Xcel Energy®

MAY 12 2011

L-PI-11-040
TS 5.6.2
ISFSI TS 6.2

U S Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Prairie Island Nuclear Generating Plant
Units 1 and 2
Dockets 50-282 and 50-306
License Nos. DPR-42 and DPR-60

Prairie Island Independent Spent
Fuel Storage Installation
Docket 72-10
Materials License No. SNM-2506

2010 Annual Radiological Environmental Monitoring Program (REMP) Report

Pursuant to Prairie Island Nuclear Generating Plant (PINGP) Technical Specification (TS) 5.6.2, Appendix A to Operating Licenses DPR-42 and DPR-60, and Prairie Island Independent Spent Fuel Storage Installation Technical Specification (ISFSI TS) 6.2, Appendix A to Materials License SNM-2506, the Northern States Power Company, a Minnesota corporation (NSPM), doing business as Xcel Energy (hereafter "NSPM"), submits one copy of the Annual Radiological Environmental Monitoring Program report for the period January 1, 2010 through December 31, 2010 as Enclosure 1.

Summary of Commitments

This letter contains no new commitments and no revisions to existing commitments.

Mark A. Schimmel
Site Vice President, Prairie Island Nuclear Generating Plant
Northern States Power Company - Minnesota

Enclosure

cc: Regional Administrator, USNRC, Region III
Project Manager, Prairie Island Nuclear Generating Plant, USNRC, NRR
NRC Resident Inspector, Prairie Island Nuclear Generating Plant
Billy Dickson, USNRC, Region III
Director of NMSS, USNRC
Department of Health, State of Minnesota
PI Dakota Community Environmental Coordinator

IE25
NMSS06

1717 Wakonade Drive East • Welch, Minnesota 55089-9642
Telephone: 651.388.1121

ENCLOSURE 1

Annual Report to the United States Nuclear Regulatory Commission

Radiological Environmental Monitoring Program

January 1, 2010 through December 31, 2010

75 pages follow

ATI Environmental, Inc.
Midwest Laboratory
700 Landwehr Road • Northbrook, IL 60062-2310
phone (847) 564-0700 • fax (847) 564-4517

XCEL ENERGY CORPORATION

PRAIRIE ISLAND NUCLEAR GENERATING PLANT

ANNUAL REPORT
to the
UNITED STATES NUCLEAR REGULATORY COMMISSION

Radiological Environmental Monitoring Program

January 1 to December 31, 2010

Docket No.	50-282	License No.	DPR-42
	50-306		DPR-60
ISFSI			
Docket No.	72-10		SNM-2506

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 members of the staff of the Prairie Island Nuclear Generating Plant, operated by Northern States Power Co. –Minnesota, for XCEL Energy Corporation. The report was prepared by Environmental, Inc., Midwest Laboratory.

TABLE OF CONTENTS

Section | Page

Preface ii

List of Tables iv

List of Figures v

1.0 INTRODUCTION 1

2.0 SUMMARY 2

3.0 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (REMP) 3

3.1 Program Design and Data Interpretation 3
3.2 Program Description 4
3.3 Program Execution 5
3.4 Laboratory Procedures 6
3.5 Program Modifications 6
3.6 Land Use Census 6

4.0 RESULTS AND DISCUSSION 7

4.1 Atmospheric Nuclear Detonations and Nuclear Accidents 7

4.2 Summary of Preoperational Data 7

4.3 Program Findings 8

5.0 FIGURES AND TABLES 12

6.0 REFERENCES CITED 25

APPENDICES

A Interlaboratory Comparison Program Results A-1

Attachment 1, Acceptance Criteria for "Spiked" Samples A-2

B Data Reporting Conventions B-1

C Maximum Permissible Concentrations of Radioactivity in Air and Water Above Natural Background in Unrestricted Areas C-1

D Sampling Location Maps D-1

E Special Well and Surface Water Samples E-1

LIST OF TABLES

No.	Title	Page
5.1	Sample Collection and Analysis Program	15
5.2	Sampling Locations	16
5.3	Missed Collections and Analyses	19
5.4	Radiological Environmental Monitoring Program Summary	20

In addition, the following tables can be found in the Appendices:

Appendix A

A-1	Environmental Resources Associates, Crosscheck Program Results	A1-1
A-2	Program Results; (TLDs)	A2-1
A-3	In-house "Spiked" Samples	A3-1
A-4	In-house "Blank" Samples	A4-1
A-5	In-house "Duplicate" Samples	A5-1
A-6	Department of Energy MAPEP comparison results	A6-1
A-7	Environmental Resources Associates, Crosscheck Program Results (EML study replacement)	A7-1

Appendix C

C-1	Maximum Permissible Concentrations of Radioactivity in Air and Water Above Natural Background in Unrestricted Areas	C-2

Appendix E

E-4.1	Sample collection and analysis program	E-6
E-4.2	Sampling locations	E-7
E-4.3	REMP Summary	E-8
E-4.4	REMP Complete Data Tables	E-9
E-4.5	Supplementary Data Tables	E-12

LIST OF FIGURES

No.	Title	Page
5.1	Offsite Ambient Radiation (TLDs), average of inner and outer ring indicator locations versus control	13
5.2	Airborne Particulates; analysis for gross beta, average mean of all indicator locations (P-2,3,4,6) versus control location (P-1)	14

MAPS

Appendix D	Title	Page
	TLD locations within a one mile radius	D-2
	TLD locations, Controls	D-3
	TLD locations, surrounding the ISFSI Area	D-3
	TLD locations within a five mile radius	D-4
	REMP sampling points within a one mile radius	D-5
	REMP sampling points within a five mile radius	D-6
	REMP sampling points, Control locations	D-7
Appendix E		
	Onsite Tritium Sampling Well locations	E-14

1.0 INTRODUCTION

This report summarizes and interprets results of the Radiological Environmental Monitoring Program (REMP) conducted by Environmental, Inc., Midwest Laboratory at the Prairie Island Nuclear Generating Plant, Red Wing, Minnesota, during the period January - December, 2010. 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.

Tabulations 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, 2011b) available at Prairie Island Nuclear Generating Plant.

Prairie Island Nuclear Generating Plant is located on the Mississippi River in Goodhue County, Minnesota, owned by Xcel Energy Corporation and operated by Northern States Power Co.-Minnesota. The plant has two 575 MWe pressurized water reactors. Unit 1 achieved initial criticality on 1 December 1973. Commercial operation at full power began on 16 December 1973. Unit 2 achieved initial criticality on 17 December 1974. Commercial operation at full power began on 21 December 1974.

2.0 SUMMARY

The Radiological Environmental Monitoring Program (REMP) required by the U.S. Nuclear Regulatory Commission (NRC) Offsite Dose Calculation Manual for the Prairie Island Nuclear Generating Plant and the Independent Spent Fuel Storage Installation (ISFSI) is described. Results for 2010 are summarized and discussed.

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

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 Prairie Island 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 (TLDs).

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 Prairie Island 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 the environmental samples collected from the plant site. The plant's monitoring program includes analyses for tritium and iodine-131. Most samples are 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 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.

3.1 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 at Prairie Island 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 reactor site or ISFSI facility, as appropriate. To assure that sampling is carried out in a reproducible manner, detailed sampling procedures have been prescribed (Prairie Island Nuclear Generating Plant, 2010). Maps of fixed 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. Airborne iodine is collected by continuous pumping through charcoal filters at these same 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 (P-1), and four are indicators (P-2, P-3, P-4, and P-6).

Offsite ambient gamma radiation is monitored at thirty-four locations, using $CaSO_4$:Dy dosimeters with four sensitive areas at each location: ten in an inner ring in the general area of the site boundary, fifteen in the outer ring within a 4-5 mile radius, eight at special interest locations, and one control location, 11.1 miles distant from the plant. They are replaced and measured quarterly.

Ambient gamma radiation is monitored at the Independent Spent Fuel Storage Installation (ISFSI) Facility by twenty $CaSO_4$:Dy dosimeters. Twelve dosimeters are located inside of the earthen berm in direct line of sight from the storage casks and eight dosimeters are located outside of the earthen berm. They are replaced and measured quarterly.

Milk samples are collected monthly from four farms (three indicators and one control) and analyzed for iodine-131 and gamma-emitting isotopes. The milk is collected biweekly during the growing season (May - October), because the milk animals may be on pasture.

For additional monitoring of the terrestrial environment, green leafy vegetables (cabbage) are collected annually from the highest D/Q garden and a control location (P-38), and analyzed for gamma-emitting isotopes, including iodine-131. Corn is collected annually only if fields are irrigated with river water and analyzed for gamma-emitting isotopes. Well water and ground water are collected quarterly from four locations near the plant and analyzed for tritium and gamma-emitting isotopes.

River water is collected weekly at two locations, one upstream of the plant (P-5) and one downstream (P-6, Lock and Dam No.3). Monthly composites are analyzed for gamma-emitting isotopes. Quarterly composites are analyzed for tritium.

3.2 Program Description (continued)

Drinking water is collected weekly from the City of Red Wing well. 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, periphyton or invertebrates, and bottom sediments. Shoreline sediment is collected semi-annually from one 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:

All samples were collected and analyzed as scheduled.

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, 2009). 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 modifications to the REMP in 2010.

3.6 Land Use Census

In accordance with the Prairie Island Nuclear Generating Plant Offsite Dose Calculation Manual, H4, (ODCM) a land use census is conducted in order to 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. This census is conducted at least once per 12 months between the dates of May 1 and October 31. If new locations yield a calculated dose or dose equivalent (via the same exposure pathway) twenty percent greater than the required locations per the ODCM, then the new locations are added to the radiological 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.

This land use census insures the updating of the radiological environmental monitoring program should sampling locations change within the 5 mile radius from the plant.

The Land Use Census was completed in September, 2010. There were no changes to any of the highest D/Q locations for nearest residence, milk animal or garden sites.

No downstream irrigation of corn was discovered within 5 miles of the Prairie Island Plant. Therefore, no corn samples were collected for analysis.

4.0 RESULTS AND DISCUSSION

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

The 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 atmospheric nuclear tests in 2010. The last reported test was conducted on October 16, 1980 by the People's Republic of China. There were no reported accidents involving any significant release to the environment at nuclear reactor facilities in 2010.

4.2 Summary of Preoperational Data

The following constitutes a summary of preoperational studies conducted at the Prairie Island Nuclear Power Plant during the years 1970 to 1973, 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, since background levels of radiation were much higher in these years due to radioactive fallout from the atmosphere. Gross beta measurements in fallout declined yearly from a level of 12,167 pCi/m^2 to 1,020 pCi/m^2, and these declining values are reflected throughout the various media tested.

In the air environment, ambient gamma radiation (TLDs) averaged 9.4 mR/4 weeks during pre-operational studies. Gross beta in air particulates declined from levels of 0.38 to 0.037 pCi/m^3. Average present day levels have stabilized at around 0.025 pCi/m^3. Airborne radioiodine remained below detection levels.

In the terrestrial environment of 1970 to 1973, milk, agricultural crops, and soil were monitored. In milk samples, low levels of Cs-137, I-131, and Sr-90 were detected. Cs-137 levels declined from 16.5 to 8.6 pCi/L. Present day measurements for both Cs-137 and I-131 are below detection levels. Agricultural crop measurements averaged 57.7 pCi/g for gross beta and 0.47 pCi/g for Cs-137. Gross beta measured in soil averaged 52 pCi/g.

The aqueous environment was monitored by testing of river, well and lake waters, 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 eight separate locations, declined steadily from an average concentration of 1020 pCi/L to 490 pCi/L. Present day environmental levels of tritium measure below a detection limit of approximately 160 pCi/L. Values for gross beta, measured from 1970 to 1973, averaged 9.9 pCi/L in downstream Mississippi River water, 8.2 pCi/L for well water, and 11.0 pCi/L for lake water. Gamma emitters were below the lower limit of detection (LLD). In bottom sediments, gross beta background levels were determined at 51.0 pCi/g. Cs-137 activity during preoperational studies in 1973 measured 0.25 pCi/g upstream and 0.21 pCi/g downstream. The lower levels occasionally observed today can still be attributed to residual activity from atmospheric fallout. Gross beta in fish, measured in both flesh and skeletal samples, averaged 7.3 and 11.7 pCi/g, respectively. Gross beta background levels in aquatic vegetation, algae and periphyton samples measured 76.0 pCi/g , 46.0 pCi/g, and 13.6 pCi/g, respectively.

4.3 Program Findings

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

Ambient Radiation (TLDs)

Ambient radiation was measured in the general area of the site boundary, at the outer ring 4 - 5 mi. distant from the Plant, at special interest areas and at one control location. The means ranged from 15.8 mR/91 days at inner ring locations to 16.1 mR/91 days at outer ring locations. The mean at special interest locations was 15.4 mR/91 days and 16.0 mR/91 days at the control location. Dose rates measured at the inner and outer ring and the control locations were similar to those observed from 1994 through 2009. The results are tabulated below. No plant effect on ambient gamma radiation measurements was indicated (Figure 5-1).

Year	Average (Inner and Outer Rings)	Control		Year	Average (Inner and Outer Rings)	Control
1995	15.6	16.6		2003	16.2	16.0
1996	14.8	16.4		2004	17.6	17.6
1997	15.1	16.0		2005	16.8	16.3
1998	16.7	17.3		2006	16.6	16.6
1999	16.6	17.5		2007	17.5	17.7
2000	17.0	17.1		2008	16.9	17.1
2001	16.8	17.2		2009	15.9	16.3
2002	17.4	16.9		2010	16.0	16.0

Ambient gamma radiation as measured by thermoluminescent dosimetry.
Average quarterly dose rates (mR/91 days).

ISFSI Facility Operations Monitoring

Ambient radiation was measured inside the ISFSI earth berm, outside the ISFSI earth berm and at two special locations between the plant ISFSI and the Prairie Island Indian Community. The mean dose rates averaged 102.0 mR/91 days inside the ISFSI earth berm and 20.5 mR/91 days outside the ISFSI earth berm. Four additional casks were placed on the ISFSI pad in 2010, a total of twenty-nine loaded casks remain. The higher levels inside the earth berm are expected, due to the loaded spent fuel casks being in direct line-of-sight of the TLDs.

Ambient radiation levels measured outside the earth berm show a slight increase as compared to other offsite dose rates around the plant. If the dose rates outside the earth berm are an indication of gamma skyshine from the casks, they are consistent with predictions given in the ISFSI Safety Analysis Report, Table 7A-7, "Total Skyshine Dose Rate". The cumulative average of the two special Prairie Island Indian Community TLDs measured 15.2 and 14.7 mR/91 days. Although the skyshine neutron dose rates are not directly measured, the neutron levels measured next to the casks are below the levels predicted in the ISFSI SAR Report, Table 7A-4, "TN-40 Dose Rates at Short Distances". Therefore, the skyshine dose rates at farther distances from the casks should be at or below the calculated dose rates. No spent fuel storage effect on offsite ambient gamma radiation was indicated (Fig. 5-1).

Airborne Particulates

Typically, the highest averages for gross beta occur during the months of January and December, and the first and fourth quarters, as in 1995 through 2006, and also in 2008 through 2010. The elevated activity observed in 2007 was attributed to construction activity in the area, an increase in dust and consequent heavier particulate filter loading.

Average annual gross beta concentrations in airborne particulates were identical at the indicators versus control locations (0.025 pCi/m^3) and similar to levels observed from 1995 through 2006 and 2008 to 2009. The results are tabulated below.

Year	Average of Indicators	Control
	Concentration (pCi/m^3)	
1995	0.022	0.022
1996	0.023	0.020
1997	0.021	0.021
1998	0.022	0.018
1999	0.024	0.022
2000	0.025	0.025
2001	0.023	0.023
2002	0.028	0.023
2003	0.027	0.025
2004	0.025	0.026
2005	0.027	0.025
2006	0.026	0.025
2007	0.037	0.031
2008	0.028	0.027
2009	0.029	0.029
2010	0.025	0.025

Average annual gross beta concentrations in airborne particulates.

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 0.078 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 0.03 pCi/m^3 in all samples. There was no indication of a plant effect.

Milk

Iodine-131 results were below a detection limit of 0.5 pCi/L in all samples. Cs-137 results were below the LLD level of 5 pCi/L in all samples. No other gamma-emitting isotopes, except naturally-occurring potassium-40, were detected in any milk samples. This is consistent with the findings of the National Center for Radiological Health that most radiocontaminants in feed do not find their way into milk due to the selective metabolism of the cow. The common exceptions are radioisotopes of potassium, cesium, strontium, barium, and iodine (National Center for Radiological Health, 1968).

In summary, the milk data for 2010 show no radiological effects of the plant operation.

Drinking Water

In drinking water from the City of Red Wing well, tritium activity measured below the LLD level of 159 pCi/L in all samples.

Gross beta concentrations averaged 11.7 pCi/L throughout the year, ranging from 4.7–17.2 pCi/L. These concentrations are consistent with levels observed from 1995 through 2009. The most likely contribution is the relatively high levels of naturally-occurring radium. Gamma spectroscopy indicates the presence of lead and bismuth isotopes, which are daughters of the radium decay chain. There is no indication from the 2010 data of any effect of plant operation.

Year		Gross Beta (pCi/L)
1995		3.9
1996		6.3
1997		5.1
1998		5.4
1999		5.3
2000		10.1
2001		8.3
2002		8.7
2003		9.9
2004		9.8
2005		11.5
2006		13.4
2007		11.6
2008		11.6
2009		11.4
2010		11.7

Average annual concentrations; Gross beta in drinking water.

River Water

Measurable tritium slightly higher than the LLD level of 182 pCi/L, was detected in one of the four downstream river water composite samples, at a concentration of 230 pCi/L. This is well below the U.S. Environmental Protection Agency's drinking water standard of 20,000 pCi/L. All other samples tested measured below detection limits.

Gamma-emitting isotopes were below detection limits in all samples.

Well Water

At control well, P-43 (Peterson Farm) and the four indicator wells (P-8, Community Center, P-6, Lock and Dam No. 3, P-9, Plant Well No. 2 and P-24, Suter Farm) no tritium was detected above a concentration level of 154 pCi/L.

Gamma-emitting isotopes were below detection limits in all samples.

In summary, well water data for 2010 show no radiological effects of the plant operation.

Crops

Three samples of broadleaf vegetation, cabbage leaves, were collected in July, 2010 and analyzed for gamma-emitting isotopes, including iodine-131. The I-131 level was below 0.021 pCi/g wet weight in all samples. With the exception of naturally-occurring beryllium-7 and potassium-40, all other gamma-emitting isotopes were below their respective detection limits. There was no indication of a plant effect.

Field sampling personnel conducted an annual land use survey and found no river water taken for irrigation into fields within 5 miles downstream from the Prairie Island Plant. The collection and analysis of corn samples was not required.

