determined by gamma spectroscopy. 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  $\text{CaSO}_4:\text{Dy}$  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.

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 animals may be on pasture. Samples are analyzed for iodine-131 and gamma-emitting isotopes.

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.

Ground water is monitored by quarterly collections from three off-site locations (one control and two indicators) and one on-site Plant well. The samples are analyzed for tritium and gamma-emitting isotopes.

Twelve on-site monitoring wells were added to the program and sampled for tritium and gamma isotopic analyses. Four of the wells (M-29 to M-32) are deep water drinking wells and were only sampled until the shallow monitoring wells (M-36 to M-40) could be completed. The four deep drinking wells are no longer sampled as part of the analyses program.

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.

### Program Description (continued)

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) Air Particulates / Air Iodine:

No air particulate / air iodine samples were available from location M-4 for the week ending Sept. 5, 2007. There was no power to the substation.

(2) Milk:

Milk samples were not available from M-24 (Weinand Farm) for the November 14 and December 12 collection. The herd has been sold.

Milk samples were not available from M-28 (Hoglund Farm) June 14th through October 25th, 2007. Dairy operations were temporarily discontinued. Collections were resumed on Nov. 14, 2007.

(3) Thermoluminescent Dosimeters:

The TLD for location M-I-08 was missing in the field for the second quarter, 2007.

TLDs for location M-04C and Neutron Control B were missing in the third quarter, 2007. The TLDs for locations M-1-01 through M-I-13 and ISFSI-01 through ISFSI-10 neutron dosimeters were not installed for the third quarter, 2007, due to ISFSI construction.

TLDs for location M-12A and ISFSI-14 neutron were missing in the fourth quarter, 2007. The TLDs for locations M-1-01 through M-I-10 and ISFSI-01 through ISFSI-10 neutron dosimeters were not installed for the fourth quarter, 2007, due to ISFSI construction.

(4) Invertebrates:

The fall collection for invertebrates was missed due to river conditions. The water was too high to safely collect samples.

(5) Ground Water:

Plant Well #11 could not be sampled for the second quarter, 2007, due to site problems. A substitute sample was taken from Well #12.

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.

Gamma-spectroscopic analyses are performed using high-purity germanium (HPGe) detectors. Levels of iodine-131 in cabbage and natural vegetation and concentrations of airborne iodine-131 in charcoal samples were determined by gamma spectroscopy.

Tritium concentrations are determined by liquid scintillation.

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, 2003 ). 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

Well Water, analysis for tritium and gamma-emitting isotopes.  
Five onsite monitoring wells (M-36 through M-40) were added to the program in the fourth quarter of 2007. (Tables 5.1, 5.2).

### 3.6 Land Use Census

In accordance with the MNGP Chemistry Manual, Procedure I.05.41, "Annual Land Use Census and Critical Receptor Identification", 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<sup>2</sup> 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<sup>2</sup> 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 2007 land use census was conducted between September 10 and September 18, 2007.

There were no sectors in which the highest D/Q value increased by greater than 20%. No changes to the sampling procedures are required.

In summary, the highest D/Q locations for nearest resident, garden and nearest milk animal did not change from the 2006 census.

Details of the land use census 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 2007. 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<sup>2</sup> in 1969 and 12,000 pCi/m<sup>2</sup> 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<sup>3</sup>. Present day levels have stabilized at around 0.025 pCi/m<sup>3</sup>. 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 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 (16.1 and 15.1 mRem/91 days, respectively). The mean for special interest locations was 14.7 mRem/91 days and the mean for the control locations was 15.5 mRem/91 days. Dose rates measured at the inner and outer ring locations were similar to those observed from 1992 through 2006 and are tabulated below. No plant effect on ambient gamma radiation is indicated (Figure 5-1).

<u>Year</u>	<u>Inner Ring</u>	<u>Outer Ring</u>
<u>Dose rate (mRem/91 days)</u>		
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
2002	15.9	14.8
2003	15.6	15.0
2004	16.0	15.4
2005	15.6	15.2
2006	16.5	15.6
2007	16.1	15.1

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 and 0.028 pCi/m<sup>3</sup>, respectively) and similar to levels observed from 1992 through 2006. The results are tabulated below.

<u>Year</u>	<u>Indicators</u>	<u>Control</u>
<u>Concentration (pCi/m<sup>3</sup>)</u>		
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
2002	0.028	0.028
2003	0.027	0.027
2004	0.024	0.024
2005	0.025	0.025
2006	0.024	0.025
2007	0.027	0.028

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 usually occur during the months of January and December, and the first and fourth quarters, as seen in 1992 through 2006.

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 0.077 pCi/m<sup>3</sup> 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 0.03 pCi/m<sup>3</sup> in all samples.



## Milk

Iodine-131 activity measured below the detection limit of 0.5 pCi/L in all samples.

No gamma-emitting isotopes, excepting naturally-occurring potassium-40, were detected. 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. Common exceptions are radioisotopes of potassium, cesium, strontium, barium, and iodine.

In summary, the milk data for 2007 show no radiological effects of the plant operation.

## River Water and Drinking Water

Tritium activity measured below the LLD of 500 pCi/L in all samples. Gross beta activity in Minneapolis drinking water averaged 2.8 pCi/L and was similar to average levels observed from 1992 through 2006. Gross beta averages are tabulated below.

<u>Year</u>	<u>Gross Beta (pCi/L)</u>		<u>Year</u>	<u>Gross Beta (pCi/L)</u>
1992	2.1		2000	2.5
1993	2.6		2001	2.5
1994	2.0		2002	2.9
1995	2.3		2003	3.0
1996	2.1		2004	2.7
1997	2.3		2005	2.8
1998	2.4		2006	2.1
1999	2.2		2007	2.8

Average annual concentrations; Gross beta in drinking water.

Comparisons with data reported by the USEPA for Minneapolis drinking water samples collected from 1980 through 2005 indicate that concentrations of these nuclides are remaining fairly constant. Gamma-emitting isotopes were below detection limits in all surface water samples. There was no indication of a plant effect.

## Well Water

At the four indicator and control locations, tritium measured below the LLD level of 500 pCi/L in all samples. Gamma isotopic results were below detection limits. The data for 2007 were consistent with previous years results and no plant operational effects were indicated.

In three of the forty-nine monitoring well samples tested, tritium was detected at an average concentration of 591 pCi/L. No gamma-emitting isotopes attributable to plant operation were detected.

### Crops

Cabbage was collected in September from two locations and analyzed for iodine-131. Levels of I-131 measured below 0.034 pCi/g wet weight in both samples. Other gamma-emitting isotopes were below respective LLD levels. There was no indication of a plant effect.

There were no crops irrigated from the Mississippi River within 5 miles of the plant in 2007; 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 analyzed by gamma spectroscopy. Naturally-occurring potassium-40 was found to be similar in upstream and downstream samples (3.32 and 2.77 pCi/g wet weight, respectively). All gamma-emitting isotopes were below their respective LLD levels. There was no indication of a plant effect.

### Invertebrates

Samples were collected in the third quarter of 2007, and analyzed for gamma-emitting isotopes. All gamma-emitting isotopes were below detection limits. There was no indication of a 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. Low levels of cesium-137 were detected in three of four downstream samples, averaging, 0.083 pCi/g dry weight, and 0.030 pCi/g dry weight in one of two control samples. Similar levels of activity and distribution have been observed since 1978, and are indicative of the influence of fallout deposition. 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		Collection Type and Frequency <sup>b</sup>	Analysis Type and Frequency <sup>c</sup>
	No.	Codes (and Type) <sup>a</sup>		
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 <sup>d</sup>	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
On-site monitoring wells	12	M-29 - M-40		
Edible cultivated crops - Corn <sup>e</sup>	1	M-19	G/A	GS
Leafy Vegetable	2	M-27, St. Cloud Farmer's Mkt. (C)	G/A	I-131
Potatoes <sup>e</sup>	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

<sup>a</sup> Location codes are defined in Table 5.2. Control stations are indicated by (C). All other stations are indicators.

<sup>b</sup> 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.

<sup>c</sup> 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.

<sup>d</sup> Milk is collected biweekly during the grazing season (May - October), if milch animals are on pasture.

<sup>e</sup> 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 <sup>a</sup>	Collection Site	Sample Type <sup>b</sup>	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	0.8 mi @ 140°/SE
M-3		Air Station M-3	AP, AI	0.6 mi @ 104°/ESE
M-4		Air Station M-4	AP, AI	0.8 mi @ 147°/SSE
M-5		Air Station M-5	AP, AI	2.6 mi @ 134°/SE
M-8	C	Upstream of Plant Intake	SW, SS, BO, F	< 1000' upstream
M-9		Downstream of Plant Discharge	SW, SS, BO, F	< 1000' downstream
M-10	C	Campbell Farm	M, WW	10.6 mi @ 357°/N
M-11		City of Monticello	WW	3.3 mi @ 127°/SE
M-12		Plant Well #1	WW	0.26 mi @ 252°/SW
M-14		City of Minneapolis	DW	37.0 mi @ 132°/SE
M-15		Montissippi Park	SS	1.27 mi @ 114°/ESE
M-19		River Irrigated Corn Field <sup>c</sup>		
M-21		River Irrigated Potato Field <sup>c</sup>		
M-24		Weinand Farm	M	4.7 mi @ 180°/S
M-27		Wise residence (Highest D/Q Garden)	VE, WW	0.64 mi @ 207°/SSW
		a. Available Producer	VE	> 10.0 mi.
M-28		Hoglund Farm	M	3.8 mi @ 300°/WNW
M-29		Warehouse #5	WW	276' @ 32°/NNE
M-30		Receiving Warehouse	WW	0.27 mi @ 156°/SSE
M-31		Site Administration Building	WW	424' @ 192°/SSW
M-32		Shooting Range	WW	0.33 mi @ 111°/ESE
M-33		Monitoring Well #1	WW	593' @ 299°/WNW
M-34		Monitoring Well #2	WW	749' @ 301°/WNW
M-35		Monitoring Well #3	WW	770' @ 304°/NW
M-36		Monitoring Well #4	WW	0.1 mi @ 335°/NNW
M-37		Monitoring Well #5	WW	0.1 mi @ 253°/WSW
M-38		Monitoring Well #6	WW	229' @ 228°/SW
M-39		Monitoring Well #7	WW	0.2 mi @ 66°/ENE
M-40		Monitoring Well #8	WW	0.3 mi @ 150°/SSE
<b>General Area of the Site Boundary</b>				
M-01A		Sherburne Ave. So.	TLD	0.75 mi @ 353°/N
M-02A		Sherburne Ave. So.	TLD	0.79 mi @ 23°/NNE
M-03A		Sherburne Ave. So.	TLD	1.29 mi @ 55°/NE
M-04A		Biology Station Road	TLD	0.5 mi @ 86°/E
M-05A		Biology Station Road	TLD	0.48 mi @ 118°/ESE
M-06A		Biology Station Road	TLD	0.54 mi @ 135°/SE
M-07A		County Road 75	TLD	0.5 mi @ 155°/SSE
M-08A		County Road 75	TLD	0.48 mi @ 172°/S
M-09A		County Road 75	TLD	0.38 mi @ 209°/SSW
M-10A		County Road 75	TLD	0.38 mi @ 226°/SW
M-11A		County Road 75	TLD	0.4 mi @ 239°/WSW
M-12A		County Road 75	TLD	0.5 mi @ 262°/W
M-13A		North Boundary Road	TLD	0.89 mi @ 324°/NW
M-14A		North Boundary Road	TLD	0.78 mi @ 334°/NNW

Table 5.2. Sampling locations, Monticello Nuclear Generating Plant.

Code	Type <sup>a</sup>	Collection Site	Sample Type <sup>b</sup>	Distance and Direction from Reactor
<b>Approximately 4 to 5 miles Distant from the Plant</b>				
M-01B		Sherco #1 Air Station	TLD	4.66 mi @ 02°/N
M-02B		County Road 11	TLD	4.4 mi @ 18°/NNE
M-03B		County Road 73 & 81	TLD	4.3 mi @ 57°/NE
M-04B		County Road 73 (196th St.)	TLD	4.2 mi @ 67°/ENE
M-05B		City of Big Lake	TLD	4.3 mi @ 89°/E
M-06B		County Road 14 and 196th St.	TLD	4.3 mi @ 117°/ESE
M-07B		Monte Industrial Drive	TLD	4.3 mi @ 136°/SE
M-08B		Residence, Hwy 25 & Davidson Ave.	TLD	4.6 mi @ 162°/SSE
M-09B		Weinand Farm	TLD	4.7 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 @ 228°/SW
M-12B		Lake Maria State Park	TLD	4.2 mi @ 254°/WSW
M-13B		Bridgewater Station	TLD	4.1 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	4.4 mi @ 341°/NNW
<b>Special Interest Locations</b>				
M-01S		Osowski Fun Market	TLD	0.66 mi @ 242°/WSW
M-02S		Krone Residence	TLD	0.5 mi @ 224°/SW
M-03S		Big Oaks Park	TLD	1.53 mi @ 102°/ESE
M-04S		Pinewood School	TLD	2.3 mi @ 131°/SE
M-05S		Rivercrest Christian Academy	TLD	3.0 mi @ 118°/ESE
M-06S		Monte Public Works	TLD	2.6 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	11.6 mi @ 130°/SE
M-04C	C	Maple Lake Water Tower	TLD	10.3 mi @ 226°/ SW

<sup>a</sup> "C" denotes control location. All other locations are indicators.

<sup>b</sup> 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

<sup>c</sup> 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-04	9/5/2007	No power to substation.	None required.
MI	Gamma, I-131	M-28	6/14/2007 through 10/25/2007	Hoglund Dairy temporarily out of business for the summer.	Hoglund will inform the MNGP upon resumption of operation. Operation resumed 11/14/07.
MI	Gamma, I-131	M-24	11/14/2007 12/12/2007	Weinand Farm no longer in the dairy business.	None required.
TLD	Ambient Gamma	M-I-08	2nd. Qtr. 2007	Missing in the field	None required.
BO	Gamma	M-08 M-09	3rd. Qtr. 2007	Missed collection due to unsafe river conditions.	None required.
TLD	Ambient Gamma	M-04C M-I-01 to M-I-13	3rd. Qtr. 2007	Missing in the field Not installed due to ISFSI construction.	None required.
	Neutron Dosimetry	Control B ISFSI-01 to ISFSI-10	3rd. Qtr. 2007	Missing in the field Not installed due to ISFSI construction.	
TLD	Ambient Gamma	M-12A M-I-01 to M-I-10	4th. Qtr. 2007	Missing in the field Not installed due to ISFSI construction.	None required.
	Neutron Dosimetry	ISFSI-14 ISFSI-01 to ISFSI-10	4th. Qtr. 2007	Missing in the field Not installed due to ISFSI construction.	