Fish

Fish were collected in May and November, 2010 and analyzed for gamma emitting isotopes. Only naturally-occurring potassium-40 was detected, and there was no significant difference between upstream and downstream results. There was no indication of a plant effect.

Aquatic Insects or Periphyton

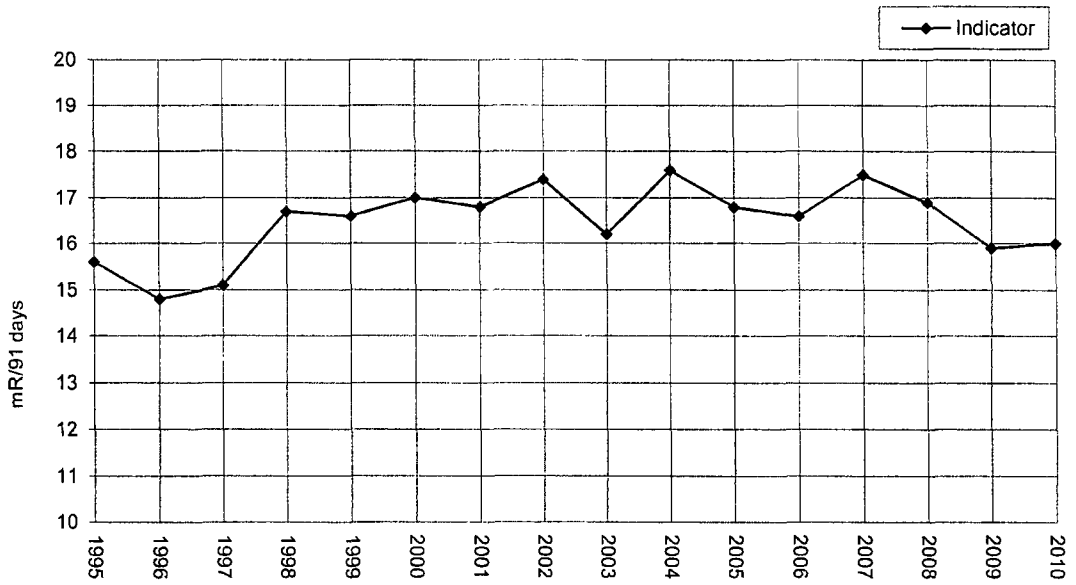
Aquatic insects (invertebrates) or periphyton were collected in May and October, 2010 and analyzed for gamma-emitting isotopes. All gamma-emitting isotopes were below detection limits. There was no indication of a plant effect.

Bottom and Shoreline Sediments

Upstream, downstream and downstream recreational area shoreline sediments were sampled in May and October, 2010 and analyzed for gamma-emitting isotopes. The only 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

Figure 5-1. Offsite Ambient Radiation (TLDs); average of inner and outer ring indicator locations versus control location.



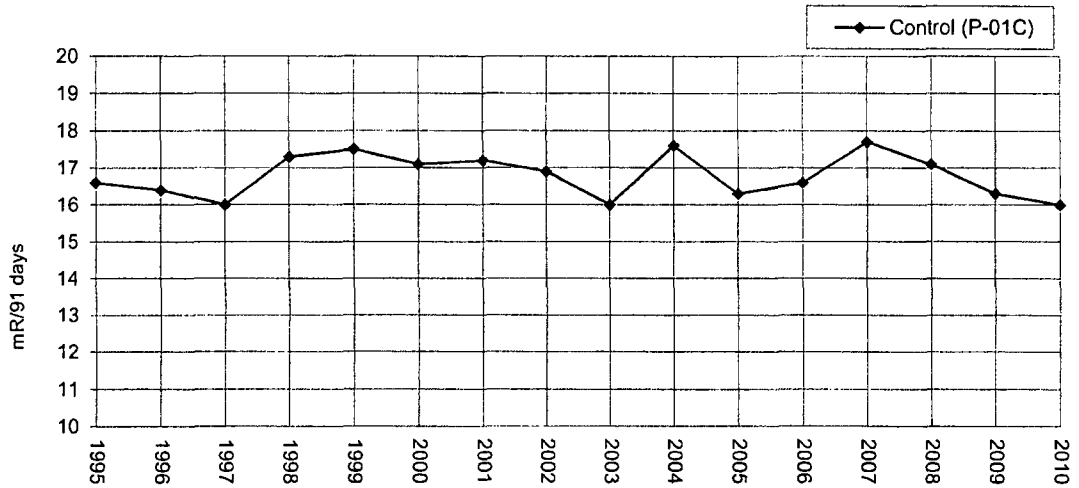
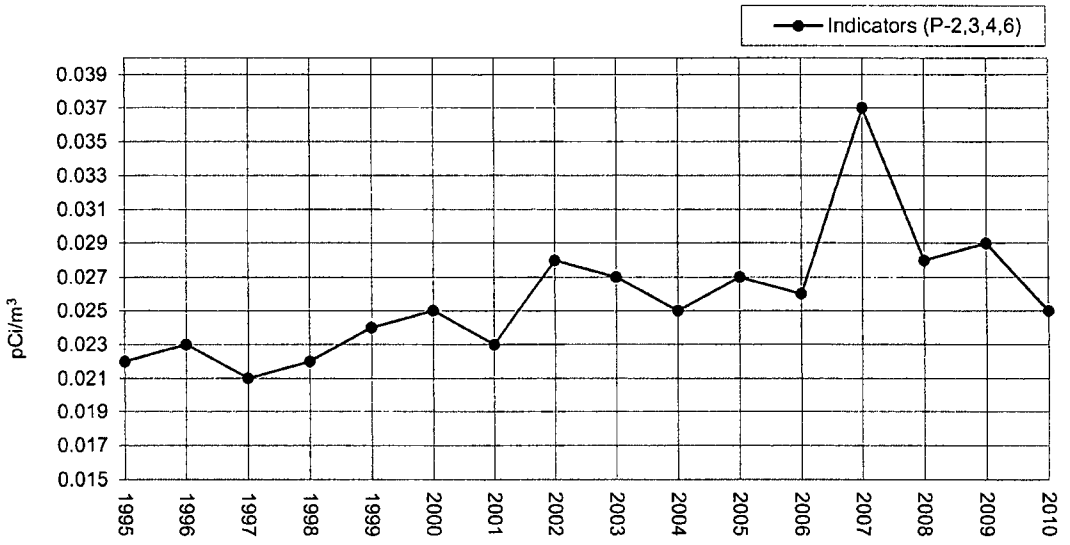
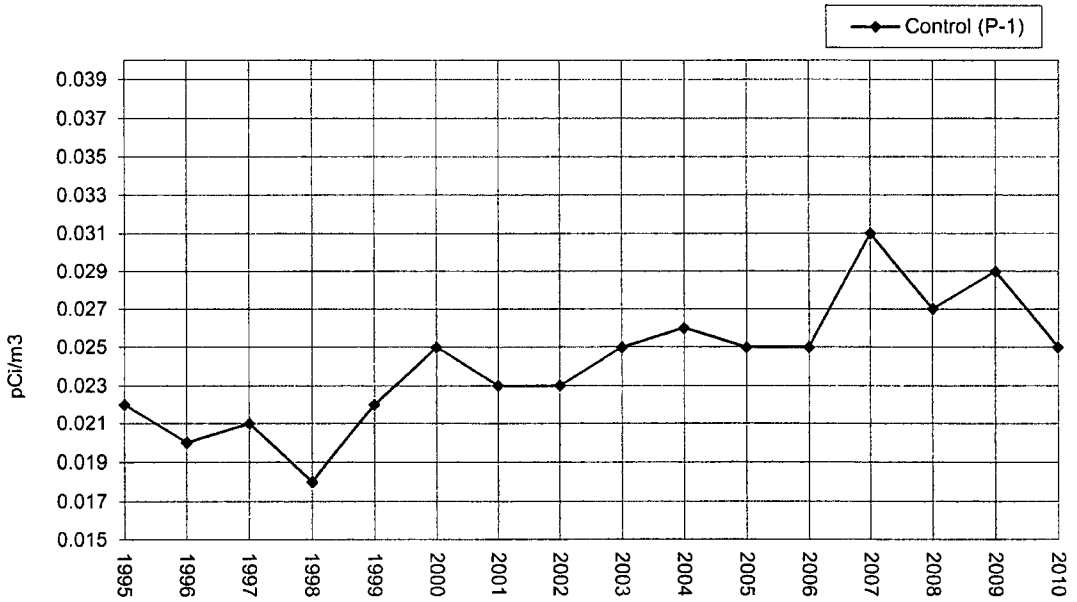


Figure 5-2. Airborne Particulates; analysis for gross beta, average mean of all indicator locations versus control location.





PRAIRIE ISLAND

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

Medium	Location No.	Location Codes (and Type)[a]	Collection Type and Frequency[b]	Analysis Type and Frequency[c]
Ambient radiation (TLD's)	54	P-01A - P-10A P-01B - P-15B P-01S - P-08S P-01IA - P-08IA P-01IB - P-08IB P-01IX- P-04IX, P-01C	C/Q	Ambient gamma
Airborne Particulates	5	P-1(C), P-2, P-3, P-4, P-6	C/W	GB, GS (QC of each location)
Airborne Iodine	5	P-1(C), P-2, P-3, P-4, P-6	C/W	I-131
Milk	4	P-18, P-37, P-42, P-43 (C)	G/M[d]	I-131, GS
River water	2	P-5(C), P-6	G/W	GS(MC), H-3(QC)
Drinking water	1	P-11	G/W	GB(MC), I-131(MC) GS (MC), H-3 (QC)
Well water	5	P-6, P-8, P-9, P-24, P-43 (C)	G/Q	H-3, GS
Edible cultivated crops - leafy green vegetables	3	P-28, P-38(C), P-45	G/A	GS (I-131)
Fish (one species, edible portion)	2	P-19(C), P-13	G/SA	GS
Periphyton or invertebrates	2	P-40(C), P-6	G/SA	GS
Bottom sediment	2	P-20(C), P-6	G/SA	GS
Shoreline sediment	1	P-12	G/SA	GS

[a] Location codes are defined in Table D-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).

Table 5.2. Sampling locations, Prairie Island Nuclear Generating Plant.

Code	Type[a]	Collection Site	Sample Type[b]	Distance and Direction from Reactor
P-1	C	Air Station P-1	AP, AI	11.8 mi @ 316°/NNW
P-2		Air Station P-2	AP, AI	0.5 mi @ 294°/WNW
P-3		Air Station P-3	AP, AI	0.8 mi @ 313°/NW
P-4		Air Station P-4	AP, AI	0.4 mi @ 359°/N
P-5	C	Upstream of Plant	RW	1.8 mi @ 11°/N
P-6		Lock and Dam #3 & Air Station P-6	AP, AI, RW WW, BS, BO[c]	1.6 mi @ 129°/SE
P-8		Community Center	WW	1.0 mi @ 321°/WNW
P-9		Plant Well #2	WW	0.3 mi @ 306°/NW
P-11		Red Wing Service Center	DW	3.3 mi @ 158°/SSE
P-12		Downstream of Plant	SS	3.0 mi @ 116°/ESE
P-13		Downstream of Plant	F[c]	3.5 mi @ 113°/ESE
P-18		Christiansen Farm	M	3.8 mi @ 88°/E
P-19	C	Upstream of Plant	F[c]	1.3 mi @ 0°/N
P-20	C	Upstream of Plant	BS	0.9 mi @ 45°/NE
P-24		Suter Residence	WW	0.6 mi @ 158°/SSE
P-28		Allyn Residence	VE	1.0 mi @ 152°/SSE
P-37		Welsch Farm	M	4.1 mi @ 87°/E
P-38	C	Cain Residence	VE	14.2 mi @ 359°/N
P-40	C	Upstream of Plant	BO[c]	0.4 mi @ 0°/N
P-42		Rother Farm	M	4.3 mi. @ 264°/W
P-43	C	Peterson Farm	M, WW	13.9 mi. @ 355°/N
P-45		Glazier Residence	VE	0.6 mi. @ 341°/NNW
General Area of the Site Boundary				
P-01A		Property Line	TLD	0.4 mi @ 359°/N
P-02A		Property Line	TLD	0.3 mi @ 10°/N
P-03A		Property Line	TLD	0.5 mi @ 183°/S
P-04A		Property Line	TLD	0.4 mi @ 204°/SWW
P-05A		Property Line	TLD	0.4 mi @ 225°/SW
P-06A		Property Line	TLD	0.4 mi @ 249°/WSW
P-07A		Property Line	TLD	0.4 mi @ 268°/W
P-08A		Property Line	TLD	0.4 mi @ 291°/WNW
P-09A		Property Line	TLD	0.7 mi @ 317°/NW
P-10A		Property Line	TLD	0.5 mi @ 333°/NNW

Table 5.2. Sampling locations, Prairie Island 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				
P-01B		Thomas Killian Residence	TLD	4.7 mi @ 355°/N
P-02B		Roy Kinneman Residence	TLD	4.8 mi @ 17°/NNE
P-03B		Wayne Anderson Farm	TLD	4.9 mi @ 46°/NE
P-04B		Nelson Drive (Road)	TLD	4.2 mi @ 61°/ENE
P-05B		County Road E and Coulee	TLD	4.2 mi @ 102°/ESE
P-06B		William Hauschiblt Residence	TLD	4.4 mi @ 112°/ESE
P-07B		Red Wing Public Works	TLD	4.7 mi @ 140°/SE
P-08B		David Wnuk Residence	TLD	4.1 mi @ 165°/SSE
P-09B		Highway 19 South	TLD	4.2 mi @ 187°/S
P-10B		Cannondale Farm	TLD	4.9 mi @ 200°/SSW
P-11B		Wallace Weberg Farm	TLD	4.5 mi @ 221°/SW
P-12B		Ray Gergen Farm	TLD	4.6 mi @ 251°/WSW
P-13B		Thomas O'Rourke Farm	TLD	4.4 mi @ 270°/W
P-14B		David J. Anderson Farm	TLD	4.9 mi @ 306°/NW
P-15B		Holst Farms	TLD	3.8 mi @ 345°/NNW
Special Interest Locations				
P-01S		Federal Lock & Dam #3	TLD	1.6 mi @ 129°/SE
P-02S		Charles Suter Residence	TLD	0.5 mi @ 155°/SSE
P-03S		Carl Gustafson Farm	TLD	2.2 mi @ 173°/S
P-04S		Richard Burt Residence	TLD	2.0 mi @ 202°/SSW
P-05S		Kinney Store	TLD	2.0 mi @ 270°/W
P-06S		Earl Flynn Farm	TLD	2.5 mi @ 299°/WNW
P-07S		Indian Community	TLD	0.7 mi @ 271°/W
P-08S		Indian Community	TLD	0.7 mi @ 287°/NWW
P-01C	C	Robert Kinneman Farm	TLD	11.1 mi @ 331°/NNW

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

Code	Type[a]	Collection Site	Sample Type[b]	Distance and Direction from ISFSI Center.
ISFSI Area Inside Earth Berm				
P-01IA		ISFSI Nuisance Fence	TLD	190' @ 45°/NE
P-02IA		ISFSI Nuisance Fence	TLD	360' @ 82°/E
P-03IA		ISFSI Nuisance Fence	TLD	370' @ 100°/E
P-04IA		ISFSI Nuisance Fence	TLD	200' @ 134°/SE
P-05IA		ISFSI Nuisance Fence	TLD	180' @ 219°/SW
P-06IA		ISFSI Nuisance Fence	TLD	320' @ 258°/WSW
P-07IA		ISFSI Nuisance Fence	TLD	320' @ 281°/WNW
P-08IA		ISFSI Nuisance Fence	TLD	190' @ 318°/NW
P-01IX		ISFSI Nuisance Fence	TLD	140' @ 180°/S
P-02IX		ISFSI Nuisance Fence	TLD	310' @ 270°/W
P-03IX		ISFSI Nuisance Fence	TLD	140' @ 0°/N
P-04IX		ISFSI Nuisance Fence	TLD	360' @ 90°/E
ISFSI Area Outside Earth Berm				
P-01IB		ISFSI Berm Area	TLD	340' @ 3°/N
P-02IB		ISFSI Berm Area	TLD	380' @ 28°/NNE
P-03IB		ISFSI Berm Area	TLD	560' @ 85°/E
P-04IB		ISFSI Berm Area	TLD	590' @ 165°/SSE
P-05IB		ISFSI Berm Area	TLD	690' @ 186°/S
P-06IB		ISFSI Berm Area	TLD	720' @ 201°/SSW
P-07IB		ISFSI Berm Area	TLD	610' @ 271°/W
P-08IB		ISFSI Berm Area	TLD	360' @ 332°/NNW

[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	SS	Shoreline Sediments
BO	Bottom organisms (periphyton or macroinvertebrates)	SW	Surface Water
		VE	Vegetation/vegetables
DW	Drinking water	WW	Well water

[c] Distance and direction data for fish and bottom organisms are approximate since availability of sample specimen may vary at any one location.

Table 5.3. Missed collections and analyses at the Prairie Island 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

Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility: Prairie Island Nuclear Power Station
Location of Facility: Goodhue, Minnesota
(County, State)

Docket No. 50-282, 50-306
Reporting Period January-December, 2010

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean: Location[d]	Location with Highest Annual Mean: Mean (F)[c] Range[c]	Control Locations Mean (F)[c] Range[c]	Number Non-Routine Results[e]
TLD (Inner Ring, Area at Site Boundary) mR/91 days)	Gamma 40	3.0	15.8 (40/40) (12.0-18.1)	P-06A 0.4 mi @ 249° /WSW	17.3 (4/4) (15.6-18.1)	(See Control below.)	0
TLD (Outer Ring, 4-5 mi. distant) mR/91 days)	Gamma 60	3.0	16.1 (60/60) (12.4-19.5)	P-01B, Killian Res. 4.7 mi @ 355° /N	17.5 (4/4) (16.1-18.1)	(See Control below.)	0
TLD (Special Interest Areas) mR/91 days)	Gamma 32	3.0	15.4 (32/32) (12.9-18.9)	P-03S, Gustafson Farm, 2.2 mi @ 173° /S	17.4 (4/4) (16.1-18.8)	(See Control below.)	0
TLD (Control) mR/91 days)	Gamma 4	3.0	None	P-01C, Robert Kinneman 11.1 mi @ 331° /NNW	16.0 (4/4) (15.4-17.0)	16.0 (4/4) (15.4-17.0)	0
Airborne Particulates (pCi/m^3)	GB 260	0.005	0.025 (208/208) (0.009-0.057)	P-06, Air Station 1.6 mi @ 129° /SE	0.026 (52 /52) (0.009-0.057)	0.025 (52/52) (0.008-0.048)	0
	GS 20						
	Be-7	0.015	0.078 (16/16) (0.054-0.097)	P-02, Air Station 0.5 mi @ 294° /WNW	0.080 (4/4) (0.054-0.097)	0.077 (4/4) (0.062-0.088)	0
	Mn-54	0.0007	< LLD	-	-	< LLD	0
	Co-58	0.0007	< LLD	-	-	< LLD	0
	Co-60	0.0007	< LLD	-	-	< LLD	0
	Zn-65	0.0013	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.0010	< LLD	-	-	< LLD	0
	Ru-103	0.0009	< LLD	-	-	< LLD	0
	Ru-106	0.0065	< LLD	-	-	< LLD	0
	Cs-134	0.0006	< LLD	-	-	< LLD	0
	Cs-137	0.0007	< LLD	-	-	< LLD	0
	Ba-La-140	0.0022	< LLD	-	-	< LLD	0
	Ce-141	0.0017	< LLD	-	-	< LLD	0
	Ce-144	0.0041	< LLD	-	-	< LLD	0
Airborne Iodine (pCi/m^3)	I-131 260	0.03	< LLD	-	-	< LLD	0

Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility	Prairie Island Nuclear Power Station	Docket No.	50-282, 50-306
Location of Facility	Goodhue, Minnesota (County, State)	Reporting Period	January-December, 2010

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean: Location[d]	Location with Highest Annual Mean: Mean (F)[c] Range[c]	Control Locations Mean (F)[c] Range[c]	Number Non-Routine Results[e]
Milk (pCi/L)	I-131 72	0.5	< LLD	-	-	< LLD	0
	GS 72						
	K-40	200	1364 (54/54) (1232-1505)	P-43 (C), Peterson 13.9 mi @ 355° /N	1421 (18 /18) (1296-1495)	1421 (18/18) (1296-1495)	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	182	230 (1/4)	P-6, Lock and Dam #3 1.6 mi @ 129°/SE	230 (1/4)	< 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	42	< LLD	-	-	< LLD	0

Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility	Prairie Island Nuclear Power Station	Docket No.	50-282, 50-306
Location of Facility	Goodhue, Minnesota (County, State)	Reporting Period	January-December, 2010

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean: Location[d]	Location with Highest Annual Mean: Mean (F)[c] Range[c]	Control Locations Mean (F)[c] Range[c]	Number Non-Routine Results[e]
Drinking Water (pCi/L)	GB 12	1.0	11.7 (12/12) (4.7-17.2)	P-11, Red Wing S.C. 3.3 mi @ 158° /SSE	11.7 (12/12) (4.7-17.2)	None	0
	I-131 12	1.0	< LLD		-	None	0
	H-3 4	159	< LLD	-	-	None	0
	GS 12						
	Mn-54	10	< LLD	-	-	None	0
	Fe-59	30	< LLD	-	-	None	0
	Co-58	10	< LLD	-	-	None	0
	Co-60	10	< LLD	-	-	None	0
	Zn-65	30	< LLD	-	-	None	0
	Zr-Nb-95	15	< LLD	-	-	None	0
	Cs-134	10	< LLD	-	-	None	0
	Cs-137	10	< LLD	-	-	None	0
	Ba-La-140	15	< LLD	-	-	None	0
	Ce-144	39	< LLD	-	-	None	0
Well Water (pCi/L)	H-3 20	154	< LLD	-	-	< LLD	0
	GS 20						
	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	46	< LLD	-	-	< LLD	0
Crops - Cabbage (pCi/gwet)	I-131 3	0.021	< LLD	-	-	< LLD	0

Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility	Prairie Island Nuclear Power Station	Docket No.	50-282, 50-306
Location of Facility	Goodhue, Minnesota (County, State)	Reporting Period	January-December, 2010

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean: Location[d]	Location with Highest Annual Mean: Mean (F)[c] Range[c]	Control Locations Mean (F)[c] Range[c]	Number Non-Routine Results[e]
Fish	GS 4						
(pCi/g wet)	K-40	0.10	2.78 (2/2) (2.74-2.82)	P-13, Downstream 3.5 mi @ 113°/ESE	2.78 (2/2) (2.74-2.82)	2.73 (2/2) (2.68-2.79)	0
	Mn-54	0.016	< LLD	-	-	< LLD	0
	Fe-59	0.038	< LLD	-	-	< LLD	0
	Co-58	0.015	< LLD	-	-	< LLD	0
	Co-60	0.014	< LLD	-	-	< LLD	0
	Zn-65	0.017	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.018	< LLD	-	-	< LLD	0
	Cs-134	0.012	< LLD	-	-	< LLD	0
	Cs-137	0.014	< LLD	-	-	< LLD	0
	Ba-La-140	0.057	< LLD	-	-	< LLD	0
Invertebrates	GS 4						
(pCi/g wet)	Be-7	0.91	< LLD	-	-	< LLD	0
	K-40	1.50	< LLD	-	-	< LLD	0
	Mn-54	0.064	< LLD	-	-	< LLD	0
	Co-58	0.069	< LLD	-	-	< LLD	0
	Co-60	0.060	< LLD	-	-	< LLD	0
	Zn-65	0.093	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.086	< LLD	-	-	< LLD	0
	Ru-103	0.090	< LLD	-	-	< LLD	0
	Ru-106	0.50	< LLD	-	-	< LLD	0
	Cs-134	0.044	< LLD	-	-	< LLD	0
	Cs-137	0.054	< LLD	-	-	< LLD	0
	Ba-La-140	0.25	< LLD	-	-	< LLD	0
	Ce-141	0.10	< LLD	-	-	< LLD	0
	Ce-144	0.34	< LLD	-	-	< LLD	0

Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility	Prairie Island Nuclear Power Station	Docket No.	50-282, 50-306
Location of Facility	Goodhue, Minnesota	Reporting Period	January-December, 2010
	(County, State)		

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean: Location[d]	Location with Highest Annual Mean: Mean (F)[c] Range[c]	Control Locations Mean (F)[c] Range[c]	Number Non-Routine Results[e]
Bottom and Shoreline Sediments (pCi/g dry)	GS 6						
	Be-7	0.28	0.46 (1/4)	P-6, Lock and Dam #3 1.6 mi @ 129°/SE	0.46 (1/2)	< LLD	0
	K-40	0.50	7.42 (4/4) (5.40-8.65)	P-20, Upstream 0.9 mi @ 45°/NE	9.58 (2/2) (8.68-10.48)	9.58 (2/2) (8.68-10.48)	0
	Mn-54	0.023	< LLD	-	-	< LLD	0
	Co-58	0.030	< LLD	-	-	< LLD	0
	Co-60	0.019	< LLD	-	-	< LLD	0
	Zn-65	0.058	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.045	< LLD	-	-	< LLD	0
	Ru-103	0.036	< LLD	-	-	< LLD	0
	Ru-106	0.16	< LLD	-	-	< LLD	0
	Cs-134	0.020	< LLD	-	-	< LLD	0
	Cs-137	0.018	< LLD	-	-	< LLD	0
				-	-		
	Ba-La-140	0.136	< LLD	-	-	< LLD	0
	Ce-141	0.053	< LLD	-	-	< LLD	0
	Ce-144	0.12	< 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.

6.0 REFERENCES CITED

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

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

Environmental, Inc., Midwest Laboratory.

_____ 2001a through 2011a. Radiation Environmental Monitoring for Monticello Nuclear Generating Plant, Complete Analysis Data Tables, January-December, 2000 through 2010.

_____ 2001b through 2011b. Radiation Environmental Monitoring for Prairie Island Nuclear Generating Plant, Complete Analysis Data Tables, January - December, 2000 through 2010.

_____ 1984a to 2000a. (formerly Teledyne Brown Engineering Environmental Services, Midwest Laboratory) Radiation Environmental Monitoring for Monticello Nuclear Generating Plant, Complete Analysis Data Tables, January - December, 1983 through 1999.

_____ 1984b to 2000b. (formerly Teledyne Brown Engineering Environmental Services, Midwest Laboratory) Radiation Environmental Monitoring for Prairie Island Nuclear Generating Plant, Complete Analysis Data Tables, January - December, 1983 through 1999.

_____ 1979a to 1983a. (formerly Hazleton Environmental Sciences Corporation) Radiation Environmental Monitoring for Monticello Nuclear Generating Plant, Complete Analysis Data Tables, January - December, 1978 through 1982.

_____ 1979b to 1983b. (formerly Hazleton Environmental Sciences Corporation) Radiation Environmental Monitoring for Prairie Island Nuclear Generating Plant, Complete Analysis Data Tables, January - December, 1978 through 1982.

_____ 2009. Quality Assurance Program Manual, Rev. 2, 10 November 2009.

_____ 2009. Quality Control Procedures Manual, Rev. 2, 08 July 2009.

_____ 2009. Quality Control Program, Rev. 2, 12 November 2009.

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

National Center for Radiological Health, 1968. Radiological Health and Data Reports, Vol. 9, No. 12, 730-746.

Northern States Power Company.

_____ 1972 through 1974. Prairie Island Nuclear Generating Plant, Environmental Monitoring and Ecological Studies Program, January 1, 1971 to December 31, 1971, 1972, 1973. Minneapolis, Minnesota.

_____ 1979 to 2008. Prairie Island Nuclear Generating Plant, Annual Radiation Environmental Monitoring Report to the U.S. Nuclear Regulatory Commission, January 1 to December 31, 1978 through 2007. Minneapolis, Minnesota.

Prairie Island Nuclear Generating Plant, 2010. Radiological Environmental Monitoring for Prairie Island Nuclear Generating Plant, Radiation Protection Implementing Procedures, 4700 series.

U.S. Dep't of Energy 1997 HASL-300, Edition 28, Procedures Manual, Environmental Measurements Laboratory, New York, NY.

6.0 REFERENCES CITED (continued)

U.S. Environmental Protection Agency .

_____ 1980. Prescribed Procedures for Measurement of Radioactivity in Drinking Water, Cincinnati, Ohio (EPA-600/4-80-032).

_____ 1984. Eastern Environmental Radiation Facility, Radiochemistry Procedures Manual, Montgomery, Alabama (EPA-520/5-84-006).

_____ 2007. RadNet, formerly Environmental Radiation Ambient Monitoring System, Gross Beta in Air, Gross Beta in Drinking Water (MN) 1981– 2005.

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

Xcel Energy Corporation.

_____ 2009 to 2011. Monticello Nuclear Generating Plant, Annual Radiation Environmental Monitoring Report to the U.S. Nuclear Regulatory Commission, January 1 to December 31, 2008 through 2010. Minneapolis, Minnesota.

_____ 2009 to 2011. Prairie Island Nuclear Generating Plant, Annual Radiation Environmental Monitoring Report to the U.S. Nuclear Regulatory Commission, January 1 to December 31, 2008 through 2010. Minneapolis, Minnesota.

ATI Environmental, Inc.
Midwest Laboratory
700 Landwehr Road • Northbrook, IL 60062-2310
phone (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, 2010 through December, 2010

Appendix A

Interlaboratory Comparison Program Results

Environmental, Inc., 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 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.

Table A-2 lists 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 the laboratory precision at the 1 sigma level for various analyses. The acceptance criteria in Table A-3 is set at ± 2 sigma.

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 determination
Gamma Emitters	5 to 100 pCi/liter or kg	5.0 pCi/liter
	> 100 pCi/liter or kg	5% of known value
Strontium-89[b]	5 to 50 pCi/liter or kg	5.0 pCi/liter
	> 50 pCi/liter or kg	10% of known value
Strontium-90[b]	2 to 30 pCi/liter or kg	5.0 pCi/liter
	> 30 pCi/liter or kg	10% of known value
Potassium-40	≥ 0.1 g/liter or kg	5% of known value
Gross alpha	≤ 20 pCi/liter	5.0 pCi/liter
	> 20 pCi/liter	25% of known value
Gross beta	≤ 100 pCi/liter	5.0 pCi/liter
	> 100 pCi/liter	5% of known value
Tritium	≤ 4,000 pCi/liter	$\pm 1\sigma = 169.85 \times (\text{known})^{0.0933}$
	> 4,000 pCi/liter	10% of known value
Radium-226,-228	≥ 0.1 pCi/liter	15% of known value
Plutonium	≥ 0.1 pCi/liter, gram, or sample	10% of known value
Iodine-131, Iodine-129[b]	≤ 55 pCi/liter	6 pCi/liter
	> 55 pCi/liter	10% of known value
Uranium-238, Nickel-63[b] Technetium-99[b]	≤ 35 pCi/liter	6 pCi/liter
	> 35 pCi/liter	15% of known value
Iron-55[b]	50 to 100 pCi/liter	10 pCi/liter
	> 100 pCi/liter	10% of known value
Other Analyses [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	Date	Analysis	Concentration (pCi/L) Laboratory Result[b]	ERA Result[c]	Control Limits	Acceptance
STW-1205	04/05/10	Sr-89	63.0 ± 5.7	60.4	48.6 - 68.2	Pass
STW-1205	04/05/10	Sr-90	37.4 ± 2.4	41.3	30.4 - 47.4	Pass
STW-1206	04/05/10	Ba-133	63.6 ± 3.3	65.9	54.9 - 72.5	Pass
STW-1206	04/05/10	Co-60	83.3 ± 2.9	84.5	76.0 - 95.3	Pass
STW-1206	04/05/10	Cs-134	71.0 ± 3.4	71.6	58.4 - 78.8	Pass
STW-1206	04/05/10	Cs-137	145.5 ± 5.1	146.0	131.0 - 163.0	Pass
STW-1206	04/05/10	Zn-65	194.9 ± 7.8	186.0	167.0 - 219.0	Pass
STW-1207	04/05/10	Gr. Alpha	26.5 ± 1.7	32.9	16.9 - 42.6	Pass
STW-1207	04/05/10	Gr. Beta	34.5 ± 1.6	37.5	24.7 - 45.0	Pass
STW-1208	04/05/10	I-131	22.7 ± 0.8	26.4	21.9 - 31.1	Pass
STW-1209	04/05/10	Ra-226	15.2 ± 0.7	14.6	10.9 - 16.8	Pass
STW-1209	04/05/10	Ra-228	15.6 ± 1.8	15.1	10.1 - 18.3	Pass
STW-1209	04/05/10	Uranium	59.5 ± 0.7	62.3	50.7 - 69.1	Pass
STW-1210	04/05/10	H-3	12955 ± 332	12400.0	10800 - 13600	Pass
STW-1224	10/04/10	Sr-89	65.3 ± 5.7	68.5	55.8 - 76.7	Pass
STW-1224	10/04/10	Sr-90	39.9 ± 2.3	43.0	31.7 - 49.3	Pass
STW-1225	10/04/10	Ba-133	67.2 ± 4.3	68.9	57.5 - 75.8	Pass
STW-1225	10/04/10	Co-60	53.2 ± 3.3	53.4	48.1 - 61.3	Pass
STW-1225	10/04/10	Cs-134	47.3 ± 5.1	43.2	34.5 - 47.5	Pass
STW-1225	10/04/10	Cs-137	118.0 ± 5.9	123.0	111.0 - 138.0	Pass
STW-1225	10/04/10	Zn-65	107.0 ± 8.7	102.0	91.8 - 122.0	Pass
STW-1226	10/04/10	Gr. Alpha	30.7 ± 2.9	42.3	21.9 - 53.7	Pass
STW-1226	10/04/10	Gr. Beta	32.7 ± 0.8	36.6	24.0 - 44.2	Pass
STW-1227	10/04/10	I-131	28.6 ± 1.1	27.5	22.9 - 32.3	Pass
STW-1228	10/04/10	Ra-226	11.8 ± 0.6	11.4	8.5 - 13.2	Pass
STW-1228	10/04/10	Ra-228	12.0 ± 1.8	9.9	6.4 - 12.3	Pass
STW-1228	10/04/10	Uranium	34.8 ± 0.4	36.8	29.8 - 41.0	Pass
STW-1229	10/04/10	H-3	13682 ± 352	12900.0	11200 - 14200	Pass

[a] 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).

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

[c] 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, $CaSO_4$: Dy Cards).

Lab Code	Date	Description	Known Value (mR)	Lab Result ± 2 sigma (mR)	Control Limits (mR)	Acceptance
Environmental, Inc.						
2010-1	6/8/2010	30 cm.	75.07	90.78 ± 3.60	52.55 - 97.59	Pass
2010-1	6/8/2010	40 cm.	42.23	50.88 ± 3.59	29.56 - 54.90	Pass
2010-1	6/8/2010	50 cm.	27.03	32.12 ± 1.90	18.92 - 35.14	Pass
2010-1	6/8/2010	60 cm.	18.77	21.80 ± 0.90	13.14 - 24.40	Pass
2010-1	6/8/2010	70 cm.	13.79	15.38 ± 1.39	9.65 - 17.93	Pass
2010-1	6/8/2010	75 cm.	12.01	11.30 ± 1.07	8.41 - 15.61	Pass
2010-1	6/8/2010	80 cm.	10.56	10.90 ± 0.61	7.39 - 13.73	Pass
2010-1	6/8/2010	90 cm.	8.34	7.84 ± 0.83	5.84 - 10.84	Pass
2010-1	6/8/2010	100 cm.	6.76	6.61 ± 0.52	4.73 - 8.79	Pass
2010-1	6/8/2010	110 cm.	5.58	4.29 ± 0.55	3.91 - 7.25	Pass
2010-1	6/8/2010	120 cm.	4.69	3.64 ± 0.33	3.28 - 6.10	Pass
2010-1	6/8/2010	150 cm.	3.00	2.82 ± 0.84	2.10 - 3.90	Pass
2010-1	6/8/2010	180 cm.	2.09	1.55 ± 0.23	1.46 - 2.72	Pass
Environmental, Inc.						
2010-2	12/13/2010	100 cm.	4.94	4.65 ± 0.57	3.46 - 6.42	Pass
2010-2	12/13/2010	110 cm.	4.09	3.50 ± 0.74	2.86 - 5.32	Pass
2010-2	12/13/2010	120 cm.	3.43	2.68 ± 0.36	2.40 - 4.46	Pass
2010-2	12/13/2010	150 cm.	2.2	1.75 ± 0.42	1.54 - 2.86	Pass
2010-2	12/13/2010	180 cm.	1.53	1.32 ± 0.52	1.07 - 1.99	Pass
2010-2	12/13/2010	40 cm.	30.89	38.56 ± 2.11	21.62 - 40.16	Pass
2010-2	12/13/2010	50 cm.	19.77	23.35 ± 1.82	13.84 - 25.70	Pass
2010-2	12/13/2010	60 cm.	13.73	14.53 ± 1.24	9.61 - 17.85	Pass
2010-2	12/13/2010	60 cm.	13.73	15.84 ± 1.53	9.61 - 17.85	Pass
2010-2	12/13/2010	80 cm.	7.72	8.33 ± 0.74	5.40 - 10.04	Pass
2010-2	12/13/2010	90 cm.	6.1	5.93 ± 0.73	4.27 - 7.93	Pass