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

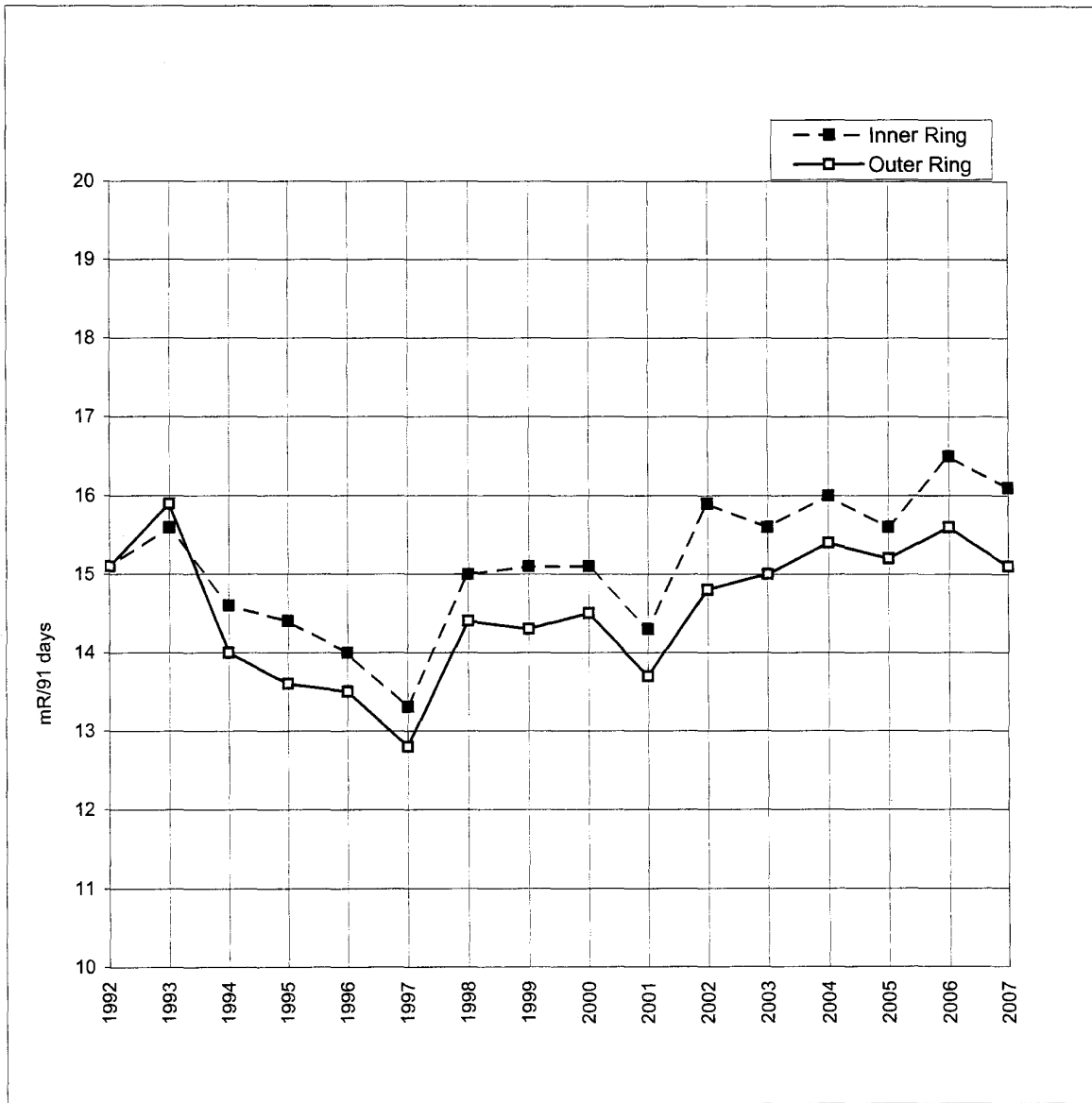




Figure 5-2. Airborne Particulates; analysis for gross beta, average mean of all indicator locations versus control location.

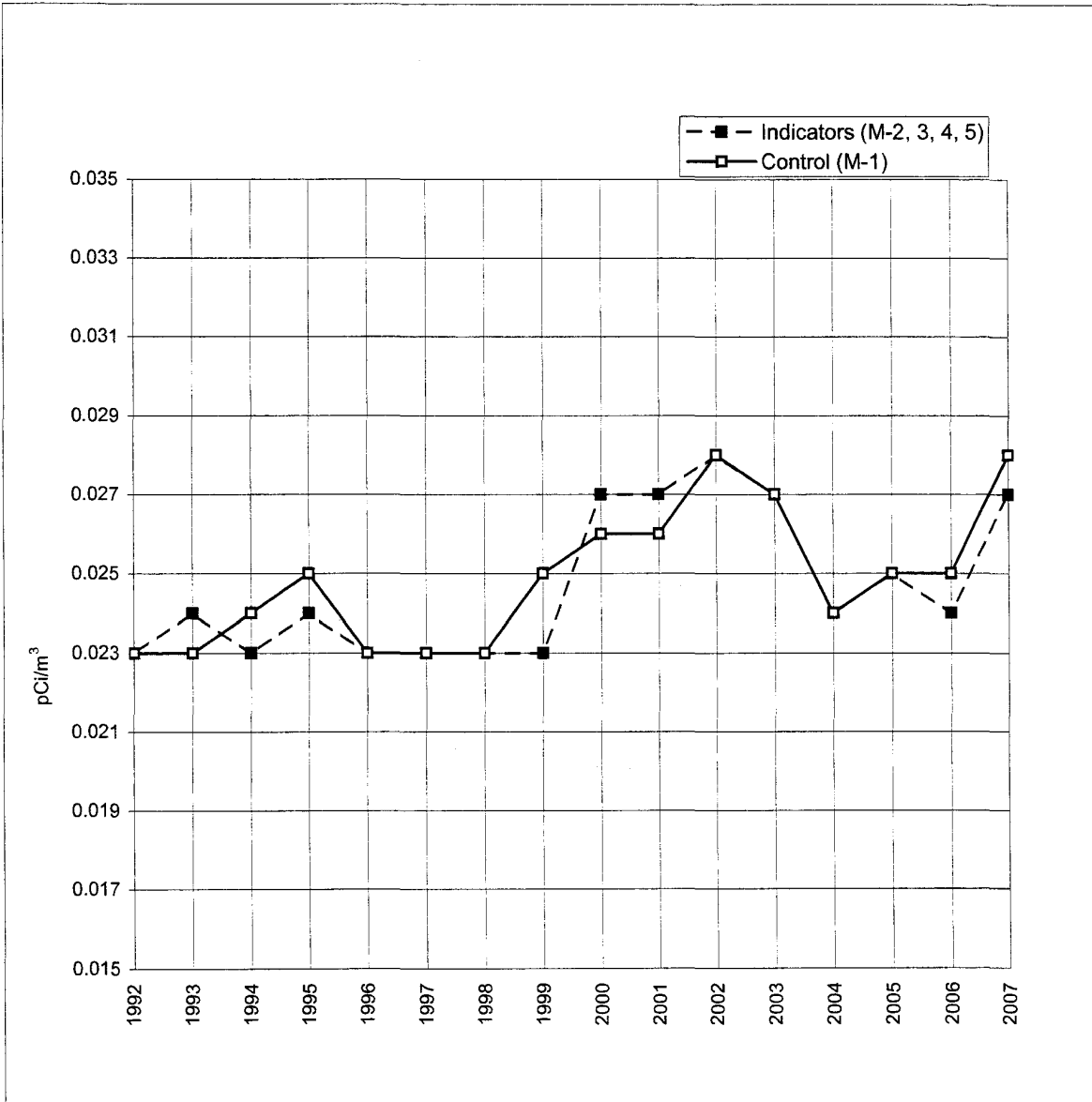


Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility	<u>Monticello Nuclear Generating Plant</u>	Docket No.	<u>50-263</u>
Location of Facility	<u>Wright, Minnesota</u>	Reporting Period	<u>January-December, 2007</u>
	( County, State )		

Sample Type (Units)	Type and Number of Analyses <sup>a</sup>	LLD <sup>b</sup>	Indicator Locations Mean (F) <sup>c</sup> Range <sup>c</sup>	Location with Highest Annual Mean		Control Locations Mean (F) <sup>c</sup> Range <sup>c</sup>	Number Non-Routine Results <sup>e</sup>
				Location <sup>d</sup>	Mean (F) <sup>c</sup> Range <sup>c</sup>		
TLD (Inner Ring, General Area at Site Boundary) mRem/91 days)	Gamma 55	3.0	16.1 (55/55) ( 12.6-20.1)	M-11A 0.4 mi @ 250°/WSW	18.1 (4 /4) (15.6-20.1)	(See Control below.)	0
TLD (Outer Ring, 4-5 mi. distant) mRem/91 days)	Gamma 64	3.0	15.1 (64/64) ( 12.6-18.9)	M-07B 4.4 mi @ 135°/SE	16.5 (4 /4) (15.2-18.3)	(See Control below.)	0
TLD (Special Interest Areas) mRem/91 days)	Gamma 24	3.0	14.7 (24/24) ( 10.7-18.0)	M-06S, Mont. Pub. Wks. 2.7 mi @ 136°/SE	16.8 (4 /4) (15.9-18.0)	(See Control below.)	0
TLD (Control) mRem/91 days)	Gamma 15	3.0	None	M-03C, County Rd.19 & Jason, 11.6 mi. @ 130°/SE	16.7 (4/4) (14.9-17.7)	15.5 (15/15) ( 13.7-17.9)	0
Airborne Particulates (pCi/m <sup>3</sup> )	GB 259	0.005	0.027 (207/207) (0.010-0.084)	M-1 (C) 11.0 mi @ 307°/NW	0.028 (52 /52) (0.010-0.083)	0.028 (52/52) (0.010-0.083)	0
	GS 20						
	Be-7	0.015	0.076 (16/16) (0.045-0.101)	M-5, Air Station 2.6 mi @ 134°/SE	0.087 (4/4) (0.058-0.101)	0.078 (4/4) (0.065-0.093)	0
	Mn-54	0.0009	< LLD	-	-	< LLD	0
	Co-58	0.0008	< LLD	-	-	< LLD	0
	Co-60	0.0011	< LLD	-	-	< LLD	0
	Zn-65	0.0014	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.0013	< LLD	-	-	< LLD	0
	Ru-103	0.0013	< LLD	-	-	< LLD	0
	Ru-106	0.0063	< LLD	-	-	< LLD	0
	Cs-134	0.0009	< LLD	-	-	< LLD	0
	Cs-137	0.0007	< LLD	-	-	< LLD	0
	Ba-La-140	0.0047	< LLD	-	-	< LLD	0
	Ce-141	0.0024	< LLD	-	-	< LLD	0
Ce-144	0.0043	< LLD	-	-	< LLD	0	
Airborne Iodine (pCi/m <sup>3</sup> )	I-131 259	0.03	< LLD	-	-	< LLD	0

Table 5.4 Radiological Environmental Monitoring Program Summary

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	( County, State )		

Sample Type (Units)	Type and Number of Analyses <sup>a</sup>	LLD <sup>b</sup>	Indicator Locations Mean (F) <sup>c</sup> Range <sup>c</sup>	Location with Highest Annual Mean		Control Locations Mean (F) <sup>c</sup> Range <sup>c</sup>	Number Non-Routine Results <sup>e</sup>
				Location <sup>d</sup>	Mean (F) <sup>c</sup> Range <sup>c</sup>		
Milk (pCi/L)	I-131 45	0.5	< LLD	-	-	< LLD	0
	GS 45						
	K-40 200		1339 (26/26) (1190-1445)	M-28 Hoglund Farm	1394 (9 /9) (1279-1445)	1389 (19/19) (1313-1513)	0
	Cs-134 5		< LLD	-	-	< LLD	0
	Cs-137 5		< LLD	-	-	< LLD	0
	Ba-La-140 5		< LLD	-	-	< LLD	0
River Water (pCi/L)	H-3 8	500	< LLD	-	-	< LLD	0
	GS 24						
	Mn-54 10		< LLD	-	-	< LLD	0
	Fe-59 30		< LLD	-	-	< LLD	0
	Co-58 10		< LLD	-	-	< LLD	0
	Co-60 10		< LLD	-	-	< LLD	0
	Zn-65 30		< LLD	-	-	< LLD	0
	Zr-Nb-95 15		< LLD	-	-	< LLD	0
	Cs-134 10		< LLD	-	-	< LLD	0
	Cs-137 10		< LLD	-	-	< LLD	0
	Ba-La-140 15		< LLD	-	-	< LLD	0
	Ce-144 45		< 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, 2007  
 ( County, State )

Sample Type (Units)	Type and Number of Analyses <sup>a</sup>	LLD <sup>b</sup>	Indicator Locations Mean (F) <sup>c</sup> Range <sup>c</sup>	Location with Highest Annual Mean		Control Locations Mean (F) <sup>c</sup> Range <sup>c</sup>	Number Non-Routine Results <sup>e</sup>
				Location <sup>d</sup>	Mean (F) <sup>c</sup> Range <sup>c</sup>		
Drinking Water (pCi/L)	GB 12	1.0	2.8 (12/12) (1.7-4.8)	M-14, Minneapolis 37.0 mi. @ 132° /SE	2.8 (12/12) (1.7-4.8)	None	0
	I-131 12	1.0	< LLD	-	-	None	0
	H-3 4	500	< LLD	-	-	None	0
	GS 12						
	Mn-54 10	10	< LLD	-	-	None	0
	Fe-59 30	30	< LLD	-	-	None	0
	Co-58 10	10	< LLD	-	-	None	0
	Co-60 10	10	< LLD	-	-	None	0
	Zn-65 30	30	< LLD	-	-	None	0
	Zr-Nb-95 15	15	< LLD	-	-	None	0
	Cs-134 10	10	< LLD	-	-	None	0
	Cs-137 10	10	< LLD	-	-	None	0
	Ba-La-140 15	15	< LLD	-	-	None	0
Ce-144 38	38	< LLD	-	-	None	0	
Well Water (pCi/L)	H-3 65	500	591(3/65) (505-732)	Monitoring Well #3 770' @304° /NW	634 (2/6) (535-732)	< LLD	0
	GS 65						
	Mn-54 10	10	< LLD	-	-	< LLD	0
	Fe-59 30	30	< LLD	-	-	< LLD	0
	Co-58 10	10	< LLD	-	-	< LLD	0
	Co-60 10	10	< LLD	-	-	< LLD	0
	Zn-65 30	30	< LLD	-	-	< LLD	0
	Zr-Nb-95 15	15	< LLD	-	-	< LLD	0
	Cs-134 10	10	< LLD	-	-	< LLD	0
	Cs-137 10	10	< LLD	-	-	< LLD	0
	Ba-La-140 15	15	< LLD	-	-	< LLD	0
	Ce-144 54	54	< LLD	-	-	< LLD	0
	Crops - Cabbage (pCi/gwet)	GS 2					
I-131		0.034	< LLD	-	-	< LLD	0
Cs-134		0.020	< LLD	-	-	< LLD	0
Cs-137		0.028	< 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, 2007  
 ( County, State )