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

Lab Code [b]	Date	Analysis	Concentration (pCi/L)[a] Laboratory results 2s, n=1 [c]	Known Activity	Control Limits [d]	Acceptance
SPW-12648	1/20/2010	Ra-228	40.04 ± 2.99	40.54	28.38 - 52.70	Pass
SPW-279	1/27/2010	U-238	4.52 ± 0.22	4.17	0.00 - 16.17	Pass
SPW-391	2/4/2010	Ni-63	179.70 ± 2.96	209.62	146.73 - 272.51	Pass
W-21210	2/12/2010	Ra-226	16.05 ± 0.39	16.77	11.74 - 21.80	Pass
W-21710	2/17/2010	Gr. Alpha	17.54 ± 0.37	20.00	10.00 - 30.00	Pass
W-21710	2/17/2010	Gr. Beta	42.47 ± 0.39	45.20	35.20 - 55.20	Pass
SPAP-669	2/25/2010	Gr. Beta	45.78 ± 0.11	49.24	29.54 - 68.94	Pass
SPAP-671	2/25/2010	Cs-134	10.56 ± 3.15	10.38	0.38 - 20.38	Pass
SPAP-671	2/25/2010	Cs-137	105.36 ± 3.15	109.20	98.28 - 120.12	Pass
SPMI-674	2/25/2010	Co-60	67.38 ± 5.65	68.79	58.79 - 78.79	Pass
SPMI-674	2/25/2010	Cs-134	60.61 ± 6.28	51.91	41.91 - 61.91	Pass
SPMI-674	2/25/2010	Cs-137	173.80 ± 10.30	163.80	147.42 - 180.18	Pass
SPW-676	2/25/2010	Co-60	66.13 ± 5.22	68.79	58.79 - 78.79	Pass
SPW-676	2/25/2010	Cs-134	51.54 ± 5.97	51.91	41.91 - 61.91	Pass
SPW-676	2/25/2010	Cs-137	179.30 ± 9.95	163.80	147.42 - 180.18	Pass
SPW-678	2/25/2010	H-3	59213.70 ± 709.90	60407.70	48326.16 - 72489.24	Pass
SPF-680	2/25/2010	Cs-134	402.56 ± 22.40	415.00	373.50 - 456.50	Pass
SPF-680	2/25/2010	Cs-137	2267.90 ± 75.60	2180.00	1962.00 - 2398.00	Pass
SPW-682	2/25/2010	Tc-99	29.70 ± 1.51	32.34	20.34 - 44.34	Pass
SPW-2871	4/5/2010	Ra-228	33.91 ± 2.85	36.80	25.76 - 47.84	Pass
W-40510	4/5/2010	Gr. Alpha	20.65 ± 0.42	20.00	10.00 - 30.00	Pass
W-40510	4/5/2010	Gr. Beta	44.72 ± 0.40	45.20	35.20 - 55.20	Pass
SPW-2083	4/28/2010	U-238	4.20 ± 0.32	4.17	0.00 - 16.17	Pass
W-51310	5/13/2010	Ra-226	17.04 ± 0.50	16.77	11.74 - 21.80	Pass
SPW-3181	6/17/2010	Tc-99	29.87 ± 1.09	32.34	20.34 - 44.34	Pass
SPW-3272	6/25/2010	H-3	5489.00 ± 224.00	5928.00	4742.40 - 7113.60	Pass
SPW-3278	6/25/2010	Fe-55	17054.00 ± 348.00	19614.00	15691.20 - 23536.80	Pass
SPW-3280	6/25/2010	C-14	3410.60 ± 9.75	4738.00	2842.80 - 6633.20	Pass
SPAP-3270	6/28/2010	Cs-134	12.24 ± 3.13	10.38	0.38 - 20.38	Pass
SPAP-3270	6/28/2010	Cs-137	103.92 ± 7.14	109.20	98.28 - 120.12	Pass
SPW-3274	6/28/2010	Co-60	67.48 ± 5.53	65.84	55.84 - 75.84	Pass
SPW-3274	6/28/2010	Cs-134	49.55 ± 6.11	46.38	36.38 - 56.38	Pass
SPW-3274	6/28/2010	Cs-137	58.85 ± 6.54	54.17	44.17 - 64.17	Pass
SPW-3274	6/28/2010	Sr-90	41.59 ± 1.83	42.72	34.18 - 51.26	Pass
SPMI-3276	6/28/2010	Co-60	66.80 ± 5.25	65.84	55.84 - 75.84	Pass
SPMI-3276	6/28/2010	Cs-134	48.20 ± 3.88	46.38	36.38 - 56.38	Pass
SPMI-3276	6/28/2010	Cs-137	62.46 ± 6.33	54.17	44.17 - 64.17	Pass
SPMI-3276	6/28/2010	Sr-90	43.32 ± 1.63	42.72	34.18 - 51.26	Pass

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

Lab Code [b]	Date	Analysis	Concentration (pCi/L)[a] Laboratory results 2s, n=1	Known Activity	Control Limits[c]	Acceptance
SPW-5081	9/9/2010	Tc-99	30.22 ± 1.06	32.34	20.34 - 44.34	Pass
W-90910	9/9/2010	Gr. Alpha	20.95 ± 0.43	20.00	10.00 - 30.00	Pass
W-90910	9/9/2010	Gr. Beta	45.20 ± 0.41	45.20	35.20 - 55.20	Pass
W-91010	9/10/2010	Ra-226	17.48 ± 0.50	16.77	11.74 - 21.80	Pass
SPW-2874	9/23/2010	Ra-228	34.60 ± 2.68	36.80	25.76 - 47.84	Pass
XWW-5302	10/6/2010	Ba-133	154.13 ± 8.90	155.21	139.69 - 170.73	Pass
XWW-5302	10/6/2010	Co-60	24.65 ± 4.11	23.28	13.28 - 33.28	Pass
XWW-5302	10/6/2010	Cs-134	14.03 ± 3.87	13.95	3.95 - 23.95	Pass
XWW-5302	10/6/2010	Cs-137	61.16 ± 6.08	59.22	49.22 - 69.22	Pass
SPW-6035	10/21/2010	U-238	4.52 ± 0.20	4.17	0.00 - 16.17	Pass
W-120110	12/1/2010	Gr. Alpha	20.27 ± 0.41	20.00	10.00 - 30.00	Pass
W-120110	12/1/2010	Gr. Beta	46.75 ± 0.41	45.20	35.20 - 55.20	Pass
W-121610	12/16/2010	Ra-226	17.99 ± 0.43	16.77	11.74 - 21.80	Pass

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

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

[c] Results are based on single determinations.

[d] Control limits are established from the precision values listed in Attachment A of this report, adjusted to ± 2σ.

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[b]	Concentration (pCi/L)[a] Laboratory results (4.66σ) LLD	Activity[c]	Acceptance Criteria (4.66 σ)
SPW-12658	Water	1/20/2010	Ra-228	0.79	0.61 ± 0.44	2
SPW-280	Water	1/27/2010	U-238	0.18	0.07 ± 0.13	1
SPW-392	Water	2/4/2010	Ni-63	15.90	-11.80 ± 9.40	20
W-21210	Water	2/12/2010	Ra-226	0.03	0.06 ± 0.02	1
W-21710	Water	2/17/2010	Gr. Alpha	0.41	0.09 ± 0.30	1
W-21710	Water	2/17/2010	Gr. Beta	0.73	0.23 ± 0.52	3.2
SPAP-668	Air Filter	2/25/2010	Gr. Beta	0.11	0.008 ± 0.002	3.2
SPAP-670	Air Filter	2/25/2010	Cs-134	1.87	-	100
SPAP-670	Air Filter	2/25/2010	Cs-137	2.31	-	100
SPMI-672	Milk	2/25/2010	Cs-137	3.52	-	10
SPMI-672	Milk	2/25/2010	I-131(G)	6.09	-	20
SPW-675	Water	2/25/2010	Co-60	1.55	-	10
SPW-675	Water	2/25/2010	Cs-137	2.69	-	10
SPW-675	Water	2/25/2010	I-131(G)	5.68	-	20
SPF-679	Fish	2/25/2010	Cs-134	10.94	-	100
SPF-679	Fish	2/25/2010	Cs-137	18.37	-	100
SPW-681	Water	2/25/2010	Tc-99	16.11	-10.75 ± 9.53	10
SPW-2881	Water	4/5/2010	Ra-228	0.89	0.22 ± 0.44	2
W-40510	Water	4/5/2010	Gr. Alpha	0.40	-0.20 ± 0.26	1
W-40510	Water	4/5/2010	Gr. Beta	0.75	-0.09 ± 0.52	3.2
SPW-2084	Water	4/28/2010	U-238	0.14	0.03 ± 0.10	1
W-51310	Water	5/13/2010	Ra-226	0.03	0.06 ± 0.02	1
SPW-3271	Water	6/25/2010	H-3	151.60	-58.10 ± 71.90	200
SPW-3278	Water	6/25/2010	Fe-55	634.50	256.80 ± 396.40	1000
SPW-3279	water	6/25/2010	C-14	8.57	-1.84 ± 5.18	200
SPAP-3269	Air Filter	6/28/2010	Cs-134	1.71	-	100
SPAP-3269	Air Filter	6/28/2010	Cs-137	2.42	-	100
SPW-3273	Water	6/28/2010	Co-60	1.64	-	10
SPW-3273	Water	6/28/2010	Cs-134	3.89	-	10
SPW-3273	Water	6/28/2010	Cs-137	4.29	-	10
SPW-3273	water	6/25/2010	Sr-90	0.50	-0.04 ± 0.22	1
SPMI-3275	Milk	6/28/2010	Cs-134	3.33	-	10
SPMI-3275	Milk	6/28/2010	Cs-137	3.82	-	10
SPMI-3275	Milk	6/28/2010	I-131(G)	3.71	-	20
SPMI-3275	Milk	6/28/2010	Sr-90	0.58	0.81 ± 0.36	1

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

Lab Code	Sample Type	Date	Analysis[b]	Concentration (pCi/L)[a] Laboratory results (4.66σ) LLD	Activity[c]	Acceptance Criteria (4.66 σ)
SPW-5080	Water	9/9/2010	Tc-99	2.15	-0.71 ± 1.29	10
W-90910	Water	9/9/2010	Gr. Alpha	0.39	0.10 ± 0.28	1
W-90910	Water	9/9/2010	Gr. Beta	0.78	-0.09 ± 0.55	3.2
W-91010	Water	9/10/2010	Ra-226	0.04	0.07 ± 0.03	1
SPW-2884	Water	9/23/2010	Ra-228	0.71	1.14 ± 0.46	2
SPW-6036	Water	10/21/2010	U-238	0.11	0.07 ± 0.10	1
W-120110	Water	12/1/2010	Gr. Alpha	0.43	-0.05 ± 0.29	1
W-120110	Water	12/1/2010	Gr. Beta	0.75	-0.08 ± 0.53	3.2
W-121610	Water	12/16/2010	Ra-226	0.03	0.04 ± 0.02	1
BKW-120610	water	12/6/2010	Ba-133	5.66	-	10
BKW-120610	water	12/6/2010	Co-60	4.49	-	10
BKW-120610	water	12/6/2010	Cs-134	4.41	-	10
BKW-120610	water	12/6/2010	Cs-137	5.33	-	10
W-121610	Water	12/16/2010	Ra-226	0.03	0.04 ± 0.02	1

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

[b] I-131(G); iodine-131 as analyzed by gamma spectroscopy.

[c] Activity reported is a net activity result. For gamma spectroscopic analysis, activity detected below the LLD value is not reported.

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

			Concentration (pCi/L)[a]			
Lab Code	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
CF-20, 21	1/4/2010	Gr. Beta	10.96 ± 0.27	11.30 ± 0.28	11.13 ± 0.19	Pass
CF-20, 21	1/4/2010	K-40	8.88 ± 0.48	8.27 ± 0.78	8.58 ± 0.46	Pass
CF-20, 21	1/4/2010	Sr-90	0.02 ± 0.01	0.02 ± 0.01	0.02 ± 0.00	Pass
CF-41, 42	1/4/2010	Be-7	0.45 ± 0.11	0.41 ± 0.14	0.43 ± 0.09	Pass
CF-41, 42	1/4/2010	Gr. Beta	3.26 ± 0.10	3.33 ± 0.11	3.30 ± 0.07	Pass
CF-41, 42	1/4/2010	K-40	2.85 ± 0.36	3.04 ± 0.22	2.95 ± 0.21	Pass
MI-111, 112	1/12/2010	K-40	1276.00 ± 98.96	1334.80 ± 105.00	1305.40 ± 72.14	Pass
DW-10010, 10011	1/13/2010	Ra-226	0.48 ± 0.10	0.43 ± 0.10	0.46 ± 0.07	Pass
DW-10010, 10011	1/13/2010	Ra-226	1.59 ± 0.61	1.13 ± 0.47	1.36 ± 0.39	Pass
WW-215, 216	1/18/2010	H-3	211.16 ± 87.57	291.90 ± 91.31	251.53 ± 63.26	Pass
DW-10022, 10023	1/21/2010	Ra-226	8.57 ± 0.91	10.20 ± 1.08	9.39 ± 0.71	Pass
DW-10022, 10023	1/21/2010	Ra-228	5.68 ± 1.36	3.59 ± 1.17	4.64 ± 0.90	Pass
WW-424, 425	1/28/2010	H-3	422.30 ± 95.90	484.20 ± 98.50	453.25 ± 68.74	Pass
DW-10034, 10035	1/28/2010	Ra-226	0.93 ± 0.13	0.90 ± 0.11	0.92 ± 0.09	Pass
DW-10034, 10035	1/28/2010	Ra-228	1.16 ± 0.62	1.29 ± 0.62	1.23 ± 0.44	Pass
SW-382, 383	2/1/2010	Gr. Beta	2.22 ± 0.68	1.18 ± 0.71	1.70 ± 0.49	Pass
DW-10046, 10047	2/2/2010	Ra-226	6.11 ± 0.91	7.88 ± 1.17	7.00 ± 0.74	Pass
DW-10046, 10047	2/2/2010	Ra-228	5.84 ± 1.11	6.13 ± 1.14	5.99 ± 0.80	Pass
WW-693, 694	2/23/2010	H-3	1458.00 ± 131.00	1531.00 ± 133.00	1494.50 ± 93.34	Pass
SW-782, 783	3/1/2010	Gr. Beta	1.05 ± 0.42	1.60 ± 0.43	1.33 ± 0.30	Pass
SW-782, 783	3/1/2010	K-40	1.50 ± 0.15	1.52 ± 0.15	1.51 ± 0.11	Pass
MI-946, 947	3/9/2010	K-40	1485.00 ± 109.30	1347.40 ± 108.30	1416.20 ± 76.93	Pass
W-1035, 1036	3/17/2010	Ra-226	11.78 ± 1.51	9.76 ± 1.26	10.77 ± 0.98	Pass
W-1035, 1036	3/17/2010	Ra-228	5.31 ± 2.42	8.45 ± 2.78	6.88 ± 1.84	Pass
SW-1285, 1286	3/17/2010	H-3	377.60 ± 104.50	282.70 ± 100.70	330.15 ± 72.56	Pass
W-1103, 1104	3/18/2010	H-3	12690 ± 333	12679 ± 333	12685 ± 235	Pass
WW-1193, 1194	3/18/2010	H-3	227.38 ± 95.19	251.81 ± 96.15	239.60 ± 67.65	Pass
LW-1909, 1910	3/24/2010	H-3	1529.40 ± 144.60	1404.40 ± 140.80	1466.90 ± 100.91	Pass
LW-1909, 1910	3/25/2010	H-3	2.40 ± 0.97	1.99 ± 1.03	2.20 ± 0.71	Pass
DW-10068, 10069	3/25/2010	Gr. Alpha	1.08 ± 1.02	1.35 ± 1.05	1.22 ± 0.73	Pass
DW-10070, 10071	3/29/2010	Ra-226	1.58 ± 0.17	1.69 ± 0.16	1.64 ± 0.12	Pass
DW-10070, 10071	3/29/2010	Ra-228	1.16 ± 0.47	1.34 ± 0.49	1.25 ± 0.34	Pass
AP-1729, 1730	3/30/2010	Be-7	0.08 ± 0.01	0.08 ± 0.01	0.08 ± 0.01	Pass
AP-1782, 1783	3/30/2010	Be-7	0.08 ± 0.01	0.09 ± 0.01	0.09 ± 0.01	Pass
E-1392, 1393	4/1/2010	Gr. Beta	1.59 ± 0.07	1.66 ± 0.08	1.63 ± 0.05	Pass
E-1392, 1393	4/1/2010	K-40	902.30 ± 179.00	1076.70 ± 202.90	989.50 ± 135.29	Pass
WW-1422, 1423	4/1/2010	Gr. Beta	22.23 ± 1.58	19.42 ± 1.40	20.83 ± 1.06	Pass
SW-1464, 1465	4/1/2010	H-3	262.06 ± 98.96	233.18 ± 97.75	247.62 ± 69.55	Pass
XW-1666, 1667	4/1/2010	Fe-55	7.05 ± 0.71	7.25 ± 0.74	7.15 ± 0.51	Pass
SG-1532, 1533	4/6/2010	Ac-228	19.45 ± 1.14	20.07 ± 1.19	19.76 ± 0.82	Pass
SG-1532, 1533	4/6/2010	Pb-214	12.66 ± 0.52	13.32 ± 0.54	12.99 ± 0.38	Pass