Sample Type (Units)	Type and Number of Analyses <sup>a</sup>	LLD <sup>b</sup>	Indicator Locations Mean (F) <sup>c</sup> Range <sup>c</sup>	Location with Highest Annual Mean		Control Locations Mean (F) <sup>c</sup> Range <sup>c</sup>	Number Non-Routine Results <sup>e</sup>
				Location <sup>d</sup>	Mean (F) <sup>c</sup> Range <sup>c</sup>		
Fish (pCi/g wet)	GS 4						
	K-40	0.10	2.77 (2/2) (2.51-3.03)	M-08, Upstream < 1000' of discharge	3.32 (2/2) (3.21-3.42)	3.32 (2/2) (3.21-3.42)	0
	Mn-54	0.015	< LLD	-	-	< LLD	0
	Fe-59	0.031	< LLD	-	-	< LLD	0
	Co-58	0.017	< LLD	-	-	< LLD	0
	Co-60	0.014	< LLD	-	-	< LLD	0
	Zn-65	0.033	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.024	< LLD	-	-	< LLD	0
	Cs-134	0.013	< LLD	-	-	< LLD	0
	Cs-137	0.016	< LLD	-	-	< LLD	0
	Ba-La-140	0.087	< LLD	-	-	< LLD	0
	Ce-144	0.10	< LLD	-	-	< LLD	0
Invertebrates (pCi/g wet)	GS 2						
	Be-7	0.76	< LLD	-	-	< LLD	0
	K-40	1.14	< LLD	-	-	< LLD	0
	Mn-54	0.063	< LLD	-	-	< LLD	0
	Fe-59	0.11	< LLD	-	-	< LLD	0
	Co-58	0.084	< LLD	-	-	< LLD	0
	Co-60	0.062	< LLD	-	-	< LLD	0
	Zn-65	0.13	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.11	< LLD	-	-	< LLD	0
	Ru-103	0.11	< LLD	-	-	< LLD	0
	Ru-106	0.53	< LLD	-	-	< LLD	0
	Cs-134	0.046	< LLD	-	-	< LLD	0
	Cs-137	0.047	< LLD	-	-	< LLD	0
	Ba-La-140	0.68	< LLD	-	-	< LLD	0
Ce-144	0.34	< LLD	-	-	< LLD	0	

Table 5.4 Radiological Environmental Monitoring Program Summary

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Location of Facility	<u>Wright, Minnesota</u>	Reporting Period	<u>January-December, 2007</u>
( County, State )			

Sample Type (Units)	Type and Number of Analyses <sup>a</sup>	LLD <sup>b</sup>	Indicator Locations Mean (F) <sup>c</sup> Range <sup>c</sup>	Location with Highest Annual Mean		Control Locations Mean (F) <sup>c</sup> Range <sup>c</sup>	Number Non-Routine Results <sup>e</sup>
				Location <sup>d</sup>	Mean (F) <sup>c</sup> Range <sup>c</sup>		
Shoreline Sediments (pCi/g dry)	GS 6						
	Be-7	0.19	0.42 (1/4)	M-15, Montissippi Park 1.27 mi @ 114°/ESE	0.42 (1/2)	< LLD	0
	K-40	0.10	10.80 (4/4) (9.86-11.79)	M-08, Upstream < 1000' of discharge	10.85 (2/2) (9.67-12.03)	10.85 (2/2) (9.67-12.03)	0
	Mn-54	0.020	< LLD	-	-	< LLD	0
	Fe-59	0.070	< LLD	-	-	< LLD	0
	Co-58	0.021	< LLD	-	-	< LLD	0
	Co-60	0.014	< LLD	-	-	< LLD	0
	Zn-65	0.045	< LLD	-	-	< LLD	0
	Nb-95	0.028	< LLD	-	-	< LLD	0
	Zr-95	0.037	< LLD	-	-	< LLD	0
	Ru-103	0.026	< LLD	-	-	< LLD	0
	Ru-106	0.16	< LLD	-	-	< LLD	0
	Cs-134	0.016	< LLD	-	-	< LLD	0
	Cs-137	0.016	0.083 (3/4) (0.043-0.120)	M-09, Downstream < 1000' of discharge	0.120 (1/2)	0.030 (1/2)	0
Ba-La-140	0.062	< LLD	-	-	< LLD	0	
Ce-144	0.10	< LLD	-	-	< LLD	0	

<sup>a</sup> GB = gross beta, GS = gamma scan.

<sup>b</sup> LLD = nominal lower limit of detection based on a 4.66 sigma counting error for background sample.

<sup>c</sup> Mean and range are based on detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (F).

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

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

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## 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 through December, 2007

## Appendix A

### Interlaboratory Comparison Program Results

Environmental, Inc., Midwest Laboratory 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 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.

Results in Table A-1 were obtained through participation in the environmental sample crosscheck program administered by Environmental Resources Associates, serving as a replacement for studies conducted previously by the U.S. EPA Environmental Monitoring Systems Laboratory, Las Vegas, Nevada.

The results in Table A-2 list results for thermoluminescent dosimeters (TLDs), via International Intercomparison of Environmental Dosimeters, when available, and internal laboratory testing.

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 lists REMP specific analytical results from 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. Complete analytical data for duplicate analyses is available upon request.

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

Results in Table A-7 were obtained through participation in the environmental sample crosscheck program administered by Environmental Resources Associates, serving as a replacement for studies conducted previously by the Environmental Measurement Laboratory Quality Assessment Program (EML).

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<sup>a</sup>

<u>Analysis</u>	<u>Level</u>	<u>One standard deviation for single determination</u>
Gamma Emitters	5 to 100 pCi/liter or kg > 100 pCi/liter or kg	5.0 pCi/liter 5% of known value
Strontium-89 <sup>b</sup>	5 to 50 pCi/liter or kg > 50 pCi/liter or kg	5.0 pCi/liter 10% of known value
Strontium-90 <sup>b</sup>	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	± 1σ = 169.85 x (known) <sup>0.0933</sup> 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 <sup>b</sup>	≤ 55 pCi/liter > 55 pCi/liter	6.0 pCi/liter 10% of known value
Uranium-238, Nickel-63 <sup>b</sup> Technetium-99 <sup>b</sup>	≤ 35 pCi/liter > 35 pCi/liter	6.0 pCi/liter 15% of known value
Iron-55 <sup>b</sup>	50 to 100 pCi/liter > 100 pCi/liter	10 pCi/liter 10% of known value
Others <sup>b</sup>	—	20% of known value

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

<sup>b</sup> Laboratory limit.

TABLE A-1. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA)<sup>a</sup>.

Lab Code	Date	Analysis	Concentration (pCi/L)				Acceptance
			Laboratory Result <sup>b</sup>	ERA Result <sup>c</sup>	Control Limits		
STW-1121	04/09/07	Sr-89	30.7 ± 4.3	35.4	26.7 - 44.1	Pass	
STW-1121	04/09/07	Sr-90	39.3 ± 1.8	42.1	33.4 - 50.8	Pass	
STW-1122	04/09/07	Ba-133	30.0 ± 2.4	29.3	20.6 - 38.0	Pass	
STW-1122	04/09/07	Co-60	118.5 ± 3.9	119.0	109.0 - 129.0	Pass	
STW-1122	04/09/07	Cs-134	52.6 ± 2.3	54.3	45.6 - 63.0	Pass	
STW-1122	04/09/07	Cs-137	49.5 ± 3.8	50.3	41.6 - 59.0	Pass	
STW-1122	04/09/07	Zn-65	91.7 ± 6.3	88.6	73.3 - 104.0	Pass	
STW-1123	04/09/07	Gr. Alpha	33.8 ± 3.5	56.5	32.0 - 81.0	Pass	
STW-1123	04/09/07	Gr. Beta	24.2 ± 2.3	25.3	16.6 - 34.0	Pass	
STW-1124	04/09/07	I-131	19.2 ± 1.2	18.9	13.7 - 24.1	Pass	
STW-1125	04/09/07	H-3	7540.0 ± 255.0	8060.0	6660.0 - 9450.0	Pass	
STW-1125	04/09/07	Ra-226	13.0 ± 0.6	13.4	9.9 - 16.9	Pass	
STW-1125	04/09/07	Ra-228	19.9 ± 2.7	18.2	10.3 - 26.1	Pass	
STW-1125	04/09/07	Uranium	4.5 ± 0.2	4.6	0.0 - 9.8	Pass	
STW-1127	07/09/07	Sr-89	51.7 ± 5.0	58.2	49.5 - 66.9	Pass	
STW-1127	07/09/07	Sr-90	21.4 ± 2.3	19.0	10.3 - 27.7	Pass	
STW-1128	07/09/07	Ba-133	19.4 ± 2.2	19.4	10.7 - 28.1	Pass	
STW-1128	07/09/07	Co-60	32.8 ± 2.0	33.5	24.8 - 42.2	Pass	
STW-1128	07/09/07	Cs-134	67.0 ± 2.9	68.9	60.2 - 77.6	Pass	
STW-1128	07/09/07	Cs-137	61.6 ± 3.8	61.3	52.6 - 70.0	Pass	
STW-1128	07/09/07	Zn-65	55.6 ± 7.5	54.6	45.2 - 64.0	Pass	
STW-1129	07/09/07	Gr. Alpha	19.2 ± 1.6	27.1	15.4 - 38.8	Pass	
STW-1129	07/09/07	Gr. Beta	9.1 ± 0.9	11.5	2.8 - 20.2	Pass	
STW-1130	07/09/07	Ra-226	7.0 ± 0.5	7.7	5.7 - 9.7	Pass	
STW-1130	07/09/07	Ra-228	9.2 ± 2.3	9.1	5.2 - 13.1	Pass	
STW-1130	07/09/07	Uranium	23.9 ± 1.1	25.1	19.9 - 30.3	Pass	
STW-1131	10/05/07	Sr-89	27.3 ± 3.3	27.4	19.3 - 33.9	Pass	
STW-1131	10/05/07	Sr-90	17.7 ± 1.2	18.2	12.9 - 21.6	Pass	
STW-1132	10/05/07	Ba-133	12.2 ± 3.3	12.6	8.6 - 15.5	Pass	
STW-1132	10/05/07	Co-60	23.8 ± 1.4	23.2	19.9 - 28.3	Pass	
STW-1132	10/05/07	Cs-134	70.5 ± 4.2	71.1	58.0 - 78.2	Pass	
STW-1132	10/05/07	Cs-137	178.2 ± 3.3	180.0	162.0 - 200.0	Pass	
STW-1132	10/05/07	Zn-65	263.9 ± 6.9	251.0	226.0 - 294.0	Pass	
STW-1133	10/05/07	Gr. Alpha	54.7 ± 2.1	58.6	30.6 - 72.9	Pass	
STW-1133	10/05/07	Gr. Beta	11.9 ± 0.9	9.7	4.3 - 18.2	Pass	
STW-1134	10/05/07	I-131	33.0 ± 1.5	28.9	24.0 - 33.8	Pass	
STW-1135	10/05/07	H-3	9965.0 ± 250.0	9700.0	8430.0 - 10700.0	Pass	
STW-1135	10/05/07	Ra-226	12.7 ± 0.2	12.9	9.6 - 14.9	Pass	
STW-1135	10/05/07	Ra-228	19.6 ± 2.4	17.9	12.0 - 21.5	Pass	
STW-1135	10/05/07	Uranium	27.3 ± 1.1	27.5	22.1 - 30.8	Pass	

<sup>a</sup> Results obtained by Environmental, Inc., Midwest Laboratory as a participant in the crosscheck program for proficiency testing in drinking water conducted by Environmental Resources Associates (ERA).

<sup>b</sup> Unless otherwise indicated, the laboratory result is given as the mean ± standard deviation for three determinations.

<sup>c</sup> 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 Dosimetry, (TLD, CaSO<sub>4</sub>: Dy Cards).

Lab Code	Date	Description	Known Value	mR		Acceptance
				Lab Result ± 2 sigma	Control Limits	
<u>Environmental, Inc.</u>						
2007-1	7/13/2007	30 cm.	54.25	60.56 ± 5.54	37.98 - 70.53	Pass
2007-1	7/13/2007	40 cm.	30.51	34.23 ± 0.96	21.36 - 39.66	Pass
2007-1	7/13/2007	50 cm.	19.53	17.95 ± 1.86	13.67 - 25.39	Pass
2007-1	7/13/2007	60 cm.	13.56	16.61 ± 0.60	9.49 - 17.63	Pass
2007-1	7/13/2007	70 cm.	9.96	9.72 ± 0.90	6.97 - 12.95	Pass
2007-1	7/13/2007	80 cm.	7.63	7.79 ± 0.33	5.34 - 9.92	Pass
2007-1	7/13/2007	90 cm.	6.03	5.53 ± 0.72	4.22 - 7.84	Pass
2007-1	7/13/2007	100 cm.	4.88	5.32 ± 0.17	3.42 - 6.34	Pass
2007-1	7/13/2007	110 cm.	4.03	3.49 ± 0.14	2.82 - 5.24	Pass
2007-1	7/13/2007	120 cm.	3.39	2.64 ± 0.14	2.37 - 4.41	Pass
2007-1	7/13/2007	150 cm.	2.17	2.13 ± 0.87	1.52 - 2.82	Pass
<u>Environmental, Inc.</u>						
2007-2	11/12/2007	30 cm.	54.37	65.47 ± 5.25	38.06 - 70.68	Pass
2007-2	11/12/2007	40 cm.	30.59	37.43 ± 2.18	21.41 - 39.77	Pass
2007-2	11/12/2007	60 cm.	13.59	15.18 ± 0.50	9.51 - 17.67	Pass
2007-2	11/12/2007	70 cm.	9.99	12.18 ± 0.46	6.99 - 12.99	Pass
2007-2	11/12/2007	80 cm.	7.65	8.74 ± 0.39	5.36 - 9.95	Pass
2007-2	11/12/2007	90 cm.	6.04	5.89 ± 0.25	4.23 - 7.85	Pass
2007-2	11/12/2007	110 cm.	4.04	4.13 ± 0.41	2.83 - 5.25	Pass
2007-2	11/12/2007	120 cm.	3.4	2.92 ± 0.13	2.38 - 4.42	Pass
2007-2	11/12/2007	120 cm.	3.4	2.91 ± 0.31	2.38 - 4.42	Pass
2007-2	11/12/2007	150 cm.	2.17	1.95 ± 0.72	1.52 - 2.82	Pass
2007-2	11/12/2007	180 cm.	1.51	1.38 ± 0.05	1.06 - 1.96	Pass

TABLE A-3. In-House "Spike" Samples

Lab Code <sup>b</sup>	Date	Analysis	Concentration (pCi/L) <sup>a</sup>			Acceptance
			Laboratory results 2s, n=1 <sup>c</sup>	Known Activity	Control Limits <sup>d</sup>	
W-30707	3/7/2007	Gr. Alpha	19.51 ± 0.40	20.08	10.04 - 30.12	Pass
W-30707	3/7/2007	Gr. Beta	67.45 ± 0.49	65.73	55.73 - 75.73	Pass
SPAP-1566	3/23/2007	Cs-134	25.35 ± 1.31	27.82	17.82 - 37.82	Pass
SPAP-1566	3/23/2007	Cs-137	107.52 ± 3.02	116.48	104.83 - 128.13	Pass
SPW-1568	3/23/2007	H-3	65595.00 ± 672.00	71118.00	56894.40 - 85341.60	Pass
SPW-1678	3/28/2007	Tc-99	28.44 ± 1.12	32.35	20.35 - 44.35	Pass
SPW-1595	4/5/2007	Cs-134	54.48 ± 2.12	54.99	44.99 - 64.99	Pass
SPW-1595	4/5/2007	Cs-137	59.03 ± 2.94	58.19	48.19 - 68.19	Pass
SPW-1595	4/5/2007	I-131(G)	83.11 ± 3.51	82.07	72.07 - 92.07	Pass
SPW-1595A	4/5/2007	I-131	78.40 ± 1.10	82.07	65.66 - 98.48	Pass
SPW-1595B	4/5/2007	I-131	78.97 ± 1.10	82.07	65.66 - 98.48	Pass
SPMI-1597	4/5/2007	Cs-134	54.03 ± 2.15	54.99	44.99 - 64.99	Pass
SPMI-1597	4/5/2007	Cs-137	59.81 ± 4.75	58.19	48.19 - 68.19	Pass
SPMI-1597	4/5/2007	I-131(G)	83.97 ± 4.07	82.07	72.07 - 92.07	Pass
SPMI-1597A	4/5/2007	I-131	79.53 ± 1.03	82.07	65.66 - 98.48	Pass
SPMI-1597B	4/5/2007	I-131	83.51 ± 1.05	82.07	65.66 - 98.48	Pass
SPCH-2839	5/17/2007	I-131(G)	78.70 ± 7.36	70.40	60.40 - 80.40	Pass
SPW-2847	5/17/2007	Cs-134	55.43 ± 1.68	52.85	42.85 - 62.85	Pass
SPW-2847	5/17/2007	Cs-137	59.86 ± 2.71	58.03	48.03 - 68.03	Pass
SPW-2847	5/17/2007	I-131(G)	63.95 ± 2.69	70.87	60.87 - 80.87	Pass
SPMI-2849	5/17/2007	Cs-134	51.37 ± 1.65	52.85	42.85 - 62.85	Pass
SPMI-2849	5/17/2007	Cs-137	60.42 ± 4.31	58.03	48.03 - 68.03	Pass
SPMI-2849	5/17/2007	I-131(G)	62.44 ± 3.14	70.87	60.87 - 80.87	Pass
SPCH-2922	5/17/2007	I-131(G)	80.00 ± 6.40	70.40	41.60 - 99.20	Pass
SPW-2847	5/18/2007	I-131	60.14 ± 0.89	70.87	56.70 - 85.04	Pass
SPW-2847	5/18/2007	Sr-89	104.93 ± 6.64	121.90	97.52 - 146.28	Pass
SPW-2847	5/18/2007	Sr-89	46.72 ± 1.97	46.08	36.08 - 56.08	Pass
SPMI-2849	5/18/2007	I-131	67.97 ± 0.88	70.87	56.70 - 85.04	Pass
SPW-2909 <sup>e</sup>	5/22/2007	Fe-55	11137.00 ± 316.00	14271.50	11417.20 - 17125.80	Fail
SPW-2911	5/22/2007	H-3	65023.00 ± 679.00	70485.00	56388.00 - 84582.00	Pass
SPAP-2913	5/22/2007	Gr. Beta	55.27 ± 8.51	52.65	42.12 - 73.71	Pass
SPAP-2915	5/22/2007	Cs-134	22.53 ± 1.12	26.42	16.42 - 36.42	Pass
SPAP-2915	5/22/2007	Cs-137	111.14 ± 3.57	116.06	104.45 - 127.67	Pass
SPF-2922	5/22/2007	Cs-134	0.52 ± 0.03	0.53	0.32 - 0.74	Pass
SPF-2922	5/22/2007	Cs-137	2.58 ± 0.07	2.32	1.39 - 3.25	Pass
SPW-3223	5/24/2007	Ni-63	2233.10 ± 10.32	2135.90	1281.54 - 2990.26	Pass
W-60507	6/5/2007	Gr. Alpha	20.93 ± 0.42	20.08	10.04 - 30.12	Pass
W-60507	6/5/2007	Gr. Beta	60.50 ± 0.46	65.73	55.73 - 75.73	Pass
SPW-4327	7/18/2007	Tc-99	25.58 ± 1.11	32.35	20.35 - 44.35	Pass
SPW-5476	8/17/2007	Ni-63	1925.18 ± 9.62	2135.90	1281.54 - 2990.26	Pass
W-92107	9/21/2007	Gr. Alpha	23.02 ± 0.44	20.08	10.04 - 30.12	Pass
W-92107	9/21/2007	Gr. Beta	61.48 ± 0.47	65.73	55.73 - 75.73	Pass

TABLE A-3. In-House "Spike" Samples

Lab Code	Date	Analysis	Concentration (pCi/L) <sup>a</sup>			Acceptance
			Laboratory results 2s, n=1 <sup>b</sup>	Known Activity	Control Limits <sup>c</sup>	
SPW-6880	10/10/2007	Tc-99	30.97 ± 1.21	32.35	20.35 - 44.35	Pass
w-111007	11/10/2007	Gr. Alpha	22.43 ± 0.42	20.08	10.04 - 30.12	Pass
w-111007	11/10/2007	Gr. Beta	64.49 ± 0.48	65.73	55.73 - 75.73	Pass
SPAP-7742	11/13/2007	Cs-134	21.18 ± 1.29	22.41	12.41 - 32.41	Pass
SPAP-7742	11/13/2007	Cs-137	113.61 ± 3.16	114.76	103.28 - 126.24	Pass
SPAP-7744	11/13/2007	Gr. Beta	53.41 ± 0.13	52.03	41.62 - 72.84	Pass
SPMI-7746	11/13/2007	Cs-134	42.20 ± 1.48	44.83	34.83 - 54.83	Pass
SPMI-7746	11/13/2007	Cs-137	56.05 ± 2.83	57.40	47.40 - 67.40	Pass
SPMI-7746	11/13/2007	Sr-90	41.02 ± 1.61	45.54	36.43 - 54.65	Pass
SPW-7748	11/13/2007	Cs-134	43.11 ± 1.52	44.80	34.80 - 54.80	Pass
SPW-7748	11/13/2007	Cs-137	59.28 ± 3.50	57.40	47.40 - 67.40	Pass
SPW-7748	11/13/2007	Sr-90	37.23 ± 1.51	45.54	36.43 - 54.65	Pass
SPW-7752	11/13/2007	Fe-55	12935.10 ± 357.00	12640.50	10112.40 - 15168.60	Pass
SPW-7758	11/13/2007	H-3	65405.00 ± 712.50	68618.00	54894.40 - 82341.60	Pass
SPF-7760	11/13/2007	Cs-134	0.45 ± 0.02	0.45	0.27 - 0.63	Pass
SPF-7760	11/13/2007	Cs-137	2.45 ± 0.07	2.29	1.37 - 3.21	Pass
SPW-8034	11/13/2007	Ni-63	2194.06 ± 10.77	2129.03	1277.42 - 2980.64	Pass

<sup>a</sup> Liquid sample results are reported in pCi/Liter, air filters( pCi/filter), charcoal (pCi/m<sup>3</sup>), and solid samples (pCi/g).

<sup>b</sup> Laboratory codes as follows: W (water), MI (milk), AP (air filter), SO (soil), VE (vegetation),  
CH (charcoal canister), F (fish).

<sup>c</sup> Results are based on single determinations.

<sup>d</sup> Control limits are based on Attachment A, Page A2 of this report.

<sup>e</sup> Sample recount: 12557 ± 335.

NOTE: For fish, Jello is used for the Spike matrix. For Vegetation, cabbage is used for the Spike matrix.

TABLE A-4. In-House "Blank" Samples

Lab Code	Sample Type	Date	Analysis <sup>b</sup>	Concentration (pCi/L) <sup>a</sup>		
				Laboratory results (4.66σ)		Acceptance Criteria (4.66 σ)
				LLD	Activity <sup>c</sup>	
W-30707	water	3/7/2007	Gr. Alpha	0.40	0.01 ± 0.28	2
W-30707	water	3/7/2007	Gr. Beta	0.75	0.06 ± 0.53	4
SPAP-1567	Air Filter	3/23/2007	Cs-134	0.79		100
SPW-1567	Air Filter	3/23/2007	Cs-137	1.01		100
SPW-1568	water	3/23/2007	H-3	176.10	-26.16 ± 91.62	200
SPW-1596	water	4/5/2007	Cs-134	3.28		10
SPW-1596	water	4/5/2007	Cs-137	3.45		10
SPW-1596	water	4/5/2007	I-131	0.27	0.02 ± 0.18	0.5
SPW-1596	water	4/5/2007	I-131(G)	2.91		20
SPMI-1598	Milk	4/5/2007	Cs-134	3.30		10
SPMI-1598	Milk	4/5/2007	Cs-137	5.08		10
SPMI-1598	Milk	4/5/2007	I-131	0.26	-0.10 ± 0.17	0.5
SPMI-1598	Milk	4/5/2007	I-131(G)	4.10		20
SPCH-2839	Charcoal Canister	5/17/2007	I-131(G)	2.24		9.6
SPW-2848	water	5/17/2007	Cs-134	3.14		10
SPW-2848	water	5/17/2007	Cs-137	1.37		10
SPW-2848	water	5/17/2007	I-131(G)	5.34		20
SPMI-2850	Milk	5/17/2007	Cs-134	3.32		10
SPMI-2850	Milk	5/17/2007	Cs-137	2.60		10
SPMI-2850	Milk	5/17/2007	I-131(G)	4.77		20
SPW-2848	water	5/18/2007	I-131	0.34	-0.06 ± 0.19	0.5
SPW-2848	water	5/18/2007	Sr-89	0.81	-0.02 ± 0.65	5
SPW-2848	water	5/18/2007	Sr-90	0.53	0.01 ± 0.25	1
SPMI-2850	Milk	5/18/2007	I-131	0.45	0.20 ± 0.26	0.5
SPMI-2850	Milk	5/18/2007	Sr-89	0.96	-0.73 ± 1.02	5
SPMI-2850 <sup>d</sup>	Milk	5/18/2007	Sr-90	0.58	0.96 ± 0.38	1
SPAP-2914	Air Filter	5/22/2007	Gr. Beta	0.004	-0.002 ± 0.002	0.01
SPAP-2916	Air Filter	5/22/2007	Cs-134	2.84		100
SPAP-2916	Air Filter	5/22/2007	Cs-137	2.24		100
SPF-2923	Fish	5/22/2007	Cs-134	8.71		100
SPF-2923	Fish	5/22/2007	Cs-137	8.35		100
SPW-3224	water	5/24/2007	Ni-63	1.61	-0.30 ± 0.84	20
W-60507	water	6/5/2007	Gr. Alpha	0.43	-0.01 ± 0.30	2
W-60507	water	6/5/2007	Gr. Beta	0.77	0.01 ± 0.54	4
SPW-4328	water	7/18/2007	Tc-99	6.41	-3.12 ± 3.84	10
SPW-5477	water	8/17/2007	Ni-63	1.48	4.38 ± 1.01	20
W-92107	water	9/21/2007	Gr. Alpha	0.41	0.09 ± 0.29	2
W-92107	water	9/21/2007	Gr. Beta	0.75	-0.26 ± 0.51	4



TABLE A-4. In-House "Blank" Samples

Lab Code	Sample Type	Date	Analysis <sup>b</sup>	Concentration (pCi/L) <sup>a</sup>		
				Laboratory results (4.66σ)		Acceptance Criteria (4.66 σ)
				LLD	Activity <sup>c</sup>	
SPW-6881	water	10/10/2007	Tc-99	6.82	-6.58 ± 4.04	10
SPAP-7743	Air Filter	11/13/2007	Gr. Beta	0.003	-0.002 ± 0.002	0.01
SPMI-7745	Milk	11/13/2007	Cs-134	2.16		10
SPMI-7745	Milk	11/13/2007	Cs-137	3.46		10
SPMI-7745	Milk	11/13/2007	I-131(G)	5.89		20
SPMI-7745	Milk	11/13/2007	Sr-90	0.59	0.73 ± 0.35	1
SPW-7747	water	11/13/2007	Cs-134	2.39		10
SPW-7747	water	11/13/2007	Cs-137	3.53		10
SPW-7747	water	11/13/2007	I-131(G)	12.51		20
SPW-7747	water	11/13/2007	Sr-90	0.71	-0.04 ± 0.32	1
SPW-7751	water	11/13/2007	Fe-55	15.50	-4.18 ± 9.20	1000
SPW-7757	water	11/13/2007	H-3	151.35	-14.98 ± 78.85	200
SPF-7759	Fish	11/13/2007	Cs-134	5.50		100
SPF-7759	Fish	11/13/2007	Cs-137	5.10		100
SPW-8033	water	11/13/2007	Ni-63	1.45	-0.19 ± 0.87	20
W-120607	water	12/6/2007	Gr. Alpha	0.40	0.02 ± 0.28	2
W-120607	water	12/6/2007	Gr. Beta	0.77	-0.70 ± 0.51	4

<sup>a</sup> Liquid sample results are reported in pCi/Liter, air filters( pCi/filter), charcoal (pCi/charcoal canister), and solid samples (pCi/kg).

<sup>b</sup> I-131(G); iodine-131 as analyzed by gamma spectroscopy.

<sup>c</sup> Activity reported is a net activity result. For gamma spectroscopic analysis, activity detected below the LLD value is not reported.

<sup>d</sup> Low levels of Sr-90 are still detected in the environment. A concentration of (1-5 pCi/L) in milk is not unusual.