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

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
SG-1506, 1507	4/7/2010	Ac-228	1.28 ± 0.15	1.15 ± 0.14	1.22 ± 0.10	Pass
SG-1506, 1507	4/7/2010	Pb-214	1.24 ± 0.10	1.22 ± 0.09	1.23 ± 0.07	Pass
SW-1645, 1646	4/14/2010	H-3	312.00 ± 100.00	352.00 ± 102.00	332.00 ± 71.42	Pass
DW-10095, 10096	4/14/2010	Ra-226	4.87 ± 0.53	5.57 ± 0.61	5.22 ± 0.40	Pass
DW-10095, 10096	4/14/2010	Ra-228	2.49 ± 0.56	2.76 ± 0.60	2.63 ± 0.41	Pass
W-2013, 2014	4/16/2010	Gr. Alpha	33.45 ± 3.98	39.11 ± 4.54	36.28 ± 3.02	Pass
W-2013, 2014	4/16/2010	Gr. Beta	14.83 ± 0.96	16.07 ± 0.96	15.45 ± 0.68	Pass
WW-2431, 2432	4/19/2010	H-3	400.40 ± 98.10	377.70 ± 97.10	389.05 ± 69.01	Pass
SO-2037, 2038	4/22/2010	K-40	2.89 ± 0.40	2.89 ± 0.51	2.89 ± 0.32	Pass
W-2325, 2326	4/26/2010	H-3	399.00 ± 92.00	429.00 ± 94.00	414.00 ± 65.76	Pass
AP-2149, 2150	4/29/2010	Be-7	0.14 ± 0.08	0.26 ± 0.12	0.20 ± 0.07	Pass
LW-2191, 2192	4/29/2010	Gr. Beta	1.16 ± 0.56	0.79 ± 0.52	0.97 ± 0.38	Pass
G-2170, 2171	5/3/2010	Be-7	0.91 ± 0.32	0.86 ± 0.26	0.89 ± 0.21	Pass
G-2170, 2171	5/3/2010	Gr. Beta	8.73 ± 0.22	9.01 ± 0.23	8.87 ± 0.16	Pass
G-2170, 2171	5/3/2010	K-40	7.24 ± 0.44	7.48 ± 0.78	7.36 ± 0.45	Pass
SWT-2282, 2283	5/4/2010	Gr. Beta	0.73 ± 0.52	1.58 ± 0.57	1.16 ± 0.39	Pass
WW-2233, 2234	5/5/2010	Gr. Alpha	1.56 ± 1.47	2.27 ± 1.65	1.92 ± 1.10	Pass
WW-2233, 2234	5/5/2010	Gr. Beta	2.33 ± 1.14	4.08 ± 1.24	3.21 ± 0.84	Pass
TD-2410, 2411	5/10/2010	H-3	431.92 ± 96.50	403.05 ± 95.26	417.48 ± 67.80	Pass
SG-2347, 2348	5/13/2010	Ra-226	37.34 ± 0.42	37.91 ± 0.36	37.63 ± 0.28	Pass
F-2463, 2464	5/17/2010	K-40	2.69 ± 0.56	2.65 ± 0.38	2.67 ± 0.34	Pass
XW-2834, 2835	5/20/2010	H-3	209.53 ± 83.34	263.11 ± 85.95	236.32 ± 59.86	Pass
WW-2597, 2598	5/25/2010	H-3	288.10 ± 98.20	155.80 ± 93.40	221.95 ± 67.76	Pass
MI-2639, 2640	5/25/2010	K-40	1428.80 ± 110.60	1408.60 ± 107.40	1418.70 ± 77.08	Pass
SL-2771, 2772	6/1/2010	Gr. Beta	5.33 ± 0.18	5.30 ± 0.18	5.32 ± 0.13	Pass
SL-2771, 2772	6/1/2010	K-40	4.67 ± 0.46	4.88 ± 0.46	4.78 ± 0.33	Pass
SW-2879, 2880	6/1/2010	H-3	335.60 ± 92.60	356.40 ± 93.60	346.00 ± 65.83	Pass
SG-2904, 2905	6/7/2010	Gamma	5.20 ± 0.20	5.50 ± 0.10	5.35 ± 0.11	Pass
SO-3039, 3040	6/8/2010	Be-7	0.12 ± 0.03	0.13 ± 0.08	0.13 ± 0.04	Pass
SO-3039, 3040	6/8/2010	Cs-137	0.01 ± 0.00	0.01 ± 0.00	0.01 ± 0.00	Pass
SO-3039, 3040	6/8/2010	Gr. Beta	22.80 ± 2.05	23.84 ± 2.44	23.32 ± 1.59	Pass
SO-3039, 3040	6/8/2010	K-40	11.30 ± 1.20	11.70 ± 1.20	11.50 ± 0.85	Pass
SO-3039, 3040	6/8/2010	U-233/4	0.12 ± 0.02	0.13 ± 0.01	0.13 ± 0.01	Pass
SO-3039, 3040	6/8/2010	U-238	0.12 ± 0.01	0.13 ± 0.01	0.13 ± 0.01	Pass
WW-3060, 3061	6/14/2010	H-3	199.16 ± 95.13	203.59 ± 95.34	201.38 ± 67.34	Pass
VE-3351, 3352	6/21/2010	Be-7	1.86 ± 0.25	1.85 ± 0.27	1.85 ± 0.18	Pass
VE-3351, 3352	6/21/2010	K-40	6.10 ± 0.52	6.10 ± 0.57	6.10 ± 0.39	Pass
W-3469, 3470	6/25/2010	H-3	573.00 ± 110.00	525.00 ± 108.00	549.00 ± 77.08	Pass
SG-3539, 3540	6/29/2010	Ac-228	14.55 ± 0.51	14.57 ± 0.44	14.56 ± 0.34	Pass
SG-3539, 3540	6/29/2010	Pb-214	15.50 ± 1.56	16.80 ± 1.71	16.15 ± 1.16	Pass
AP-3743, 3744	6/30/2010	Be-7	0.07 ± 0.01	0.07 ± 0.01	0.07 ± 0.01	Pass

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

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
G-3427, 3428	7/1/2010	Be-7	1.18 ± 0.29	1.06 ± 0.25	1.12 ± 0.19	Pass
G-3427, 3428	7/1/2010	K-40	8.79 ± 0.64	7.85 ± 0.65	8.32 ± 0.46	Pass
SW-3512, 3513	7/6/2010	H-3	441.00 ± 103.00	423.00 ± 102.00	432.00 ± 72.48	Pass
AP-3680, 3681	7/8/2010	Be-7	0.16 ± 0.08	0.13 ± 0.07	0.15 ± 0.05	Pass
VE-3791, 3792	7/12/2010	K-40	4.37 ± 0.38	4.23 ± 0.35	4.30 ± 0.26	Pass
WW-3934, 3935	7/12/2010	H-3	3091.00 ± 187.00	3242.00 ± 191.00	3166.50 ± 133.65	Pass
DW-10135, 10136	7/13/2010	Ra-226	0.18 ± 0.07	0.26 ± 0.07	0.22 ± 0.05	Pass
DW-10135, 10136	7/13/2010	Ra-228	0.76 ± 0.44	0.81 ± 0.41	0.79 ± 0.30	Pass
W-4063, 4064	7/14/2010	H-3	469.00 ± 104.00	351.00 ± 99.00	410.00 ± 71.79	Pass
DW-10143, 10144	7/19/2010	Gr. Alpha	2.84 ± 0.74	2.49 ± 0.73	2.67 ± 0.52	Pass
DW-10148, 10149	7/23/2010	Ra-226	2.08 ± 0.39	2.97 ± 0.55	2.53 ± 0.34	Pass
DW-10148, 10149	7/23/2010	Ra-228	1.90 ± 0.61	2.00 ± 0.61	1.95 ± 0.43	Pass
DW-10159, 10160	7/23/2010	Ra-226	0.91 ± 0.14	0.79 ± 0.21	0.85 ± 0.13	Pass
DW-10159, 10160	7/23/2010	Ra-228	1.41 ± 0.54	1.30 ± 0.53	1.36 ± 0.38	Pass
SL-4106, 4107	8/2/2010	Be-7	2.05 ± 0.20	2.05 ± 0.18	2.05 ± 0.13	Pass
SL-4106, 4107	8/2/2010	Gr. Beta	5.06 ± 0.32	4.62 ± 0.30	4.84 ± 0.22	Pass
SL-4106, 4107	8/2/2010	K-40	1.89 ± 0.24	1.70 ± 0.17	1.80 ± 0.15	Pass
SG-4085, 4086	8/3/2010	Ra-226	20.23 ± 2.04	21.45 ± 2.16	20.84 ± 1.49	Pass
SG-4085, 4086	8/3/2010	Ra-228	15.88 ± 0.41	16.24 ± 0.36	16.06 ± 0.27	Pass
SWT-4304, 4305	8/3/2010	Gr. Beta	2.08 ± 1.07	2.44 ± 0.98	2.26 ± 0.73	Pass
BS-4398, 4399	8/10/2010	Cs-137	78.80 ± 33.50	94.30 ± 51.90	86.55 ± 30.89	Pass
BS-4398, 4399	8/10/2010	K-40	13708 ± 795	12091 ± 1110	12900 ± 683	Pass
VE-4531, 4532	8/11/2010	Gr. Beta	36.20 ± 0.90	35.80 ± 0.90	36.00 ± 0.64	Pass
VE-4531, 4532	8/11/2010	K-40	27.31 ± 0.70	27.58 ± 0.62	27.45 ± 0.47	Pass
VE-4531, 4532	8/11/2010	U-233/4	0.014 ± 0.003	0.014 ± 0.003	0.014 ± 0.002	Pass
VE-4531, 4532	8/11/2010	U-238	0.012 ± 0.003	0.010 ± 0.002	0.011 ± 0.002	Pass
DW-10170, 10171	8/13/2010	Ra-226	1.32 ± 0.14	1.26 ± 0.14	1.29 ± 0.10	Pass
DW-10170, 10171	8/13/2010	Ra-228	2.55 ± 0.78	1.76 ± 0.71	2.16 ± 0.53	Pass
AP-4766, 4767	8/26/2010	Be-7	0.18 ± 0.09	0.25 ± 0.13	0.22 ± 0.08	Pass
DW-10182, 10183	8/27/2010	Ra-226	0.15 ± 0.08	0.11 ± 0.07	0.13 ± 0.05	Pass
VE-4928, 4929	9/1/2010	K-40	2.99 ± 0.41	3.18 ± 0.28	3.09 ± 0.25	Pass
SL-4883, 4884	9/1/2010	Gr. Beta	6.90 ± 0.20	7.10 ± 0.20	7.00 ± 0.14	Pass
SL-4883, 4884[b]	9/1/2010	K-40	7.15 ± 0.99	5.07 ± 0.51	6.11 ± 0.56	Fail
W-5135, 5136	9/6/2010	H-3	658.60 ± 110.80	600.90 ± 108.50	629.75 ± 77.54	Pass
SW-5071, 5072	9/13/2010	H-3	186.70 ± 101.10	267.30 ± 104.40	227.00 ± 72.66	Pass
XWW-5246, 5247	9/14/2010	H-3	1990.60 ± 157.70	1986.20 ± 157.60	1988.40 ± 111.48	Pass

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

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
VE-5114, 5115	9/9/2010	Be-7	1.14 ± 0.35	1.48 ± 0.26	1.31 ± 0.22	Pass
VE-5114, 5115	9/9/2010	Gr. Beta	34.72 ± 1.29	33.38 ± 1.23	34.05 ± 0.89	Pass
VE-5114, 5115	9/9/2010	H-3	79367 ± 837	79421 ± 837	79394 ± 592	Pass
VE-5114, 5115	9/9/2010	K-40	22.13 ± 0.67	21.93 ± 0.58	22.03 ± 0.44	Pass
VE-5114, 5115	9/9/2010	U-233/4	0.08 ± 0.01	0.06 ± 0.01	0.07 ± 0.01	Pass
MI-5267, 5268	9/20/2010	K-40	1281.10 ± 118.90	1218.60 ± 110.80	1249.85 ± 81.26	Pass
SO-5357, 5358	9/23/2010	K-40	10894.00 ± 560.00	11175.00 ± 760.00	11034.50 ± 472.02	Pass
AP-5357, 5358	9/23/2010	Be-7	0.11 ± 0.02	0.09 ± 0.02	0.10 ± 0.01	Pass
DW-10194, 10195	9/23/2010	Ra-226	0.40 ± 0.10	0.20 ± 0.10	0.30 ± 0.07	Pass
DW-10194, 10195	9/23/2010	Ra-228	1.61 ± 0.65	0.88 ± 0.47	1.25 ± 0.40	Pass
WW-5442, 5443	9/29/2010	H-3	6706.00 ± 252.00	6510.00 ± 249.00	6608.00 ± 177.13	Pass
VE-5469, 5470	9/29/2010	K-40	2.86 ± 0.38	2.57 ± 0.37	2.72 ± 0.26	Pass
BS-5886, 5887	9/29/2010	Cs-137	83.36 ± 23.31	58.97 ± 21.16	71.17 ± 15.74	Pass
BS-5886, 5887	9/29/2010	K-40	13913.00 ± 775.40	13582.00 ± 710.30	13747.50 ± 525.78	Pass
G-5513, 5514	10/4/2010	Be-7	6.73 ± 0.40	6.36 ± 0.41	6.55 ± 0.29	Pass
E-5492, 5493	10/4/2010	Gr. Beta	1.74 ± 0.05	1.77 ± 0.05	1.76 ± 0.04	Pass
E-5492, 5493	10/4/2010	K-40	1.57 ± 0.17	1.55 ± 0.18	1.56 ± 0.12	Pass
G-5512, 5513	10/4/2010	Gr. Beta	10.86 ± 0.44	10.39 ± 0.39	10.63 ± 0.29	Pass
G-5512, 5513	10/4/2010	K-40	7.10 ± 0.54	7.41 ± 0.59	7.26 ± 0.40	Pass
MI-5541, 5542	10/4/2010	K-40	1090.60 ± 106.70	1246.10 ± 102.60	1168.35 ± 74.01	Pass
MI-5541, 5542	10/4/2010	Sr-90	1.44 ± 0.38	1.11 ± 0.35	1.27 ± 0.26	Pass
F-6061, 6062	10/9/2010	H-3	7.64 ± 0.23	7.49 ± 0.23	7.57 ± 0.16	Pass
F-6061, 6062	10/9/2010	K-40	2.81 ± 0.40	2.56 ± 0.50	2.68 ± 0.32	Pass
VE-5740, 5741	10/10/2010	K-40	4.92 ± 0.53	4.61 ± 0.34	4.77 ± 0.32	Pass
VE-5761, 5762	10/12/2010	Be-7	1.05 ± 0.29	0.69 ± 0.15	0.87 ± 0.16	Pass
VE-5761, 5762	10/12/2010	K-40	3.45 ± 0.45	3.34 ± 0.29	3.40 ± 0.27	Pass
AP-5910, 5911	10/14/2010	Be-7	0.23 ± 0.09	0.30 ± 0.12	0.26 ± 0.08	Pass
WW-6294, 6295	10/18/2010	H-3	1681.49 ± 146.32	1637.41 ± 144.98	1659.45 ± 102.99	Pass
P-6038, 6039	10/19/2010	H-3	2131.90 ± 159.50	2212.00 ± 161.70	2171.95 ± 113.56	Pass
AP-6195, 6196	10/21/2010	Be-7	0.27 ± 0.11	0.26 ± 0.13	0.26 ± 0.09	Pass
WW-6366, 6367	10/23/2010	H-3	477.28 ± 102.02	529.99 ± 104.27	503.64 ± 72.94	Pass
SWU-6315, 6316	10/26/2010	Gr. Beta	1.85 ± 1.00	1.40 ± 0.90	1.62 ± 0.67	Pass
SO-6336, 6337	10/28/2010	Cs-137	0.23 ± 0.03	0.23 ± 0.04	0.23 ± 0.02	Pass
SO-6336, 6337	10/28/2010	Gr. Beta	26.36 ± 1.67	24.78 ± 1.52	25.57 ± 1.13	Pass
SO-6336, 6337	10/28/2010	K-40	13.43 ± 0.76	13.73 ± 0.81	13.58 ± 0.56	Pass
AP-6453, 6454	10/28/2010	Be-7	0.23 ± 0.12	0.30 ± 0.15	0.26 ± 0.10	Pass
BS-6475, 6476	11/1/2010	Gr. Beta	13.13 ± 1.83	12.75 ± 1.67	12.94 ± 1.24	Pass
F-6658, 6659	11/3/2010	K-40	2.79 ± 0.40	2.94 ± 0.44	2.86 ± 0.30	Pass
F-6565, 6566	11/4/2010	Cs-137	0.06 ± 0.02	0.04 ± 0.01	0.05 ± 0.01	Pass
F-6565, 6566	11/4/2010	Gr. Beta	3.90 ± 0.10	4.10 ± 0.10	3.96 ± 0.06	Pass
F-6565, 6566	11/4/2010	K-40	2.63 ± 0.45	2.57 ± 0.35	2.60 ± 0.29	Pass
SS-5761, 5762	11/16/2010	K-40	15.42 ± 1.57	15.87 ± 1.21	15.65 ± 0.99	Pass
WW-7056, 7057	11/30/2010	Gr. Beta	2.09 ± 0.84	2.22 ± 0.80	2.16 ± 0.58	Pass

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

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
SO-7166, 7167	11/30/2010	Cs-137	0.12 ± 0.04	0.11 ± 0.03	0.11 ± 0.03	Pass
SO-7166, 7167	11/30/2010	K-40	14.93 ± 0.88	14.49 ± 0.86	14.71 ± 0.61	Pass
WW-7412, 7413	12/6/2010	H-3	469.78 ± 146.32	503.57 ± 93.96	486.68 ± 86.94	Pass
MI-7187, 7188	12/8/2010	K-40	1495.10 ± 129.00	1398.40 ± 109.10	1446.75 ± 84.47	Pass
MI-7187, 7188	12/8/2010	Sr-90	0.57 ± 0.31	0.66 ± 0.28	0.62 ± 0.21	Pass
WW-7255, 7256	12/8/2010	H-3	243.46 ± 90.39	327.34 ± 94.11	285.40 ± 65.24	Pass
AP-7276, 7277	12/9/2010	Be-7	0.13 ± 0.07	0.18 ± 0.10	0.16 ± 0.06	Pass
XWW-7297, 7298	12/9/2010	H-3	686.00 ± 102.00	764.60 ± 105.00	725.30 ± 73.19	Pass
AP-7344, 7345	12/16/2010	Be-7	0.16 ± 0.09	0.17 ± 0.09	0.16 ± 0.06	Pass
SWT-7480, 7481	12/28/2010	Gr. Beta	0.90 ± 0.40	1.03 ± 0.41	0.97 ± 0.29	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.

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

[b] Analysis was repeated, result of reanalysis: 4.83 ± 0.29 pCi/L.