TABLE A-5. In-House "Duplicate" Samples

Lab Code	Date	Analysis	Concentration (pCi/L) <sup>a</sup>			Acceptance
			First Result	Second Result	Averaged Result	
E-20, 21	1/2/2007	Gr. Beta	1.76 ± 0.07	1.70 ± 0.06	1.73 ± 0.05	Pass
E-20, 21	1/2/2007	K-40	1.49 ± 0.24	1.57 ± 0.27	1.53 ± 0.18	Pass
CF-41, 42	1/2/2007	Gr. Beta	18.02 ± 0.41	18.81 ± 0.42	18.42 ± 0.29	Pass
CF-41, 42	1/2/2007	K-40	11.68 ± 1.12	12.67 ± 0.97	12.18 ± 0.74	Pass
CF-41, 42	1/2/2007	Sr-90	0.039 ± 0.011	0.026 ± 0.010	0.033 ± 0.007	Pass
P-9516, 9517	1/3/2007	H-3	270.78 ± 91.74	301.18 ± 92.99	285.98 ± 65.31	Pass
LW-9579, 9580	1/4/2007	Gr. Beta	0.91 ± 0.31	0.93 ± 0.30	0.92 ± 0.22	Pass
DW-70085, 70086	1/9/2007	Gr. Alpha	7.95 ± 1.20	7.92 ± 1.42	7.94 ± 0.93	Pass
DW-70037, 70038	1/11/2007	Gr. Alpha	55.47 ± 3.99	52.87 ± 4.02	54.17 ± 2.83	Pass
DW-70054, 70055	1/18/2007	Gr. Alpha	2.68 ± 0.88	1.88 ± 0.78	2.28 ± 0.59	Pass
DW-70122, 70123	1/18/2007	Gr. Alpha	4.30 ± 1.14	6.25 ± 1.16	5.28 ± 0.81	Pass
DW-70122, 70123	1/18/2007	Gr. Beta	4.22 ± 0.70	5.33 ± 0.75	4.78 ± 0.51	Pass
DW-70098, 70099	1/25/2007	Gr. Alpha	3.27 ± 0.90	1.97 ± 0.92	2.62 ± 0.64	Pass
DW-70110, 70111	1/25/2007	Gr. Alpha	2.19 ± 0.92	1.69 ± 0.79	1.94 ± 0.61	Pass
SWU-676, 677	1/30/2007	Gr. Beta	1.77 ± 0.39	2.11 ± 0.39	1.94 ± 0.28	Pass
DW-70148, 70149	1/30/2007	Gr. Alpha	4.65 ± 1.37	5.20 ± 1.81	4.93 ± 1.14	Pass
SW-600, 601	2/1/2007	K-40	1.24 ± 0.12	1.20 ± 0.12	1.22 ± 0.08	Pass
SW-601, 602	2/1/2007	Gr. Beta	0.89 ± 0.37	1.02 ± 0.25	0.96 ± 0.22	Pass
DW-1138, 1139	2/9/2007	H-3	2707.00 ± 161.00	2700.00 ± 161.00	2703.50 ± 113.84	Pass
MI-721, 722	2/13/2007	K-40	1330.40 ± 117.60	1316.40 ± 116.50	1323.40 ± 82.77	Pass
SW-847, 848	2/13/2007	Gr. Alpha	3.82 ± 1.67	2.61 ± 1.24	3.22 ± 1.04	Pass
SW-847, 848	2/13/2007	Gr. Beta	7.33 ± 1.37	5.89 ± 0.90	6.61 ± 0.82	Pass
DW-70175, 70176	2/14/2007	Gr. Alpha	11.72 ± 1.68	8.84 ± 1.32	10.28 ± 1.07	Pass
DW-70187, 70188	2/14/2007	Gr. Alpha	6.79 ± 1.18	6.47 ± 1.08	6.63 ± 0.80	Pass
SWU-1162, 1163	2/27/2007	Gr. Beta	3.63 ± 0.69	2.61 ± 0.44	3.12 ± 0.41	Pass
DW-70205, 70206	2/28/2007	Gr. Alpha	0.88 ± 0.80	1.31 ± 0.79	1.10 ± 0.56	Pass
PW-1117, 1118	3/1/2007	Gr. Alpha	3.79 ± 1.91	3.62 ± 2.09	3.71 ± 1.42	Pass
PW-1117, 1118	3/1/2007	Gr. Beta	7.12 ± 1.40	7.20 ± 1.39	7.16 ± 0.99	Pass
W-2122, 2123	3/5/2007	Gr. Alpha	6.10 ± 4.16	3.80 ± 4.30	4.95 ± 2.99	Pass
W-2122, 2123	3/5/2007	Gr. Beta	10.65 ± 2.15	13.11 ± 2.42	11.88 ± 1.62	Pass
W-2085, 2086	3/6/2007	Gr. Alpha	2.51 ± 2.29	1.10 ± 2.78	1.81 ± 1.80	Pass
W-2085, 2086	3/6/2007	Gr. Beta	11.02 ± 1.85	9.50 ± 2.01	10.26 ± 1.37	Pass
DW-70232, 70233	3/8/2007	Gr. Alpha	4.75 ± 1.28	5.98 ± 1.31	5.37 ± 0.92	Pass
WW-1477, 1478	3/12/2007	Gr. Beta	6.41 ± 1.48	4.10 ± 1.25	5.26 ± 0.97	Pass
WW-1498, 1499	3/15/2007	Gr. Beta	0.83 ± 0.31	0.97 ± 0.33	0.90 ± 0.22	Pass
W-2140, 2141	3/19/2007	Gr. Alpha	2.31 ± 1.57	1.33 ± 1.64	1.82 ± 1.14	Pass
W-2140, 2141	3/19/2007	Gr. Beta	4.26 ± 1.00	5.58 ± 1.02	4.92 ± 0.71	Pass
DW-1626, 1627	3/21/2007	H-3	4973.00 ± 209.00	5190.00 ± 213.00	5081.50 ± 149.21	Pass
MI-1647, 1648	3/21/2007	K-40	1448.80 ± 120.20	1439.30 ± 126.00	1444.05 ± 87.07	Pass
DW-70248, 70249	3/21/2007	Gr. Alpha	11.10 ± 1.18	9.90 ± 1.16	10.50 ± 0.83	Pass
W-2150, 2151	3/26/2007	Gr. Alpha	3.56 ± 2.20	3.30 ± 1.81	3.43 ± 1.42	Pass
W-2150, 2151	3/26/2007	Gr. Beta	9.26 ± 1.00	10.17 ± 1.90	9.72 ± 1.07	Pass
LW-1941, 1942	3/31/2007	Gr. Beta	1.35 ± 0.43	1.36 ± 0.41	1.36 ± 0.30	Pass

TABLE A-5. In-House "Duplicate" Samples

Lab Code	Date	Analysis	Concentration (pCi/L) <sup>a</sup>			Acceptance
			First Result	Second Result	Averaged Result	
MI-1824, 1825	4/2/2007	K-40	1316.10 ± 110.60	1229.80 ± 110.50	1272.95 ± 78.17	Pass
MI-1824, 1825	4/2/2007	Sr-90	1.20 ± 0.50	1.10 ± 0.36	1.15 ± 0.31	Pass
AP-2170, 2171	4/2/2007	Be-7	0.08 ± 0.01	0.08 ± 0.01	0.08 ± 0.01	Pass
WW-1850, 1851	4/3/2007	H-3	-5.83 ± 102.29	150.05 ± 80.14	72.11 ± 64.97	Pass
AP-2198, 2199	4/3/2007	Be-7	0.08 ± 0.01	0.08 ± 0.01	0.08 ± 0.01	Pass
AP-2370, 2371	4/3/2007	Be-7	0.07 ± 0.01	0.07 ± 0.01	0.07 ± 0.01	Pass
DW-70300, 70301	4/4/2007	Gr. Alpha	3.78 ± 0.89	3.66 ± 0.96	3.72 ± 0.65	Pass
DW-70300, 70301	4/4/2007	Gr. Beta	2.93 ± 0.61	2.91 ± 0.64	2.92 ± 0.44	Pass
DW-70335, 70336	4/5/2007	Gr. Alpha	24.37 ± 2.89	22.72 ± 2.91	23.55 ± 2.05	Pass
DW-70335, 70336	4/5/2007	Gr. Beta	20.26 ± 1.37	18.33 ± 1.34	19.30 ± 0.96	Pass
SW-1898, 1899	4/10/2007	Gr. Alpha	3.86 ± 1.40	4.78 ± 1.51	4.32 ± 1.03	Pass
SW-1898, 1899	4/10/2007	Gr. Beta	6.31 ± 1.36	7.03 ± 1.42	6.67 ± 0.98	Pass
SW-1898, 1899	4/10/2007	H-3	241.99 ± 93.35	318.10 ± 96.48	280.04 ± 67.12	Pass
DW-70346, 70347	4/11/2007	Gr. Alpha	1.83 ± 1.08	2.54 ± 1.04	2.19 ± 0.75	Pass
DW-70346, 70347	4/11/2007	Gr. Beta	4.62 ± 0.72	4.01 ± 0.71	4.32 ± 0.51	Pass
DW-70376, 70377	4/11/2007	Gr. Alpha	1.81 ± 0.80	1.66 ± 0.86	1.74 ± 0.59	Pass
DW-70376, 70377	4/11/2007	Gr. Beta	1.84 ± 0.62	2.24 ± 0.61	2.04 ± 0.44	Pass
DW-70311, 70312	4/12/2007	Gr. Alpha	10.82 ± 1.50	13.20 ± 1.56	12.01 ± 1.08	Pass
WW-2349, 2350	4/17/2007	Gr. Alpha	0.71 ± 0.56	0.62 ± 0.52	0.66 ± 0.38	Pass
WW-2461, 2462	4/25/2007	H-3	190.30 ± 100.31	115.95 ± 97.65	153.13 ± 70.00	Pass
LW-2437, 2438	4/26/2007	Gr. Beta	2.71 ± 0.50	2.15 ± 0.45	2.43 ± 0.34	Pass
LW-2917, 2918	4/30/2007	Gr. Beta	1.97 ± 0.79	2.78 ± 0.81	2.38 ± 0.57	Pass
SO-2583, 2584	5/1/2007	Be-7	544.99 ± 247.70	601.13 ± 192.20	573.06 ± 156.76	Pass
SO-2583, 2584	5/1/2007	Cs-137	119.22 ± 36.61	87.46 ± 23.97	103.34 ± 21.88	Pass
SO-2583, 2584	5/1/2007	K-40	17825.00 ± 749.90	17672.00 ± 724.30	17748.50 ± 521.29	Pass
SO-2583, 2584	5/1/2007	Gr. Alpha	11.49 ± 3.96	8.04 ± 3.88	9.77 ± 2.77	Pass
SO-2583, 2584	5/1/2007	Gr. Beta	31.02 ± 3.74	26.10 ± 3.40	28.56 ± 2.53	Pass
SO-2583, 2584	5/1/2007	Sr-90	0.086 ± 0.024	0.068 ± 0.025	0.077 ± 0.017	Pass
S-2620, 2621	5/2/2007	H-3	277.90 ± 126.70	304.40 ± 101.00	291.15 ± 81.02	Pass
MI-2610, 2611	5/3/2007	K-40	1549.20 ± 184.20	1388.80 ± 128.20	1469.00 ± 112.21	Pass
W-4469, 4470	5/7/2007	Gr. Beta	10.60 ± 1.90	11.10 ± 1.80	10.85 ± 1.31	Pass
SS-2697, 2698	5/8/2007	Cs-137	0.06 ± 0.02	0.05 ± 0.03	0.05 ± 0.02	Pass
SS-2697, 2698	5/8/2007	K-40	8.03 ± 0.57	7.36 ± 0.68	7.70 ± 0.44	Pass
MI-2790, 2791	5/14/2007	K-40	1694.30 ± 126.20	1627.60 ± 128.80	1660.95 ± 90.16	Pass
W-4505, 4506	5/14/2007	Gr. Beta	3.30 ± 1.70	3.90 ± 1.50	3.60 ± 1.13	Pass
DW-3219, 3220	5/26/2007	I-131	0.62 ± 0.32	0.69 ± 0.31	0.66 ± 0.22	Pass
SO-3416, 3417	5/31/2007	Cs-137	0.15 ± 0.03	0.15 ± 0.03	0.15 ± 0.02	Pass
SO-3416, 3417	5/31/2007	Gr. Beta	22.88 ± 2.33	22.46 ± 2.37	22.67 ± 1.66	Pass
SO-3416, 3417	5/31/2007	K-40	12.26 ± 0.80	12.36 ± 0.65	12.31 ± 0.52	Pass
F-3561, 3562	5/31/2007	K-40	3.06 ± 0.39	3.37 ± 0.45	3.21 ± 0.30	Pass
SL-3311, 3312	6/4/2007	Be-7	0.61 ± 0.29	0.55 ± 0.25	0.58 ± 0.19	Pass
SL-3311, 3312	6/4/2007	K-40	5.78 ± 0.67	4.87 ± 0.25	5.33 ± 0.36	Pass

TABLE A-5. In-House "Duplicate" Samples

Lab Code	Date	Analysis	Concentration (pCi/L) <sup>a</sup>			Acceptance
			First Result	Second Result	Averaged Result	
SL-3992, 3993	6/4/2007	Be-7	0.75 ± 0.19	0.74 ± 0.32	0.75 ± 0.19	Pass
SL-3992, 3993	6/4/2007	Gr. Beta	13.61 ± 1.12	14.06 ± 1.08	13.84 ± 0.78	Pass
SL-3992, 3993	6/4/2007	K-40	2.43 ± 0.36	2.29 ± 0.40	2.36 ± 0.27	Pass
W-5087, 5088	6/11/2007	Gr. Beta	8.70 ± 1.90	7.70 ± 1.90	8.20 ± 1.34	Pass
SW-3710, 3711	6/14/2007	H-3	9571.51 ± 287.22	9879.21 ± 291.42	9725.36 ± 204.59	Pass
W-4062, 4063	6/28/2007	Gr. Alpha	0.76 ± 0.63	0.32 ± 0.66	0.54 ± 0.45	Pass
W-4062, 4063	6/28/2007	Gr. Beta	0.97 ± 0.53	0.58 ± 0.57	0.78 ± 0.39	Pass
AP-4448, 4449	6/28/2007	Be-7	0.10 ± 0.02	0.09 ± 0.02	0.10 ± 0.01	Pass
SG-3735, 3736	6/30/2007	Be-7	0.84 ± 0.12	0.82 ± 0.18	0.83 ± 0.11	Pass
SG-3735, 3736	6/30/2007	Cs-137	0.07 ± 0.01	0.07 ± 0.01	0.07 ± 0.01	Pass
SG-3735, 3736	6/30/2007	Gr. Beta	29.51 ± 2.22	30.81 ± 2.22	30.16 ± 1.57	Pass
SG-3735, 3736	6/30/2007	K-40	9.41 ± 0.31	8.90 ± 0.48	9.16 ± 0.29	Pass
LW-4175, 4176	6/30/2007	Gr. Beta	2.18 ± 0.60	1.93 ± 0.68	2.06 ± 0.45	Pass
SG-5422, 5423	7/2/2007	Gr. Alpha	10.31 ± 1.98	10.57 ± 1.99	10.44 ± 1.40	Pass
SG-5422, 5423	7/2/2007	Gr. Beta	18.59 ± 1.46	20.97 ± 1.49	19.78 ± 1.04	Pass
AP-4656, 4657	7/3/2007	Be-7	0.09 ± 0.02	0.10 ± 0.02	0.10 ± 0.01	Pass
AP-4763, 4764	7/3/2007	Be-7	0.11 ± 0.02	0.10 ± 0.02	0.11 ± 0.01	Pass
SG-5430, 5431	7/11/2007	Be-7	10.17 ± 0.48	10.06 ± 0.51	10.12 ± 0.35	Pass
SG-5430, 5431	7/11/2007	Cs-137	0.050 ± 0.010	0.059 ± 0.011	0.055 ± 0.007	Pass
SG-5430, 5431	7/11/2007	Gr. Alpha	17.86 ± 2.78	15.74 ± 2.70	16.80 ± 1.94	Pass
SG-5430, 5431	7/11/2007	Gr. Beta	26.19 ± 1.74	25.04 ± 1.86	25.62 ± 1.27	Pass
SG-5430, 5431	7/11/2007	K-40	7.69 ± 0.30	7.65 ± 0.28	7.67 ± 0.21	Pass
WW-4298, 4299	7/12/2007	Gr. Beta	1.74 ± 0.74	2.22 ± 0.80	1.98 ± 0.55	Pass
DW-70612, 70613	7/23/2007	Gr. Alpha	4.54 ± 1.11	4.19 ± 0.97	4.37 ± 0.74	Pass
WW-4918, 4919	7/25/2007	H-3	240.43 ± 111.12	216.68 ± 110.27	228.56 ± 78.27	Pass
MI-4742, 4743	7/26/2007	K-40	1820.30 ± 134.10	1802.90 ± 199.50	1811.60 ± 120.19	Pass
VE-4939, 4940	8/1/2007	Be-7	0.39 ± 0.21	0.45 ± 0.20	0.42 ± 0.15	Pass
VE-4939, 4940	8/1/2007	Gr. Beta	5.50 ± 0.14	5.76 ± 0.13	5.63 ± 0.10	Pass
VE-4939, 4940	8/1/2007	K-40	3.36 ± 0.45	3.36 ± 0.21	3.36 ± 0.25	Pass
SG-6274, 6275	8/6/2007	Gr. Alpha	16.68 ± 3.29	19.26 ± 3.39	17.97 ± 2.36	Pass
SG-6274, 6275	8/6/2007	Gr. Beta	40.93 ± 2.74	42.42 ± 2.66	41.68 ± 1.91	Pass
SW-5218, 5219	8/7/2007	I-131	1.31 ± 0.24	1.42 ± 0.24	1.37 ± 0.17	Pass
SG-6284, 6285	8/8/2007	Cs-137	0.043 ± 0.006	0.051 ± 0.007	0.047 ± 0.005	Pass
SG-6284, 6285	8/8/2007	Gr. Alpha	9.38 ± 2.93	13.61 ± 3.38	11.50 ± 2.24	Pass
SG-6284, 6285	8/8/2007	Gr. Beta	33.46 ± 2.84	32.87 ± 2.93	33.17 ± 2.04	Pass
SG-6284, 6285	8/8/2007	K-40	16.15 ± 0.24	16.23 ± 0.25	16.19 ± 0.17	Pass
WW-5310, 5311	8/9/2007	H-3	644.00 ± 106.00	831.00 ± 113.00	737.50 ± 77.47	Pass
SW-5393, 5394	8/14/2007	Gr. Beta	2.32 ± 1.31	1.71 ± 1.27	2.02 ± 0.92	Pass
SW-5393, 5394	8/14/2007	H-3	190.06 ± 86.80	69.05 ± 80.88	129.55 ± 59.32	Pass
W-5468, 5469	8/15/2007	H-3	262.58 ± 108.43	346.53 ± 111.42	304.55 ± 77.74	Pass

TABLE A-5. In-House "Duplicate" Samples

Lab Code	Date	Analysis	Concentration (pCi/L) <sup>a</sup>			Acceptance
			First Result	Second Result	Averaged Result	
VE-5553, 5554	8/22/2007	K-40	1.89 ± 0.33	1.89 ± 0.22	1.89 ± 0.20	Pass
WW-5643, 5644	8/22/2007	H-3	259.00 ± 110.00	266.00 ± 110.00	262.50 ± 77.78	Pass
SWU-5799, 5800	8/28/2007	Gr. Beta	2.64 ± 1.18	3.62 ± 1.06	3.13 ± 0.79	Pass
DW-70752, 70753	8/31/2007	Gr. Alpha	14.41 ± 1.48	12.90 ± 1.50	13.66 ± 1.05	Pass
VE-5917, 5918	9/4/2007	Be-7	0.94 ± 0.17	0.83 ± 0.20	0.89 ± 0.13	Pass
VE-5917, 5918	9/4/2007	K-40	3.73 ± 0.37	3.58 ± 0.36	3.66 ± 0.26	Pass
VE-5917, 5918	9/4/2007	Gr. Beta	2.71 ± 0.10	2.69 ± 0.10	2.70 ± 0.07	Pass
MI-6009, 6010	9/11/2007	K-40	1348.90 ± 113.40	1388.10 ± 116.40	1368.50 ± 81.25	Pass
MI-6030, 6031	9/12/2007	K-40	1242.70 ± 118.00	1475.60 ± 119.60	1359.15 ± 84.01	Pass
MI-6030, 6031	9/12/2007	Sr-90	1.00 ± 0.38	0.90 ± 0.34	0.95 ± 0.26	Pass
DW-70718, 70719	9/12/2007	Gr. Alpha	23.04 ± 3.71	23.22 ± 3.61	23.13 ± 2.59	Pass
DW-70718, 70719	9/12/2007	Gr. Beta	16.13 ± 1.59	17.36 ± 1.69	16.75 ± 1.16	Pass
SO-6156, 6157	9/14/2007	H-3	181.99 ± 90.67	232.19 ± 92.95	207.09 ± 64.92	Pass
SO-6484, 6485	9/17/2007	Cs-137	0.01 ± 0.00	0.01 ± 0.00	0.01 ± 0.00	Pass
SO-6484, 6485	9/17/2007	Gr. Beta	24.20 ± 2.60	23.30 ± 2.30	23.75 ± 1.74	Pass
SO-6484, 6485	9/17/2007	K-40	11.52 ± 1.16	10.89 ± 1.10	11.20 ± 0.80	Pass
WW-6469, 6470	9/21/2007	Gr. Beta	27.19 ± 2.51	24.23 ± 2.29	25.71 ± 1.70	Pass
E-6647, 6648	10/1/2007	Gr. Beta	1.82 ± 0.10	1.93 ± 0.11	1.88 ± 0.07	Pass
E-6647, 6648	10/1/2007	K-40	1.48 ± 0.24	1.31 ± 0.23	1.40 ± 0.17	Pass
WW-6656, 6657	10/1/2007	Gr. Beta	2.80 ± 0.97	1.95 ± 0.87	2.38 ± 0.65	Pass
TD-7080, 7081	10/2/2007	H-3	332.00 ± 229.00	383.00 ± 191.00	357.50 ± 149.10	Pass
SG-6891, 6892	10/3/2007	Gr. Alpha	12.93 ± 2.12	13.52 ± 2.07	13.23 ± 1.48	Pass
SG-6891, 6892	10/3/2007	Gr. Beta	18.08 ± 1.41	18.27 ± 1.36	18.18 ± 0.98	Pass
AP-7191, 7192	10/3/2007	Be-7	0.09 ± 0.01	0.09 ± 0.01	0.09 ± 0.01	Pass
WW-6786, 6787	10/8/2007	H-3	13333 ± 322	13532 ± 324	13433 ± 228	Pass
WW-6786, 6787	10/8/2007	H-3	13188 ± 322	13556 ± 326	13372 ± 229	Pass
VE-6828, 6829	10/8/2007	Gr. Alpha	0.06 ± 0.04	0.06 ± 0.05	0.06 ± 0.03	Pass
VE-6828, 6829	10/8/2007	Gr. Beta	5.55 ± 0.21	5.20 ± 0.22	5.38 ± 0.10	Pass
VE-6828, 6829	10/8/2007	K-40	5.45 ± 0.43	5.20 ± 0.49	5.32 ± 0.33	Pass
SS-6870, 6871	10/9/2007	Gr. Beta	18.10 ± 2.08	21.71 ± 2.19	19.90 ± 1.51	Pass
SS-6870, 6871	10/9/2007	K-40	10.19 ± 0.66	9.72 ± 0.68	9.95 ± 0.47	Pass
LW-7507, 7508	10/11/2007	Gr. Beta	1.40 ± 0.56	1.44 ± 0.54	1.42 ± 0.39	Pass
MI-6933, 6934	10/16/2007	K-40	1386.60 ± 104.70	1331.20 ± 106.70	1358.90 ± 74.74	Pass
MI-6933, 6934	10/16/2007	Sr-90	1.73 ± 0.52	2.17 ± 0.57	1.95 ± 0.39	Pass
MI-7059, 7060	10/17/2007	K-40	1424.80 ± 106.60	1448.60 ± 115.30	1436.70 ± 78.51	Pass
F-7213, 7214	10/24/2007	H-3	6.83 ± 0.22	7.24 ± 0.22	7.03 ± 0.16	Pass
F-7213, 7214	10/24/2007	K-40	3.13 ± 0.51	3.16 ± 0.48	3.15 ± 0.35	Pass
WW-7408, 7409	10/24/2007	H-3	340.71 ± 90.45	346.22 ± 90.67	343.46 ± 64.03	Pass
DW-70856, 70857	10/24/2007	Gr. Alpha	11.03 ± 1.66	10.71 ± 1.34	10.87 ± 1.07	Pass
SO-7508, 7509	10/26/2007	Cs-137	0.30 ± 0.04	0.29 ± 0.05	0.29 ± 0.03	Pass
SO-7508, 7509	10/26/2007	Gr. Beta	34.43 ± 2.72	37.25 ± 3.07	35.84 ± 2.05	Pass
SO-7508, 7509	10/26/2007	K-40	16.84 ± 0.84	17.43 ± 1.05	17.14 ± 0.67	Pass

TABLE A-5. In-House "Duplicate" Samples

Lab Code	Date	Analysis	Concentration (pCi/L) <sup>a</sup>			Acceptance
			First Result	Second Result	Averaged Result	
SS-7529, 7530	10/29/2007	Cs-137	0.12 ± 0.03	0.12 ± 0.02	0.12 ± 0.02	Pass
SS-7529, 7530	10/29/2007	K-40	11.85 ± 0.68	11.75 ± 0.58	11.80 ± 0.45	Pass
SW-7589, 7590	10/30/2007	Gr. Beta	1.75 ± 0.29	1.24 ± 0.26	1.50 ± 0.19	Pass
SWU-7733, 7734	10/30/2007	Gr. Beta	1.66 ± 1.01	2.43 ± 1.13	2.05 ± 0.76	Pass
MI-7618, 7619	10/31/2007	K-40	1376.80 ± 114.30	1426.70 ± 128.80	1401.75 ± 86.10	Pass
VE-7666, 7667	11/5/2007	Gr. Alpha	0.07 ± 0.04	0.16 ± 0.05	0.11 ± 0.03	Pass
VE-7666, 7667	11/5/2007	Gr. Beta	6.03 ± 0.15	6.13 ± 0.15	6.08 ± 0.10	Pass
VE-7666, 7667	11/5/2007	K-40	5.82 ± 0.36	5.74 ± 0.36	5.78 ± 0.25	Pass
DW-7853, 7854	11/9/2007	I-131	1.61 ± 0.40	1.08 ± 0.39	1.35 ± 0.28	Pass
MI-7874, 7875	11/14/2007	K-40	1407.70 ± 101.30	1362.60 ± 114.50	1385.15 ± 76.44	Pass
WW-8142, 8143	11/28/2007	Gr. Beta	9.51 ± 2.21	7.86 ± 2.01	8.68 ± 1.49	Pass
DW-8094, 8095	11/29/2007	Gr. Beta	1.60 ± 0.58	1.25 ± 0.54	1.43 ± 0.40	Pass
F-8328, 8329	12/11/2007	Gr. Beta	3.97 ± 0.08	4.00 ± 0.08	3.99 ± 0.05	Pass
WW-8378, 8379	12/11/2007	H-3	296.00 ± 103.00	407.00 ± 107.00	351.50 ± 74.26	Pass

Note: 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.

<sup>a</sup> Results are reported in units of pCi/L, except for air filters (pCi/Filter), food products, vegetation, soil, sediment (pCi/g).

TABLE A-6. Department of Energy's Mixed Analyte Performance Evaluation Program (MAPEP)<sup>a</sup>.