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

			Concentration [b]			
Lab Code [c]	Date	Analysis	Laboratory result	Known Activity	Control Limits [d]	Acceptance
STVE-1199	03/01/10	Co-57	0.01 ± 0.03	0.00	-	Pass
STVE-1199	03/01/10	Co-60	3.39 ± 0.12	3.27	2.29 - 4.25	Pass
STVE-1199	03/01/10	Cs-134	4.74 ± 0.15	4.39	3.07 - 5.71	Pass
STVE-1199	03/01/10	Cs-137	3.32 ± 0.17	3.06	2.14 - 3.98	Pass
STVE-1199	03/01/10	Mn-54	0.01 ± 0.05	0.00	-	Pass
STVE-1199	03/01/10	Zn-65	8.03 ± 0.33	7.10	4.97 - 9.23	Pass
STW-1200	03/01/10	Gr. Alpha	0.40 ± 0.05	0.68	0.00 - 1.35	Pass
STW-1200	03/01/10	Gr. Beta	3.03 ± 0.07	3.09	1.55 - 4.64	Pass
STW-1201	03/01/10	Am-241	1.05 ± 0.08	1.30	0.91 - 1.69	Pass
STW-1201	03/01/10	Co-57	28.90 ± 0.40	28.30	19.80 - 36.80	Pass
STW-1201	03/01/10	Co-60	0.06 ± 0.05	0.00	-	Pass
STW-1201	03/01/10	Cs-134	-0.03 ± 0.09	0.00	-	Pass
STW-1201	03/01/10	Cs-137	60.60 ± 0.60	60.60	42.40 - 78.80	Pass
STW-1201	03/01/10	Fe-55	3.00 ± 14.40	0.00	-	Pass
STW-1201	03/01/10	H-3	93.20 ± 18.30	90.80	63.60 - 118.00	Pass
STW-1201	03/01/10	Mn-54	27.80 ± 0.40	26.90	18.80 - 35.00	Pass
STW-1201	03/01/10	Ni-63	49.10 ± 3.50	59.90	41.90 - 77.90	Pass
STW-1201	03/01/10	Sr-90	-0.10 ± 0.60	0.00	-	Pass
STW-1201	03/01/10	Tc-99	0.50 ± 0.50	0.00	-	Pass
STW-1201	03/01/10	U-233/4	1.21 ± 0.05	1.22	0.85 - 1.59	Pass
STW-1201	03/01/10	U-238	1.20 ± 0.05	1.25	0.88 - 1.63	Pass
STW-1201	03/01/10	Zn-65	42.70 ± 0.80	40.70	28.50 - 52.90	Pass
STSO-1202	03/01/10	Co-57	520.00 ± 10.80	522.00	365.00 - 679.00	Pass
STSO-1202	03/01/10	Co-60	599.10 ± 2.80	622.00	435.00 - 809.00	Pass
STSO-1202	03/01/10	Cs-134	666.10 ± 4.70	733.00	513.00 - 953.00	Pass
STSO-1202	03/01/10	Cs-137	774.40 ± 4.50	779.00	545.00 - 1013.00	Pass
STSO-1202	03/01/10	K-40	562.00 ± 15.30	559.00	391.00 - 727.00	Pass
STSO-1202	03/01/10	Mn-54	866.20 ± 4.60	849.00	594.00 - 1104.00	Pass
STSO-1202	03/01/10	Sr-90	225.50 ± 11.80	288.00	202.00 - 374.00	Pass
STSO-1202	03/01/10	U-233/4	59.90 ± 2.50	60.00	42.00 - 78.00	Pass
STSO-1202	03/01/10	U-238	62.10 ± 2.60	64.00	45.00 - 83.00	Pass
STSO-1202	03/01/10	Zn-65	-1.23 ± 1.96	0.00	-	Pass
STAP-1203	03/01/10	Am-241	0.10 ± 0.01	0.15	0.10 - 0.19	Pass
STAP-1203	03/01/10	Co-57	0.01 ± 0.02	0.00	-	Pass
STAP-1203	03/01/10	Co-60	2.63 ± 0.19	2.47	1.73 - 3.22	Pass
STAP-1203	03/01/10	Cs-134	2.21 ± 0.34	2.13	1.49 - 2.77	Pass
STAP-1203	03/01/10	Cs-137	1.66 ± 0.22	1.53	1.07 - 1.99	Pass
STAP-1203	03/01/10	Mn-54	3.42 ± 0.26	3.02	2.11 - 3.93	Pass
STAP-1203	03/01/10	Sr-90	0.02 ± 0.06	0.00	-	Pass
STAP-1203	03/01/10	Zn-65	-0.05 ± 0.11	0.00	-	Pass

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

			Concentration [b]			
Lab Code [c]	Date	Analysis	Laboratory result	Known Activity	Control Limits [d]	Acceptance
STAP-1204	03/01/10	Gr. Alpha	0.13 ± 0.03	0.43	0.00 - 0.85	Pass
STAP-1204	03/01/10	Gr. Beta	1.46 ± 0.07	1.29	0.65 - 1.94	Pass
STW-1211	08/01/10	Am-241	0.02 ± 0.02	0.00	-	Pass
STW-1211	08/01/10	Co-57	36.40 ± 4.80	36.00	25.20 - 46.80	Pass
STW-1211	08/01/10	Co-60	28.30 ± 1.00	28.30	19.80 - 36.80	Pass
STW-1211	08/01/10	Cs-134	29.30 ± 2.10	31.40	22.00 - 40.80	Pass
STW-1211	08/01/10	Cs-137	44.60 ± 1.80	44.20	30.90 - 57.50	Pass
STW-1211	08/01/10	Fe-55	48.50 ± 20.10	60.20	42.10 - 78.30	Pass
STW-1211	08/01/10	H-3	503.60 ± 12.80	453.40	317.40 - 589.40	Pass
STW-1211	08/01/10	K-40	38.50 ± 2.50	38.90	27.20 - 50.60	Pass
STW-1211	08/01/10	Mn-54	0.10 ± 0.30	0.00	-	Pass
STW-1211	08/01/10	Ni-63	49.30 ± 3.10	56.10	39.30 - 72.90	Pass
STW-1211	08/01/10	Pu-238	1.49 ± 0.15	1.81	1.27 - 2.35	Pass
STW-1211	08/01/10	Pu-239/40	1.20 ± 0.10	1.35	0.95 - 1.76	Pass
STW-1211	08/01/10	Sr-90	9.20 ± 1.30	8.30	5.80 - 10.80	Pass
STW-1211	08/01/10	Tc-99	28.10 ± 0.90	33.60	23.50 - 43.70	Pass
STW-1211	08/01/10	U-233/4	2.04 ± 0.14	2.01	1.41 - 2.61	Pass
STW-1211	08/01/10	U-238	2.05 ± 0.14	2.07	1.45 - 2.69	Pass
STW-1211	08/01/10	Zn-65	32.80 ± 3.00	31.00	21.70 - 40.30	Pass
STW-1212	08/01/10	Gr. Alpha	1.54 ± 0.09	1.92	0.58 - 3.26	Pass
STW-1212	08/01/10	Gr. Beta	4.13 ± 0.15	4.39	2.20 - 6.59	Pass
STVE-1213	08/01/10	Co-57	9.60 ± 0.54	8.27	5.79 - 10.75	Pass
STVE-1213	08/01/10	Co-60	0.05 ± 0.08	0.00	-	Pass
STVE-1213	08/01/10	Cs-134	4.83 ± 0.26	4.79	3.35 - 6.23	Pass
STVE-1213	08/01/10	Cs-137	6.45 ± 0.66	5.88	4.12 - 7.64	Pass
STVE-1213	08/01/10	Mn-54	7.12 ± 0.66	6.29	4.40 - 8.17	Pass
STVE-1213	08/01/10	Zn-65	6.05 ± 0.74	5.39	3.77 - 7.01	Pass
STSO-1214	08/01/10	Co-57	0.10 ± 1.60	0.00	-	Pass
STSO-1214	08/01/10	Co-60	370.00 ± 6.00	343.00	240.00 - 446.00	Pass
STSO-1214	08/01/10	Cs-134	1005.00 ± 21.00	940.00	658.00 - 1222.00	Pass
STSO-1214	08/01/10	Cs-137	755.00 ± 15.00	670.00	469.00 - 871.00	Pass
STSO-1214	08/01/10	K-40	783.00 ± 54.00	699.00	489.00 - 909.00	Pass
STSO-1214	08/01/10	Mn-54	942.00 ± 15.00	820.00	574.00 - 1066.00	Pass
STSO-1214	08/01/10	Pu-238	69.20 ± 6.20	64.00	45.00 - 83.00	Pass
STSO-1214	08/01/10	Pu-239/40	76.50 ± 6.20	71.00	50.00 - 92.00	Pass
STSO-1214	08/01/10	Sr-90	3.50 ± 8.00	0.00	-	Pass
STSO-1214	08/01/10	U-233/4	76.50 ± 6.20	71.00	50.00 - 92.00	Pass
STSO-1214	08/01/10	U-238	271.40 ± 9.00	289.00	202.00 - 376.00	Pass
STSO-1214	08/01/10	Zn-65	310.00 ± 18.00	265.00	186.00 - 345.00	Pass

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

			Concentration [b]			
Lab Code [c]	Date	Analysis	Laboratory result	Known Activity	Control Limits [d]	Acceptance
STAP-1215	08/01/10	Co-57	4.47 ± 0.21	4.08	2.86 - 5.30	Pass
STAP-1215	08/01/10	Co-60	3.15 ± 0.30	2.92	2.04 - 3.80	Pass
STAP-1215	08/01/10	Cs-134	3.03 ± 0.17	2.98	2.09 - 3.87	Pass
STAP-1215	08/01/10	Cs-137	0.01 ± 0.05	0.00	-	Pass
STAP-1215	08/01/10	Mn-54	3.69 ± 0.39	3.18	2.23 - 4.13	Pass
STAP-1215	08/01/10	Sr-90	1.00 ± 0.12	1.01	0.71 - 1.31	Pass
STAP-1215	08/01/10	Zn-65	0.03 ± 0.15	0.00	-	Pass
STAP-1216	08/01/10	Gr. Alpha	0.01 ± 0.01	0.00	-	Pass
STAP-1216	08/01/10	Gr. Beta	0.54 ± 0.05	0.50	0.25 - 0.75	Pass

[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] Results are reported in units of Bq/kg (soil), Bq/L (water) or Bq/total sample (filters, vegetation).

[c] Laboratory codes as follows: STW (water), STAP (air filter), STSO (soil), STVE (vegetation).

[d] MAPEP results are presented as the known values and expected laboratory precision (1 sigma, 1 determination) and control limits as defined by the MAPEP. A known value of "zero" indicates an analysis was included in the testing series as a "false positive". MAPEP does not provide control limits.

TABLE A-7. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA)[a].

Lab Code [b]	Date	Analysis	Concentration (pCi/L) Laboratory Result [c]	ERA Result [d]	Control Limits	Acceptance
STAP-1217	09/20/10	Am-241	55.6 ± 2.9	74.1	43.3 - 102.0	Pass
STAP-1217	09/20/10	Co-60	517.1 ± 9.1	479.0	371.0 - 598.0	Pass
STAP-1217	09/20/10	Cs-134	384.6 ± 33.7	388.0	253.0 - 480.0	Pass
STAP-1217	09/20/10	Cs-137	589.4 ± 7.1	514.0	386.0 - 675.0	Pass
STAP-1217	09/20/10	Mn-54	0.0 ± 0.0	-	-	Pass
STAP-1217	09/20/10	Pu-238	76.5 ± 4.0	72.9	50.0 - 95.8	Pass
STAP-1217	09/20/10	Pu-239/40	73.0 ± 3.8	69.6	50.5 - 90.1	Pass
STAP-1217	09/20/10	Sr-90	172.9 ± 21.3	159.0	70.0 - 247.0	Pass
STAP-1217	09/20/10	U-233/234	64.9 ± 3.9	71.8	45.2 - 106.0	Pass
STAP-1217	09/20/10	U-238	68.0 ± 4.0	71.2	45.6 - 101.0	Pass
STAP-1217	09/20/10	Uranium	135.5 ± 8.7	146.0	74.6 - 232.0	Pass
STAP-1217	09/20/10	Zn-65	563.1 ± 15.3	465.0	322.0 - 644.0	Pass
STAP-1218	09/20/10	Gr. Alpha	66.1 ± 3.2	52.3	27.1 - 78.7	Pass
STAP-1218	09/20/10	Gr. Beta	69.9 ± 2.5	52.7	32.5 - 77.0	Pass
STSO-1219	09/20/10	Ac-228	1632.0 ± 80.4	1830.0	1170.0 - 2580.0	Pass
STSO-1219	09/20/10	Am-241	1063.0 ± 120.9	1120.0	669.0 - 1440.0	Pass
STSO-1219	09/20/10	Bi-212	1752.0 ± 255.6	2070.0	543.0 - 3100.0	Pass
STSO-1219	09/20/10	Bi-214	909.3 ± 38.9	983.0	603.0 - 1410.0	Pass
STSO-1219	09/20/10	Co-60	4852.0 ± 153.5	4780.0	3480.0 - 6420.0	Pass
STSO-1219	09/20/10	Cs-134	2190.0 ± 50.7	2240.0	1440.0 - 2700.0	Pass
STSO-1219	09/20/10	Cs-137	3584.0 ± 42.5	3530.0	2700.0 - 4580.0	Pass
STSO-1219	09/20/10	K-40	10017.0 ± 274.5	10700.0	7760.0 - 14500.0	Pass
STSO-1219	09/20/10	Mn-54	0.0 ± 0.0	-	-	Pass
STSO-1219	09/20/10	Pb-212	1573.0 ± 28.2	1640.0	1060.0 - 2310.0	Pass
STSO-1219	09/20/10	Pb-214	999.0 ± 39.2	969.0	580.0 - 1440.0	Pass
STSO-1219	09/20/10	Pu-238	1568.0 ± 155.0	1280.0	733.0 - 1800.0	Pass
STSO-1219	09/20/10	Pu-239/40	1445.0 ± 142.9	1180.0	805.0 - 1570.0	Pass
STSO-1219 [e]	09/20/10	U-233/234	599.4 ± 69.4	1360.0	862.0 - 1690.0	Fail
STSO-1219 [e]	09/20/10	U-238	633.8 ± 71.3	1340.0	819.0 - 1700.0	Fail
STSO-1219 [e]	09/20/10	Uranium	1248.0 ± 152.7	2770.0	1580.0 - 3740.0	Fail
STSO-1219	09/20/10	Zn-65	2447.0 ± 60.1	2300.0	1820.0 - 3080.0	Pass
STVE-1220	09/20/10	Co-60	1108.0 ± 38.7	1010.0	683.0 - 1450.0	Pass
STVE-1220	09/20/10	Cs-134	1161.0 ± 57.3	1040.0	595.0 - 1440.0	Pass
STVE-1220	09/20/10	Cs-137	1400.0 ± 43.0	1260.0	924.0 - 1750.0	Pass
STVE-1220	09/20/10	K-40	27400.0 ± 683.4	22600.0	16200.0 - 32000.0	Pass
STVE-1220	09/20/10	Mn-54	0.0 ± 0.0	-	-	Pass

TABLE A-7. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA)[a].

Lab Code [b]	Date	Analysis	Concentration (pCi/L) Laboratory Result [c]	ERA Result [d]	Control Limits	Acceptance
STVE-1220	09/20/10	Am-241	4185.0 ± 180.0	4760.0	2710.0 - 6540.0	Pass
STVE-1220	09/20/10	Cm-244	2329.0 ± 132.5	2740.0	1350.0 - 4270.0	Pass
STVE-1220	09/20/10	Pu-238	4912.0 ± 194.0	4740.0	2560.0 - 6940.0	Pass
STVE-1220	09/20/10	Pu-239/40	4765.0 ± 111.0	4470.0	2770.0 - 6100.0	Pass
STVE-1220	09/20/10	Sr-90	7706.0 ± 583.9	7810.0	4360.0 - 10400.0	Pass
STVE-1220	09/20/10	U-233/234	3862.0 ± 203.0	4010.0	2750.0 - 5320.0	Pass
STVE-1220	09/20/10	U-238	3926.0 ± 205.3	3980.0	2800.0 - 5030.0	Pass
STVE-1220	09/20/10	Uranium	7671.0 ± 201.2	8180.0	5620.0 - 10600.0	Pass
STVE-1220	09/20/10	Zn-65	1443.0 ± 81.0	1210.0	874.0 - 1650.0	Pass
STW-1221	09/20/10	Am-241	127.9 ± 4.2	176.0	120.0 - 238.0	Pass
STW-1221	09/20/10	Co-60	697.8 ± 10.4	714.0	622.0 - 844.0	Pass
STW-1221	09/20/10	Cs-134	437.5 ± 13.3	492.0	363.0 - 565.0	Pass
STW-1221	09/20/10	Cs-137	612.8 ± 11.6	625.0	531.0 - 749.0	Pass
STW-1221	09/20/10	Fe-55	936.8 ± 508.2	825.0	480.0 - 1100.0	Pass
STW-1221	09/20/10	Mn-54	0.0 ± 0.0	-	-	Pass
STW-1221	09/20/10	Pu-238	148.1 ± 6.0	162.0	122.0 - 201.0	Pass
STW-1221	09/20/10	Pu-239/40	154.1 ± 6.2	148.0	114.0 - 183.0	Pass
STW-1221	09/20/10	Sr-90	872.3 ± 13.4	921.0	585.0 - 1230.0	Pass
STW-1221	09/20/10	U-233/234	99.1 ± 4.4	109.0	82.2 - 140.0	Pass
STW-1221	09/20/10	U-238	103.7 ± 4.5	108.0	82.5 - 134.0	Pass
STW-1221	09/20/10	Uranium	206.5 ± 9.8	221.0	159.0 - 294.0	Pass
STW-1221	09/20/10	Zn-65	489.1 ± 16.2	489.0	414.0 - 610.0	Pass
STW-1222	09/20/10	Gr. Alpha	110.6 ± 3.5	146.0	64.8 - 216.0	Pass
STW-1222	09/20/10	Gr. Beta	134.6 ± 2.6	143.0	83.6 - 210.0	Pass
STW-1223	09/20/10	H-3	23500.0 ± 1438.0	21600.0	14100.0 - 31900.0	Pass

[a] 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).

[b] Laboratory codes as follows: STW (water), STAP (air filter), STSO (soil), STVE (vegetation).

[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. A known value of "zero" indicates an analysis was included in the testing series as a "false positive". Control limits are not provided.

[e] Analysis was repeated using total dissolution. Results of the reanalysis,
U-233/234: 1137 ± 254 pCi/kg, U-238: 1193 ± 116 pCi/kg, Total Uranium: 2379 ± 254 pCi/kg.

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 4.66σ uncertainty for a background sample.

3.0. Duplicate analyses

If duplicate analyses are reported, the convention is as follows. :

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:

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

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 numbers 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.