Lab Code <sup>c</sup>	Date	Analysis	Concentration <sup>b</sup>			Acceptance
			Laboratory result	Known Activity	Control Limits <sup>d</sup>	
STW-1110	01/01/07	Gr. Alpha	0.45 ± 0.08	0.33	0.00 - 0.65	Pass
STW-1110	01/01/07	Gr. Beta	0.90 ± 0.14	0.85	0.43 - 1.28	Pass
STW-1111 <sup>e</sup>	01/01/07	Am-241	2.80 ± 0.21	1.71	1.20 - 2.22	Fail
STW-1111	01/01/07	Co-57	151.60 ± 10.00	143.70	100.60 - 186.80	Pass
STW-1111	01/01/07	Cs-134	79.20 ± 8.00	83.50	58.50 - 108.60	Pass
STW-1111	01/01/07	Cs-137	168.70 ± 12.10	163.00	114.10 - 211.90	Pass
STW-1111	01/01/07	Fe-55	130.30 ± 19.90	129.30	90.50 - 168.10	Pass
STW-1111	01/01/07	H-3	262.20 ± 9.10	283.00	198.10 - 367.90	Pass
STW-1111	01/01/07	Mn-54	130.60 ± 11.50	123.80	86.70 - 160.90	Pass
STW-1111	01/01/07	Ni-63	127.80 ± 3.60	130.40	91.30 - 169.50	Pass
STW-1111	01/01/07	Ni-63	127.80 ± 3.60	130.40	91.30 - 169.50	Pass
STW-1111	01/01/07	Pu-238	2.03 ± 0.17	2.25	1.58 - 2.93	Pass
STW-1111	01/01/07	Pu-239/40	2.27 ± 0.17	2.22	1.55 - 2.89	Pass
STW-1111	01/01/07	Sr-90	9.60 ± 1.40	8.87	6.21 - 11.53	Pass
STW-1111	01/01/07	Tc-99	8.80 ± 1.50	88.00	7.40 - 13.70	Pass
STW-1111	01/01/07	U-233/4	2.44 ± 0.21	2.49	1.74 - 3.24	Pass
STW-1111	01/01/07	U-238	2.44 ± 0.21	2.48	1.74 - 3.22	Pass
STW-1111	01/01/07	Zn-65	123.70 ± 17.00	114.80	80.40 - 149.20	Pass
STSO-1112 <sup>f</sup>	01/01/07	Am-241	46.40 ± 9.00	34.80	24.40 - 45.20	Fail
STSO-1112	01/01/07	Co-57	501.20 ± 2.90	471.20	329.80 - 612.60	Pass
STSO-1112	01/01/07	Co-60	285.90 ± 2.10	274.70	192.30 - 357.10	Pass
STSO-1112	01/01/07	Cs-134	325.90 ± 7.40	327.40	229.20 - 425.60	Pass
STSO-1112	01/01/07	Cs-137	855.70 ± 4.60	799.70	559.80 - 1039.60	Pass
STSO-1112	01/01/07	Mn-54	750.90 ± 4.70	685.20	479.60 - 890.80	Pass
STAP-1113	01/01/07	Gr. Alpha	0.27 ± 0.04	0.60	0.00 - 1.20	Pass
STAP-1113	01/01/07	Gr. Beta	0.57 ± 0.05	0.44	0.22 - 0.66	Pass
STAP-1114	01/01/07	Am-241	0.10 ± 0.03	0.10	0.07 - 0.13	Pass
STAP-1114	01/01/07	Co-57	3.51 ± 0.07	2.89	2.02 - 3.75	Pass
STAP-1114	01/01/07	Co-60	2.98 ± 0.10	2.91	2.03 - 3.78	Pass
STAP-1114	01/01/07	Cs-134	4.02 ± 0.16	4.20	2.94 - 5.45	Pass
STAP-1114	01/01/07	Cs-137	2.75 ± 0.12	2.57	1.80 - 3.34	Pass
STAP-1114	01/01/07	Mn-54	3.94 ± 0.12	3.52	2.46 - 4.57	Pass
STAP-1114	01/01/07	Pu-238	0.07 ± 0.01	0.07	0.05 - 0.09	Pass
STAP-1114	01/01/07	Pu-239/40	0.08 ± 0.01	0.08	0.06 - 0.11	Pass
STAP-1114	01/01/07	Sr-90	0.58 ± 0.18	0.61	0.43 - 0.79	Pass
STAP-1114	01/01/07	U-233/4	0.09 ± 0.01	0.10	0.07 - 0.13	Pass
STAP-1114	01/01/07	U-238	0.09 ± 0.01	0.10	0.07 - 0.13	Pass
STAP-1114	01/01/07	Zn-65	2.70 ± 0.10	2.68	1.88 - 3.49	Pass

TABLE A-6. Department of Energy's Mixed Analyte Performance Evaluation Program (MAPEP)<sup>a</sup>.

Lab Code <sup>c</sup>	Date	Analysis	Concentration <sup>b</sup>		Control Limits <sup>d</sup>	Acceptance
			Laboratory result	Known Activity		
STVE-1115	01/01/07	Co-57	8.90 ± 0.20	8.19	5.73 - 10.64	Pass
STVE-1115	01/01/07	Co-60	6.50 ± 0.20	5.82	4.08 - 7.57	Pass
STVE-1115	01/01/07	Cs-134	6.90 ± 0.30	6.21	4.35 - 8.07	Pass
STVE-1115	01/01/07	Cs-137	8.20 ± 0.30	6.99	4.90 - 9.09	Pass
STVE-1115	01/01/07	Mn-54	10.10 ± 0.30	8.46	5.91 - 10.98	Pass

<sup>a</sup> 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

<sup>b</sup> Results are reported in units of Bq/kg (soil), Bq/L (water) or Bq/total sample (filters, vegetation).

<sup>c</sup> Laboratory codes as follows: STW (water), STAP (air filter), STSO (soil), STVE (vegetation).

<sup>d</sup> MAPEP results are presented as the known values and expected laboratory precision (1 sigma, 1 determination) and control limits as defined by the MAPEP.

<sup>e</sup> Result of reanalysis, 2.08 ± 0.13 pCi/L.

<sup>f</sup> The test samples were recounted on lower background detectors. Result of the recounts: 41.4 ± 6.3 Bq/kg.



TABLE A-7. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA)<sup>a</sup>.

Lab Code <sup>b</sup>	Date	Analysis	Concentration (pCi/L)		Control Limits	Acceptance
			Laboratory Result <sup>c</sup>	ERA Result <sup>d</sup>		
STAP-1116	03/19/07	Gr. Alpha	34.64 ± 2.56	25.8	12.4 - 39	Pass
STAP-1116	03/19/07	Gr. Beta	93.41 ± 3.20	79.5	48.8 - 116	Pass
STAP-1117	03/19/07	Am-241	56.04 ± 3.90	57.5	33.1 - 80	Pass
STAP-1117	03/19/07	Co-60	1610.00 ± 8.40	1300.0	1010.0 - 1620	Pass
STAP-1117	03/19/07	Cs-134	1340.40 ± 48.84	1120.0	732.0 - 1380	Pass
STAP-1117 <sup>e</sup>	03/19/07	Cs-137	345.30 ± 8.20	255.0	192.0 - 336	Fail
STAP-1117 <sup>f</sup>	03/19/07	Fe-55	< 134.0	0.0		Pass
STAP-1117 <sup>f</sup>	03/19/07	Mn-54	< 5.0	0.0		Pass
STAP-1117	03/19/07	Pu-238	43.32 ± 2.28	37.4	25.7 - 49	Pass
STAP-1117	03/19/07	Pu-239/40	35.23 ± 2.24	31.6	22.9 - 41	Pass
STAP-1117	03/19/07	Sr-90	156.10 ± 6.60	156.0	66.6 - 246	Pass
STAP-1117	03/19/07	U-233/4	42.22 ± 1.84	47.8	30.1 - 71	Pass
STAP-1117	03/19/07	U-238	42.00 ± 1.84	47.4	30.2 - 68	Pass
STAP-1117	03/19/07	Uranium	85.79 ± 3.60	97.3	49.5 - 155	Pass
STAP-1117	03/19/07	Zn-65	363.80 ± 11.90	245.0	208.0 - 412	Pass
STSO-1118	03/19/07	Ac-228	3097.77 ± 94.96	2790.0	1790.0 - 3930	Pass
STSO-1118	03/19/07	Am-241	1000.70 ± 156.10	927.0	548.0 - 1200	Pass
STSO-1118	03/19/07	Bi-212	2467.87 ± 114.33	2500.0	658.0 - 3730	Pass
STSO-1118	03/19/07	Co-60	7847.40 ± 86.60	7330.0	5340.0 - 9820	Pass
STSO-1118	03/19/07	Cs-134	7910.60 ± 356.88	7560.0	4850.0 - 9070	Pass
STSO-1118	03/19/07	Cs-137	4635.00 ± 99.10	4300.0	3290.0 - 5580	Pass
STSO-1118	03/19/07	K-40	12201.60 ± 423.20	11100.0	8050.0 - 15000	Pass
STSO-1118 <sup>f</sup>	03/19/07	Mn-54	< 34.0	0.0		Pass
STSO-1118	03/19/07	Pb-212	2046.80 ± 127.20	1730.0	1120.0 - 2430	Pass
STSO-1118	03/19/07	Pb-214	4142.80 ± 110.40	3330.0	1980.0 - 4980	Pass
STSO-1118	03/19/07	Pu-238	1099.20 ± 73.10	857.0	490.0 - 1200	Pass
STSO-1118	03/19/07	Pu-239/40	1586.10 ± 82.00	1360.0	928.0 - 1810	Pass
STSO-1118	03/19/07	Sr-90	6163.30 ± 791.60	7500.0	2610.0 - 12400	Pass
STSO-1118	03/19/07	Th-234	4329.40 ± 569.10	3590.0	2190.0 - 4560	Pass
STSO-1118	03/19/07	U-233/4	3236.70 ± 106.00	3620.0	2280.0 - 4520	Pass
STSO-1118	03/19/07	U-238	3425.20 ± 134.00	3590.0	2190.0 - 4560	Pass
STSO-1118	03/19/07	Uranium	6787.80 ± 240.00	7380.0	4210.0 - 9930	Pass
STSO-1118	03/19/07	Uranium	6787.80 ± 240.00	7380.0	4210.0 - 9930	Pass
STSO-1118 <sup>f</sup>	03/19/07	Zn-65	0.00 ± 0.00	0.0	0.0 - 0	Pass

TABLE A-7. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA)<sup>a</sup>.

Lab Code <sup>b</sup>	Date	Analysis	Concentration (pCi/L)		Control Limits	Acceptance
			Laboratory Result <sup>c</sup>	ERA Result <sup>d</sup>		
STVE-1119	03/19/07	Am-241	3249.60 ± 150.30	3550.0	2020.0 - 4890	Pass
STVE-1119	03/19/07	Cm-244	1860.70 ± 91.50	1840.0	905.0 - 2870	Pass
STVE-1119	03/19/07	Co-60	2827.90 ± 62.40	2600.0	1760.0 - 3720	Pass
STVE-1119	03/19/07	Cs-134	654.80 ± 48.40	579.0	308.0 - 822	Pass
STVE-1119	03/19/07	Cs-137	3307.30 ± 58.80	2920.0	2150.0 - 4060	Pass
STVE-1119	03/19/07	K-40	40814.20 ± 618.80	37900.0	27200.0 - 53600	Pass
STVE-1119 <sup>f</sup>	03/19/07	Mn-54	< 27.6	0.0		Pass
STVE-1119	03/19/07	Pu-238	2762.00 ± 251.10	2430.0	1250.0 - 3600	Pass
STVE-1119	03/19/07	Pu-239/40	2156.60 ± 83.40	1900.0	1180.0 - 2600	Pass
STVE-1119	03/19/07	Sr-90	8999.70 ± 580.90	8890.0	4900.0 - 11800	Pass
STVE-1119	03/19/07	U-233/4	2821.90 ± 73.50	2940.0	1930.0 - 3920	Pass
STVE-1119	03/19/07	U-238	2896.10 ± 50.70	2910.0	2090.0 - 3610	Pass
STVE-1119	03/19/07	Uranium	5718.00 ± 124.15	5980.0	4110.0 - 7770	Pass
STVE-1119	03/19/07	Zn-65	474.30 ± 45.70	366.0	267.0 - 500	Pass
STW-1120	03/19/07	Am-241	133.50 ± 10.60	179.0	123.0 - 243	Pass
STW-1120	03/19/07	Co-60	541.40 ± 9.00	536.0	467.0 - 631	Pass
STW-1120	03/19/07	Cs-134	1623.80 ± 66.10	1750.0	1290.0 - 2020	Pass
STW-1120	03/19/07	Cs-137	1839.10 ± 17.90	1850.0	1570.0 - 2220	Pass
STW-1120	03/19/07	Fe-55	829.50 ± 226.80	671.0	392.0 - 896	Pass
STW-1120 <sup>f</sup>	03/19/07	Mn-54	< 8.1	0.0		Pass
STW-1120	03/19/07	Pu-238	123.30 ± 4.30	116.0	87.6 - 144	Pass
STW-1120	03/19/07	Pu-239/40	95.10 ± 3.80	90.9	70.3 - 113	Pass
STW-1120	03/19/07	Sr-90	949.40 ± 16.70	989.0	630.0 - 1320	Pass
STW-1120	03/19/07	U-233/4	164.20 ± 6.58	192.0	145.0 - 247	Pass
STW-1120	03/19/07	U-238	169.20 ± 8.22	190.0	145.0 - 236	Pass
STW-1120	03/19/07	Uranium	339.60 ± 10.66	391.0	282.0 - 521	Pass
STW-1120	03/19/07	Zn-65	2009.00 ± 36.40	1910.0	1600.0 - 2410	Pass

<sup>a</sup> Results obtained by Environmental, Inc., Midwest Laboratory as a participant in the crosscheck program for proficiency testing administered by Environmental Resources Associates, serving as a replacement for studies conducted previously by the Environmental Measurements Laboratory Quality Assessment Program (EML).

<sup>b</sup> Laboratory codes as follows: STW (water), STAP (air filter), STSO (soil), STVE (vegetation).

<sup>c</sup> Unless otherwise indicated, the laboratory result is given as the mean ± standard deviation for three determinations.

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

<sup>e</sup> A high bias (~ 20%) was observed in gamma results for air filters. A composite filter geometry was used in the calculations vs. a single filter geometry. Result of recalculation. Cs-137, 305.8 ± 6.0 pCi/filter.

<sup>f</sup> Included in the testing series as a "false positive". No activity expected.

APPENDIX B

DATA REPORTING CONVENTIONS

## Data Reporting Conventions

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

### 2.0. Single Measurements

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

where:  $x$  = value of the measurement;

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

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

where  $L$  = the lower limit of detection based on  $4.66\sigma$  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  $x_1, x_2, \dots, x_n$  are defined as follows:

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

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

4.3 If all 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<sup>a</sup>.

	Air (pCi/m <sup>3</sup> )	Water (pCi/L)	
Gross alpha	$1 \times 10^{-3}$	Strontium-89	8,000
Gross beta	1	Strontium-90	500
Iodine-131 <sup>b</sup>	$2.8 \times 10^{-1}$	Cesium-137	1,000
		Barium-140	8,000
		Iodine-131	1,000
		Potassium-40 <sup>c</sup>	4,000
		Gross alpha	2
		Gross beta	10
		Tritium	$1 \times 10^6$

<sup>a</sup> 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.

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

<sup>c</sup> A natural radionuclide.