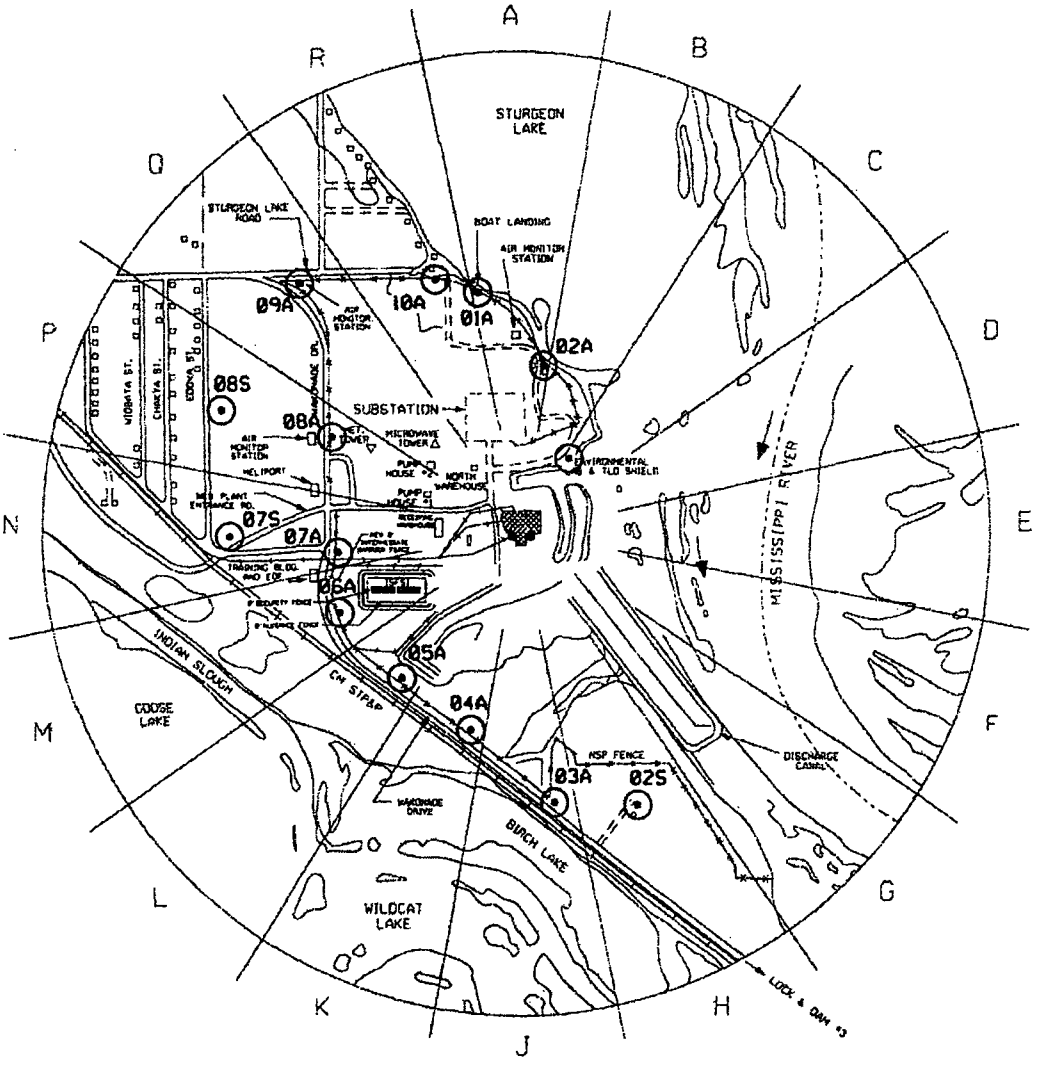
[b] Value adjusted by a factor of 700 to reduce the dose resulting from the air-grass-cow-milk-child pathway.

[c] A natural radionuclide.

APPENDIX D

Sampling Location Maps

TLD LOCATIONS
ONE MILE RADIUS



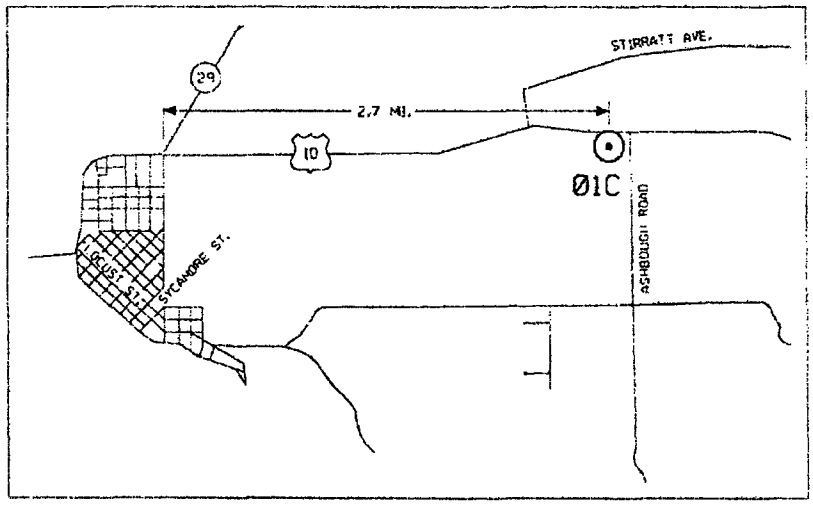
PLANT AREA ENLARGED PLAN [1.00 MILE RADIUS]

[NO SCALE]

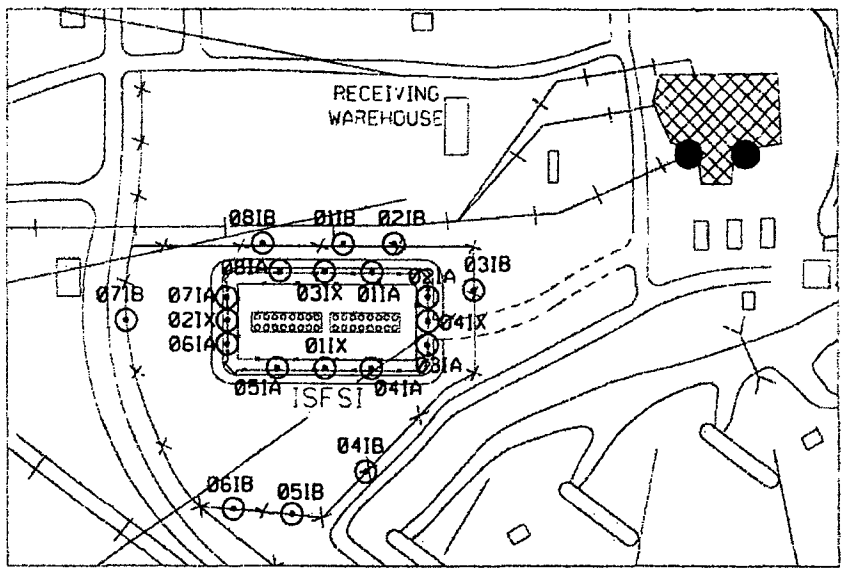
MONITORING LEGEND:

⊙ PRAIRIE ISLAND TLD POINTS

TLD LOCATIONS



CONTROL POINTS
PRESCOTT, WISCONSIN



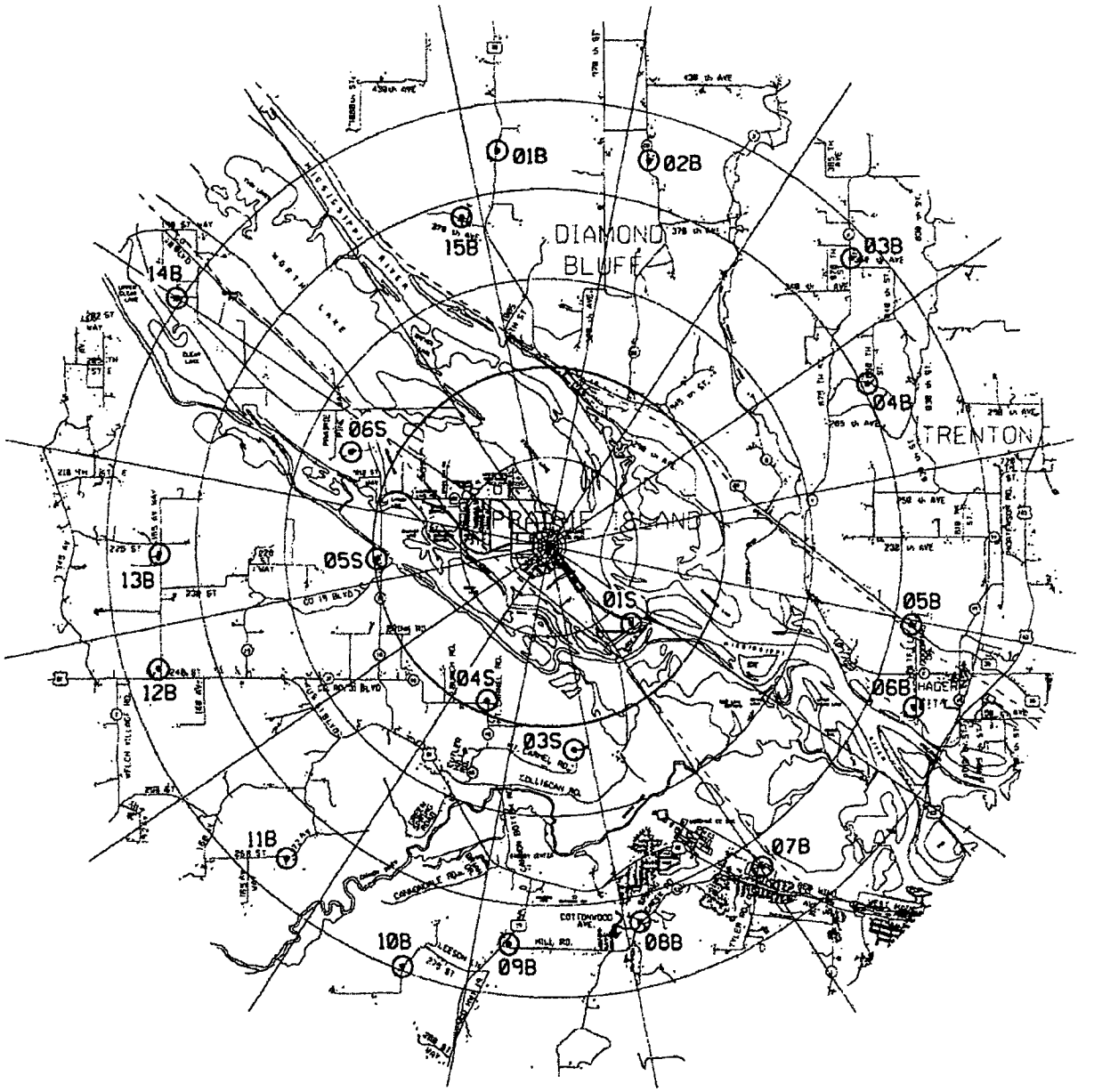
ISFSI AREA TLD LOCATIONS

MONITORING LEGEND:

⊙ PRAIRIE ISLAND TLD POINTS

TLD LOCATIONS

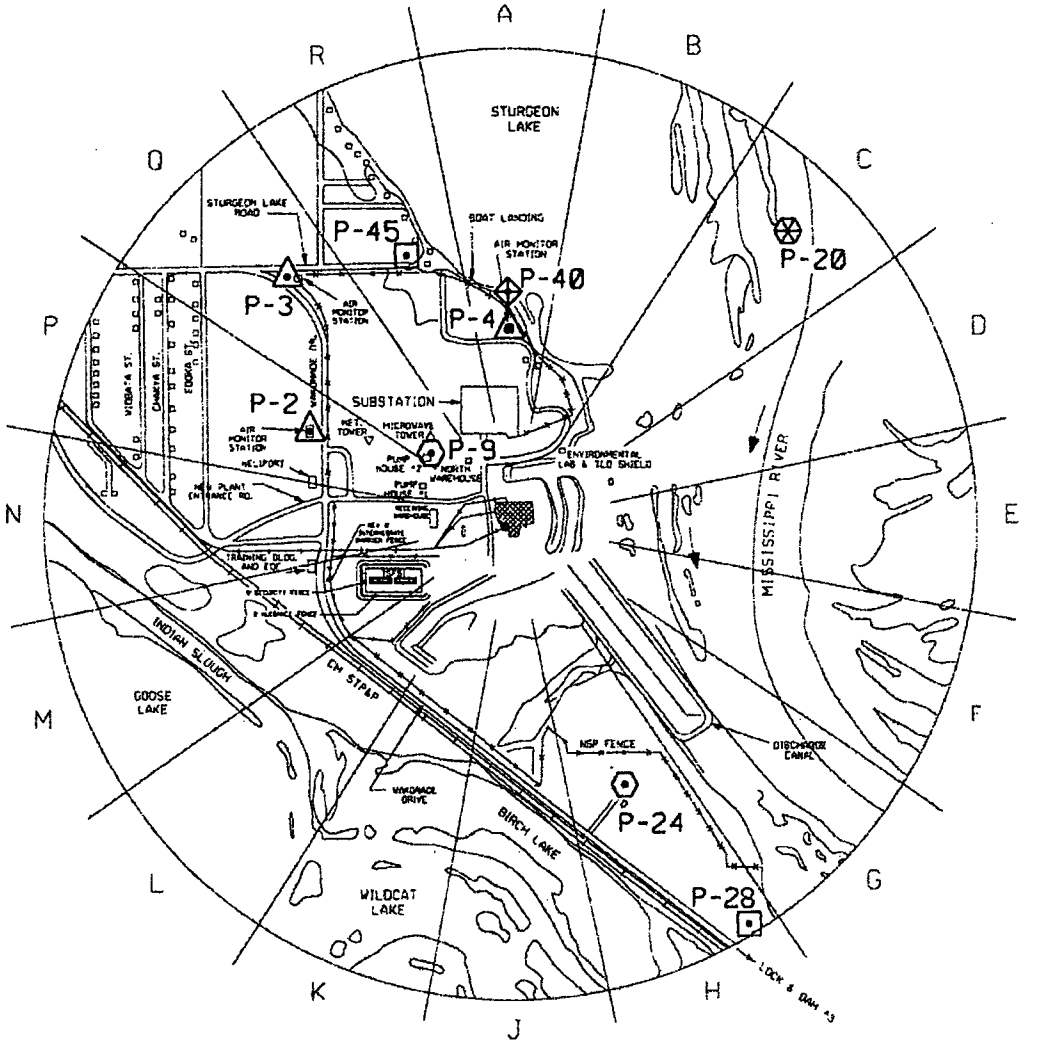
FIVE MILE RADIUS



MONITORING LEGEND:

⊙ PRAIRIE ISLAND TLD POINTS

ENVIRONMENTAL SAMPLING POINTS
ONE MILE RADIUS



PLANT AREA ENLARGED PLAN [1.00 MILE RADIUS]

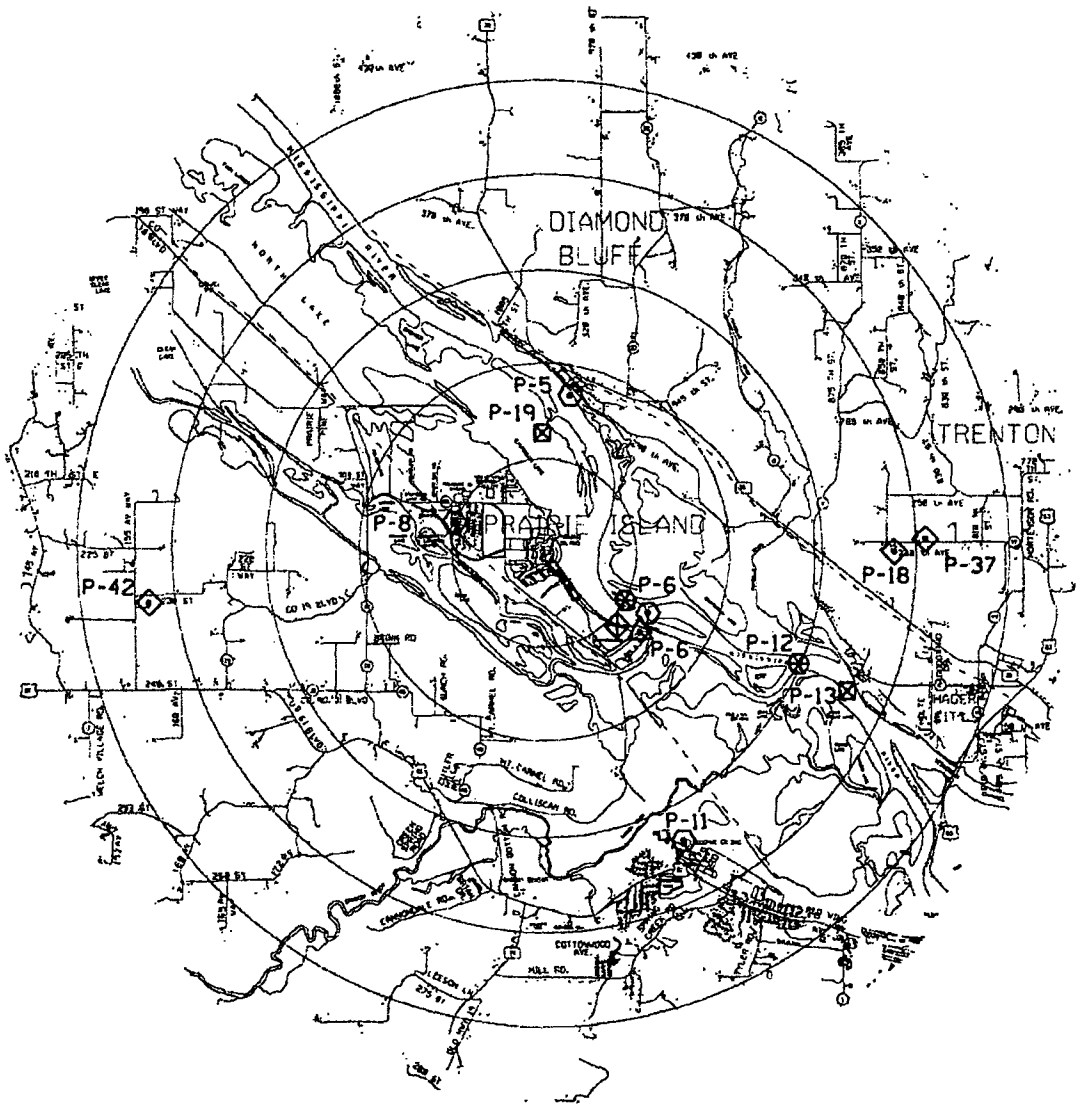
[NO SCALE]

MONITORING LEGEND

- MILK SAMPLING POINT ID NUMBERS P-18, P-37, P-42, P-43
- AIR SAMPLING POINT ID NUMBERS P-1, P-2, P-3, P-4, P-6
- WATER SAMPLING POINT ID NUMBERS P-5, P-6, P-8, P-9, P-11, P-24, P-43
- VEGETATION / VEGETABLES ID NUMBERS P-28, P-38, P-45
- FISH SAMPLING POINT ID NUMBERS P-13, P-19
- INVERTEBRATES POINT ID NUMBERS P-6, P-40
- SEDIMENT SAMPLING POINT ID NUMBERS P-6, P-12, P-20