APPENDIX D  
Sampling Location Maps

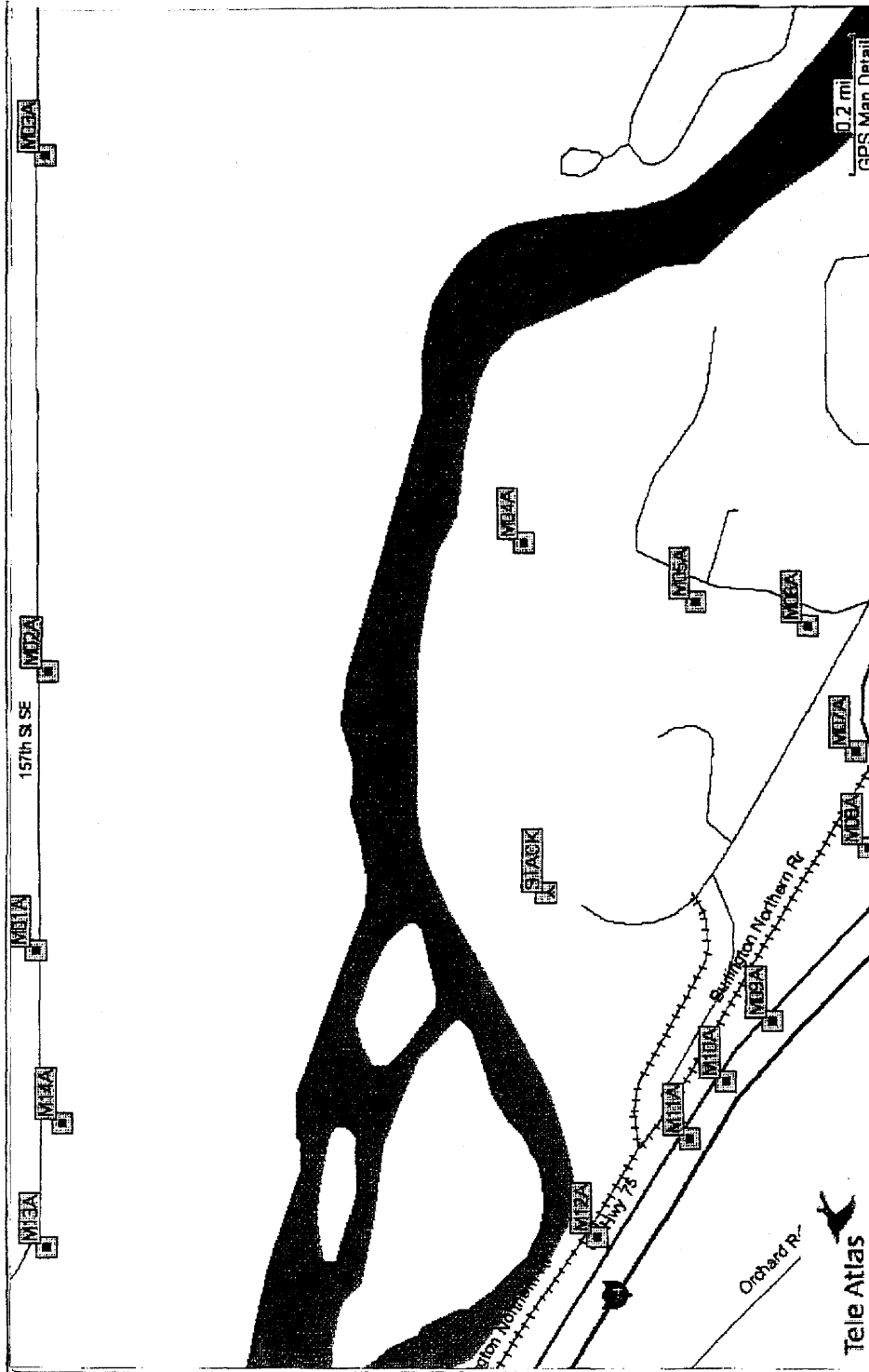


Figure D-1, Sample Collection and Analysis program: TLD locations, Inner ring (Table 5.2).



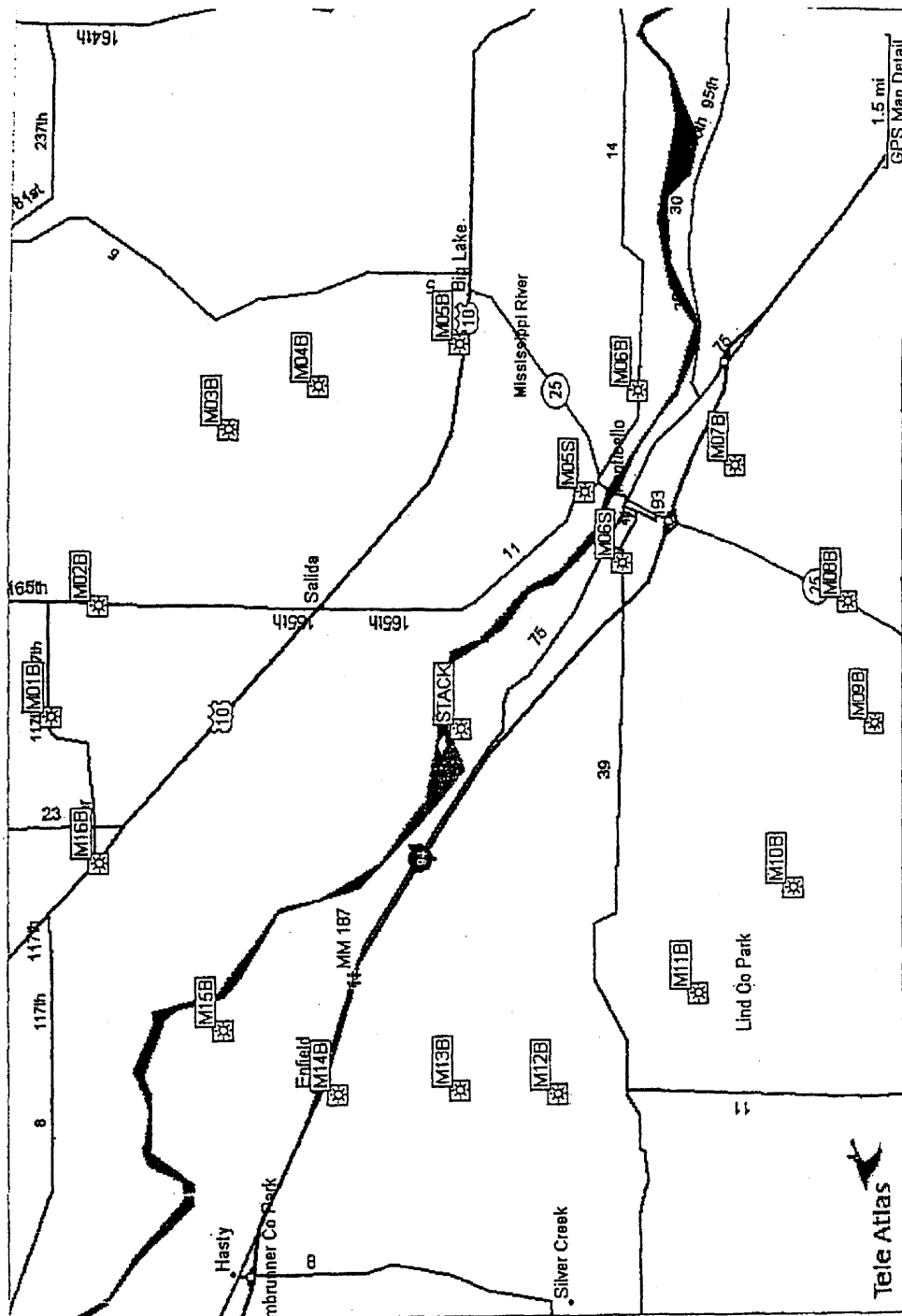


Figure D-2. Sample Collection and Analysis program: TLD locations, Outer ring (Table 5.2).



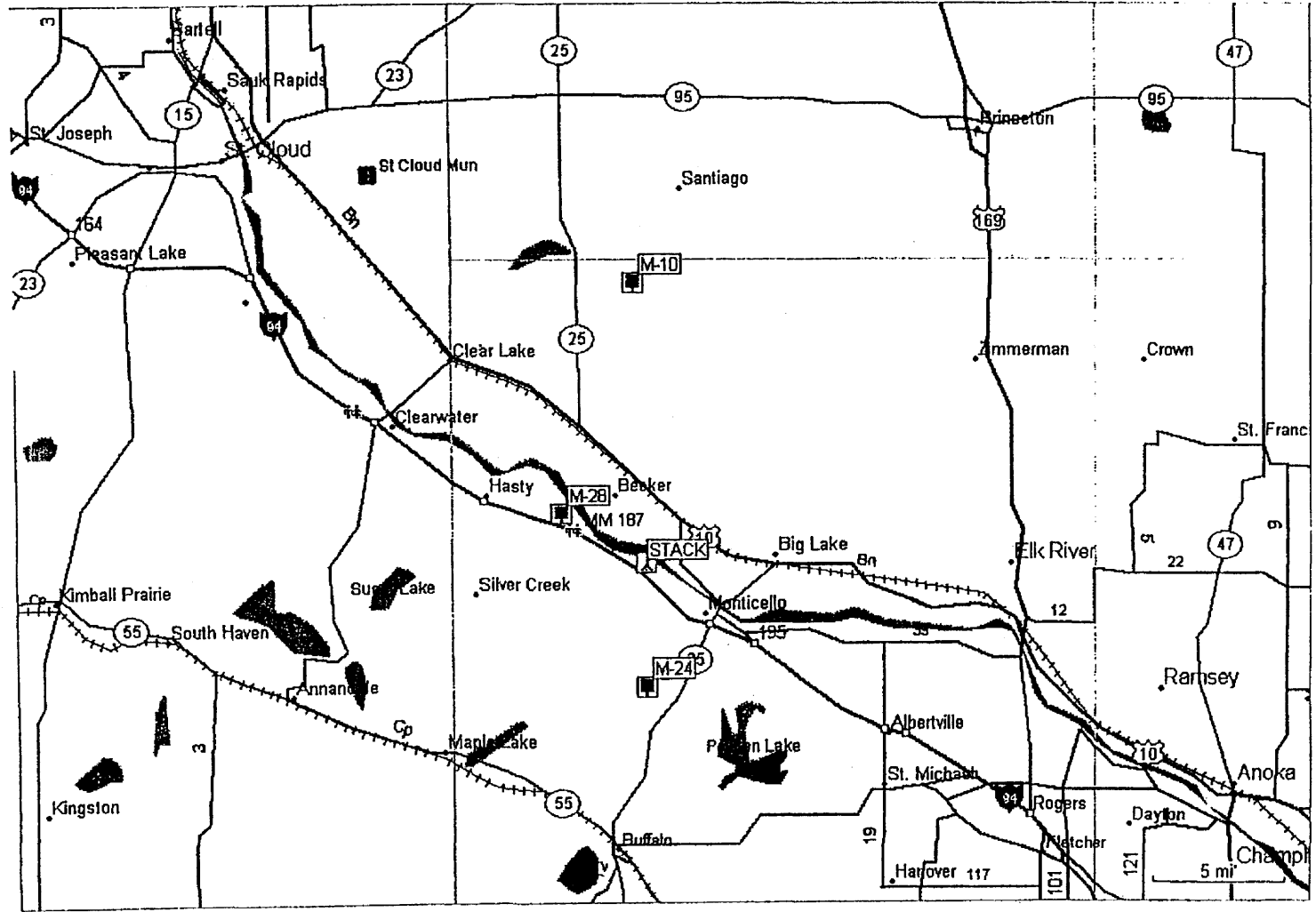


Figure D-4. Sample Collection and Analysis Program: Radiation Environmental Monitoring Program, Milk sampling locations. (Table 5.2)

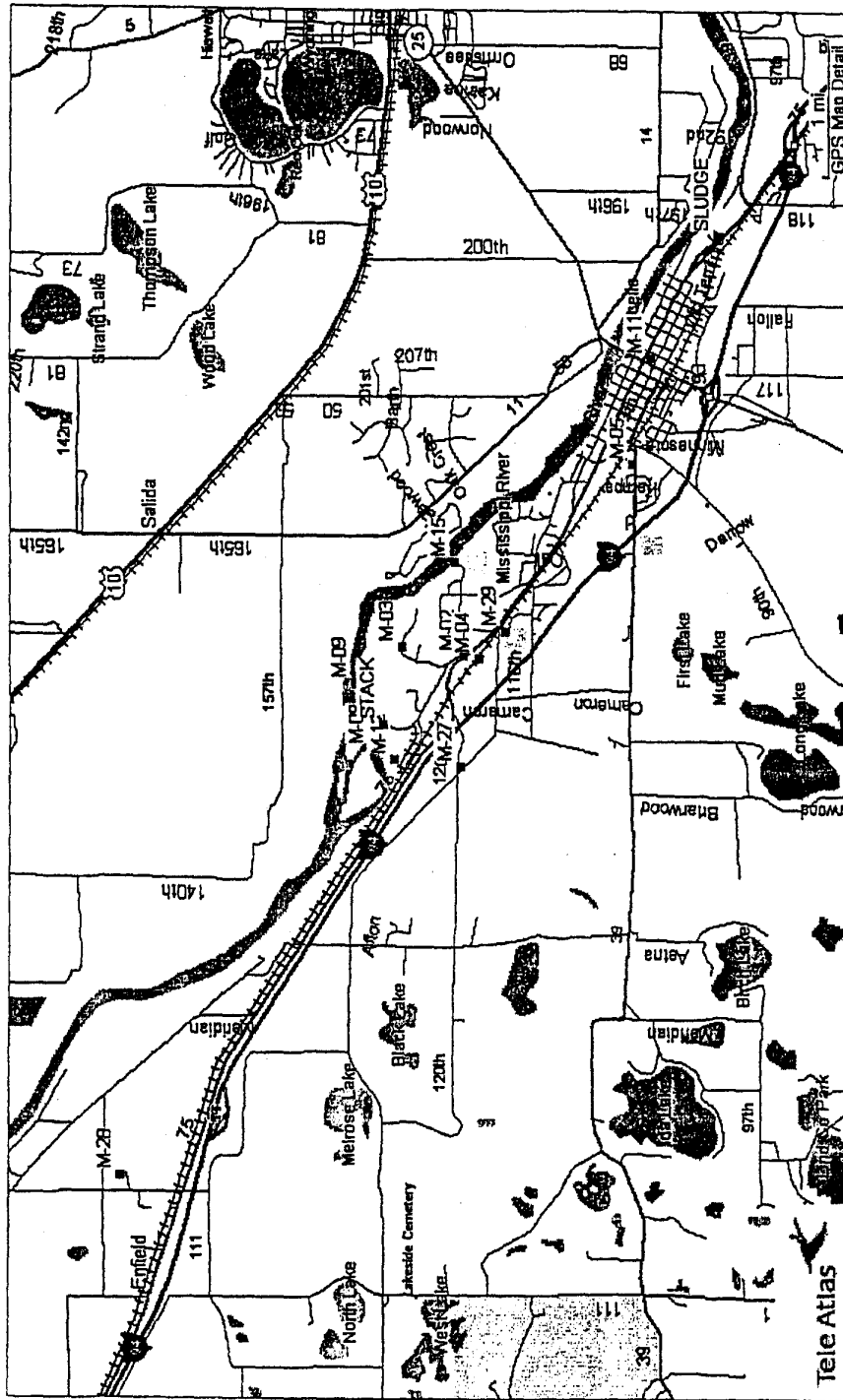


Figure D-5. Sample Collection and Analysis Program: Radiation Environmental Monitoring Program, Milk, Sludge, Ground Water and Shoreline sampling locations (Table 5-2.)