ENVIRONMENTAL SAMPLING POINTS

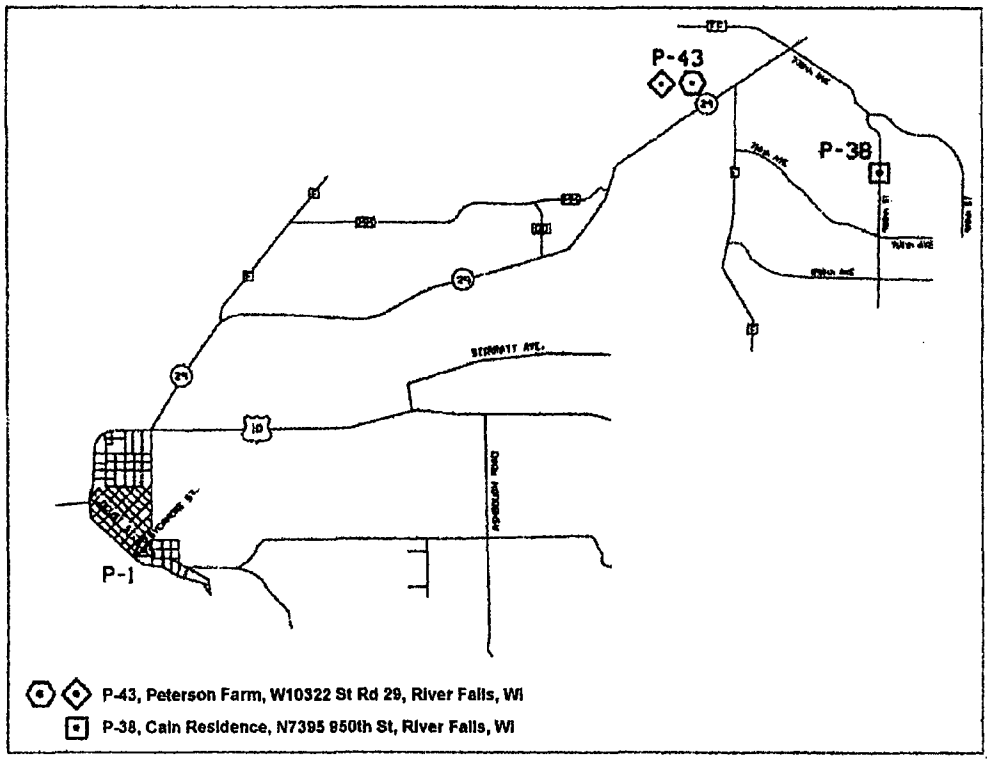
FIVE MILE RADIUS



MONITORING LEGEND

- MILK SAMPLING POINT ID NUMBERS P-18, P-37, P-42, P-43
- AIR SAMPLING POINT ID NUMBERS P-1, P-2, P-3, P-4, P-6
- WATER SAMPLING POINT ID NUMBERS P-5, P-6, P-8, P-9, P-11, P-24, P-43
- VEGETATION / VEGETABLES ID NUMBERS P-28, P-38, P-45
- FISH SAMPLING POINT ID NUMBERS P-13, P-19
- INVERTEBRATES POINT ID NUMBERS P-6, P-40
- SEDIMENT SAMPLING POINT ID NUMBERS P-6, P-12, P-20

ENVIRONMENTAL SAMPLING POINTS



CONTROL POINTS
PRESCOTT, WISCONSIN

MONITORING LEGEND

- MILK SAMPLING POINT ID NUMBERS
  P-18, P-37, P-41, P-42, P-43
- AIR SAMPLING POINT ID NUMBERS
  P-1, P-2, P-3, P-4, P-6
- WATER SAMPLING POINT ID NUMBERS
  P-5, P-6, P-8, P-9, P11, P-43
- VEGETATION / VEGETABLES ID NUMBERS
  P-28, P-38, P-45

APPENDIX E

Special Well and

Surface Water Samples

1.0 INTRODUCTION

This appendix to the Radiation Environmental Monitoring Program Annual Report to the United States Nuclear Regulatory Commission summarizes and interprets results of the special well and surface water samples taken at the Prairie Island Nuclear Generating Plant, Red Wing, Minnesota, during the period January - December, 2010. This supplemental special sampling program was established in December of 1989 when higher than expected levels of tritium were detected in a nearby residence well sample.

Tabulations of the special sampling program individual analyses made during the year are included in this appendix. A summary table of tritium analyses is also included in this appendix.

2.0 SUMMARY

This special sampling program was established following the detection of tritium in a residence well water sample south of the PINGP during 1989. This program is described and the results for 2010 are summarized and discussed.

Program findings for 2010 detected low levels of tritium in nearby residence wells and ground water surface samples at or near the expected natural background levels with the exception of sample wells P-10 and MW-8. The 2010 sample results (except for P-10 and MW-8) ranged from <19 pCi/L to 178 pCi/L. Sample well P-10 ranged from 172 pCi/L to 2980 pCi/L. Sample well MW-8 ranged from 181 pCi/L to 436 pCi/L. All tritium results are far below the Environmental Protection Agency's drinking water standard of 20,000 pCi/L and present no harm to any members of the public.

None of the water samples monitored for gamma-emitting isotopes showed any activity greater than the LLD.

3.0 Special Tritium Sampling Program

3.1 Program Design and Data Interpretation

The purpose of this sampling program is to assess the impact of any tritium leaching into the environment (ground water system) from the PINGP. For this purpose, special water samples are collected and analyzed for tritium content.

3.2 Program Description

The sampling and analysis schedule for the special water sampling program is summarized in Table E-4.1 and briefly reviewed below. Table E-4.2 defines the additional sample locations and codes for the special water sampling program.

Special well and surface water samples were collected quarterly at one location, monthly at five locations, semi-annually at 6 locations, and annually at thirty-two locations. The Peterson (P-43) and Hanson (SW-1) farm wells are used as control locations for these special samples.

To detect low levels of tritium at or below natural background levels, analyses of the samples have been contracted to a laboratory (University of Waterloo Laboratories) capable of detecting tritium concentrations down to 19 pCi/L. Waterloo Laboratories report tritium analyses results in Tritium Units (1 TU = 3.2 pCi/L). The tritium results in this report are indicated in pCi/L.

3.3 Program Execution

The special water sampling was executed as described in the preceding section. Documentation of gamma analyses using a PI plant spectrometer on samples from P-10, MW-7, and S-6 (sent for hard-to-detect nuclide analysis) could not be found. AR 1276964 was written to document this event and determine corrective actions.

3.4 Program Modifications

Changes to the program in 2010 include:

- added sampling at the Birch Lake seepage (P-31) with the intent to take quarterly (spring, summer, fall) samples but only the summer and fall samples were taken in 2010
- added annual sampling of 3 additional Prairie Island Indian Community locations PIIC-03, PIIC-19, and PIIC-24
- Samples were taken from monitoring wells P-10 and MW-7 and S-6 stormwater runoff and were sent to Environmental Incorporated for analysis for hard-to-detect nuclides in accordance with American Nuclear Insurers recommendations
- added annual snow sampling at S-6, S-7, S-8, S-9, and P-43
- added spring and fall sampling for monitoring wells P-2, P-3, P-5, P-6, PZ-8, MW-4 and MW-5, in addition to the summer annual samples
- extra sampling was conducted in November for monitoring wells P-2, P-3, P-5, P-7, PZ-5, MW-4 and MW-5

3.5 Results and Discussion

Results obtained show tritium in well water and ground water samples at or near expected natural background levels except the P-10 and MW-8 sample wells. Table E-4.4 provides the complete data table of results for each period and sampling location.

The tritium level annual averages have shown a downward trend since the special sampling begun in 1989.

Except for sample wells P-10 and MW-8, the 2010 sample results are within the range of expected background tritium levels in shallow ground water and surface water due to tritium concentrations measured in precipitation. Sampling points in North America have shown tritium concentrations in precipitation ranging from 5 pCi/L to 157 pCi/L (Environmental Isotope Data No. 10; World Survey of Isotope Concentration in Precipitation (1988-1991)).

The higher level results at the Suter residence and Birch Lake in 1989 were possibly due to seepage from the PINGP discharge canal water into the ground water. This is thought to occur due to the elevation difference between the Vermillion River and the discharge canal. The Suter residence is located between the discharge canal and Birch Lake, which connects to the Vermillion River. The PINGP discharge canal piping was lengthened during 1991, so that liquid discharges from the plant are released near the end of the discharge canal, diffused and discharged to the Mississippi River. In 1992, the underground liquid discharge pipe from the plant to the discharge canal piping was replaced with a double walled leak detectable piping system. This year's sample results continue to indicate that these modifications have eliminated the suspected radioactive effluent flow into the local ground water.

The elevated tritium levels in sample wells P-10 and MW-8 in 2010 may be due to prior leakage from the PINGP liquid radwaste discharge pipe, discharge of turbine building sump water into the landlocked area or discharge of heating stream condensate to the ground in 1978-1979. The liquid radwaste discharge pipe was replaced in 1992 and the discharge to the landlocked area has been terminated, the last discharge took place on 11/14/09.

None of the water samples monitored for gamma-emitting isotopes showed any activity greater than the LLD.

Table E-4.1. Sample collection and analysis program for special well, storage tank, and surface water samples, Prairie Island Nuclear Generating Plant, 2010.

Medium	No.	Location codes and type [a]	Collection type and frequency [b]	Analysis type [c]
Well water Annual	27	P-8, REMP P-6, PIIC-02, PIIC-03, PIIC-19, PIIC-20, PIIC-22, PIIC-23, PIIC-24, PIIC-26, PIIC-28, P-7, P-11, PZ-1, PZ-2, PZ-3, PZ-4, PZ-5, PZ-7, MW-6, P-26, SW-2, P-30, SW-3, SW-4, SW-5, P-9	G/A	H-3
Well water quarterly	1	P-24D	G/Q	H-3
Well water quarterly'	7	P-2, P-3, P-5, P-6, PZ-8, MW-4, MW-5	G/Q'	H-3
Well water monthly	5	P-43(C), SW-1(C), MW-7, MW-8, P-10	G/M	H-3
Surface water	8	S-1, S-2, S-3, S-4, S-5, S-6, S-7, P-31	G/A[d]	H-3
Storage Tank	4	11 CST, 21 CST, 22 CST, U1/2 demin hdr	G/S	H-3
Storage Tank	1	Septic Tank	G/M	H-3
Snow	5	S-6, S-7, S-8, S-9, P-43(C)	G/A	H-3

[a] Location codes are defined in table D-4.2. Control Stations are indicated by (C). All other stations are indicators.

[b] Collection type is codes as follows: G/ = grab. Collection frequency is coded as follows: M = monthly; Q = quarterly; Q' = quarterly (spring, summer, and fall), S= semiannually: A = annually.

[c] Analysis type is coded as follows: H-3 = tritium.

[d] Location S-6 and S-7 are sampled semi-annually.

Table E-4.2. Sampling locations for special well, storage tank, and surface water samples, Prairie Island Nuclear Generating Plant, 2010.

Code	Collection site	Type of sample [a]	Distance and direction from reactor
P-8	PI Community well	WW	1.0 mi. @ 321°/WNW
REMP P-6	Lock & Dam #3 well	WW	1.6 mi. @ 129°/SE
PIIC-02	2077 Other Day Road	WW	1.4 mi. @ 315°/NW
PIIC-03	6096 Whipple Way	WW	1.4 mi. @ 310°/NW
PIIC-19	6372 Sturgeon Lake Rd	WW	1.7 mi. @ 293°/WNW
PIIC-20	2158 Holmquist Road	WW	1.6 mi @ 300°/WNW
PIIC-22	1773 Buffalo Slough Rd	WW	1 mi. @ 315°/NW
PIIC-23	2.7 miles NW	WW	2.7 mi @315°/NW
PIIC-24	6424 Sturgeon Lake Rd	WW	1.7 mi. @ 293°/WNW
PIIC-26	1771 Buffalo Slough Rd	WW	1 mi. @ 315°/NW
PIIC-28	1960 Larson Lane	WW	1.5 mi @ 288°/WNW
P-24D	Suter residence	WW	0.6 mi. @ 158°/SSE
P-43	Peterson Farm (Control)	WW	13.9 mi. @ 355°/N
SW-1	Hanson Farm (Control)	WW	2.2 mi. @ 315°/NW
P-2	Sample well	WW	See map
P-3	Sample well	WW	See map
P-5	Sample well	WW	See map
P-6	Sample well	WW	See map
P-7	Sample well	WW	See map
P-10	Sample well	WW	See map
P-11	Sample well	WW	See map
PZ-1	Sample well	WW	See map
PZ-2	Sample well	WW	See map
PZ-4	Sample well	WW	See map
PZ-5	Sample well	WW	See map
PZ-7	Sample well	WW	See map
PZ-8	Sample well	WW	See map
MW-4	Sample well	WW	See map
MW-5	Sample well	WW	See map
MW-6	Sample well	WW	See map
MW-7	Sample well	WW	See map
MW-8	Sample well	WW	See map
P-26	PITC well	WW	0.4 mi. @ 258°/WSW
P-30	Environ lab well	WW	0.2 mi. @ 32°/NNE

Table E-4.2. Sampling locations for special well, storage tank, and surface water samples, Prairie Island Nuclear Generating Plant, 2010 (continued).

Code	Collection site	Type of sample [a]	Distance and direction from reactor
SW-2	STA House	WW	See map
SW-3	Cooling Tower pump	WW	See map
SW-4	New Admin Bldg	WW	0.05 mi. @ 315°/NW
SW-5	Plant Screenhouse well	WW	0.05 mi. @ 0°/N
P-9	Plant well # 2	WW	0.3 mi. @ 306°/NW
S-1	Upstream Miss. River	SW	See map
S-2	Recirc/Intake canal	SW	See map
S-3	Cooling water canal	SW	See map
S-4	Discharge Canal (end)	SW	See map
S-5	Mid Discharge Canal	SW	See map
S-6	Roof Stormwater Runoff (also snow)	SW	0.05 mi. @ 0°/N
S-7	Parking Lot Stormwater (also snow)	SW	0.3 mi @ 306°/NW
S-8	P-10 are snow	SW	See map
S-9	MW-7/8 area snow	SW	See map
P-31	Birch Lake Seepage	SW	
11 CST	Storage Tank	ST	Turbine Building
21 CST	Storage Tank	ST	Turbine Building
22 CST	Storage Tank	ST	Turbine Building
Unit 1 demin hdr	Storage Tank	ST	Turbine Building
Septic System	Storage Tank	ST	Outside #1 Warehouse

[a] Sample codes: WW = Well water; SW = Surface Water: ST = Storage Tank.

Table E-4.3 Radiation Environmental Monitoring Program Summary: Special well, storage tank, and surface water samples.

Name of Facility Prairie Island Nuclear Power Station Docket No. 50-282, 50-306

Location of Facility Goodhue, Minnesota (County, State) Reporting Period January - December 2010

Sample Type (Units)	Type and Number of Analyses [a]	LLD [b]	Indicator Locations Mean (F) [c] Range [c]	Location with Highest Annual Mean: Location [d]	Location with Highest Annual Mean: Mean (F) [c] Range [c]	Control Locations Mean (F) [c] Range [c]	Number Non-Routine Results [e]
Offsite Well Water (pCi/L)	H-3 15	19	28 (3/15) (22-32)	PIIC-26	32 (1/1)	(See Control Below)	0
Onsite Well Water (pCi/L)	H-3 79	19	199 (72/79) (22-2980)	P-10	721 (12/12) (172-2980)	(See Control Below)	22
Onsite Surface Water (pCi/L)	H-3 15	19	54 (9/15) (23-125)	S-6	84 (3/3) (29/125)	(See Control Below)	0
Onsite Storage Tank (pCi/L)	H-3 19	19	77 (14/19) (20-178)	Septic System	91 (11/11) (48-178)	(See Control Below)	0
Control (offsite well water)	H-3 24	19	<LLD			<LLD	0

[a] H-3 = tritium

[b] LLD = Nominal lower limit of detection based on 4.66 sigma error for background sample. Value shown is lowest for the period.

[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 by code.

[e] Non-routine results are those which exceed ten times the control station value.

Table E-4.4 Radiological Environmental Monitoring Program , Complete Data Table, 2010.

	SAMPLE DATES	JAN 2010	FEB 2010	MAR 2010	APR 2010	MAY 2010	JUN 2010	JUL 2010	AUG 2010	SEP 2010	OCT 2010	NOV 2010	DEC 2010
CODE	SAMPLE LOCATIONS	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L
	OFFSITE WELLS												
P-8	PI Comm. Well								<19				
REMP P-6	Lock & Dam #3 well							<19					
PIIC-02	2077 Other Day Road								<19				
PIIC-03	6096 Whipple Way								<19				
PIIC-19	6372 Sturgeon Lake Rd								<19				
PIIC-20	2158 Holmquist Rd								<19				
PIIC-22	1773 Buffalo Slough Rd								22				
PIIC-23	2.7 miles NW of plant								31				
PIIC-24	6424 Sturgeon Lake Rd								<19				
PIIC-26	1771 Buffalo Slough Rd								32				
PIIC-28	1960 Larson Lane								<19				
P-24D	Suter residence	<19			<19			<19			<19		
P-43	Peterson Farm(Control	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19
SW-1	Hanson Farm (Control)	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19

Table E-4.4 Radiological Environmental Monitoring Program , Complete Data Table, 2010 (continued).

	SAMPLE DATES	JAN 2010	FEB 2010	MAR 2010	APR 2010	MAY 2010	JUN 2010	JUL 2010	AUG 2010	SEP 2010	OCT 2010	NOV 2010	DEC 2010
CODE	SAMPLE LOCATIONS	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L
	ONSITE WELLS												
P-2	Sample well				42			48		50		72	
P-3	Sample well				22			24		33		55	
P-5	Sample well				68			54		85		57	
P-6	Sample well				26			<19		41			
P-7	Sample well							30				88	
P-10	Sample well	252	172	212	222	370	293	606	290	337	2980	2526	388
P-11	Sample well							27					
PZ-1	Sample well							32					
PZ-2	Sample well							46					
PZ-4	Sample well							30					
PZ-5	Sample well							<19				36	
PZ-7	Sample well				38			38					
PZ-8	Sample well				21			31		117			
MW-4	Sample well				55			25		20		60	
MW-5	Sample well				37			31		<19		32	
MW-6	Sample well							28					
MW-7	Sample well	108	85	43	61	68	52	54	41	46	70	56	50
MW-8	Sample well	321	336	304	436	253	260	231	233	181	299	297	201
P-26	PITC well							<19					
P-30	Env. lab well							<19					
SW-3	CT pump							<19					
P-9	Plant well # 2							41					
SW-4	New Admin							<19					
SW-5	Pln Scrnhs							34					

Table E-4.4 Radiological Environmental Monitoring Program , Complete Data Table, 2010 (continued).

	SAMPLE DATES	JAN 2010	FEB 2010	MAR 2010	APR 2010	MAY 2010	JUN 2010	JUL 2010	AUG 2010	SEP 2010	OCT 2010	NOV 2010	DEC 2010
CODE	SAMPLE LOCATIONS	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L
	ONSITE SURFACE WATER												
S-1	Mississippi River upstream							<19					
S-2	Recirculation/Intake canal							<19					
S-3	Cooling water canal							23					
S-4	Discharge Canal (end)							35					
S-5	Discharge Canal (midway)							<19					
S-6	Stormwater runoff	125*				29				97			
S-7	Parking Lot runoff	46*				<19				23			
S-8	P-10 area snow	46											
S-9	MW-7/8 area snow	66											
P-31	Birch Lake Seepage						<19			<19			

* snow samples

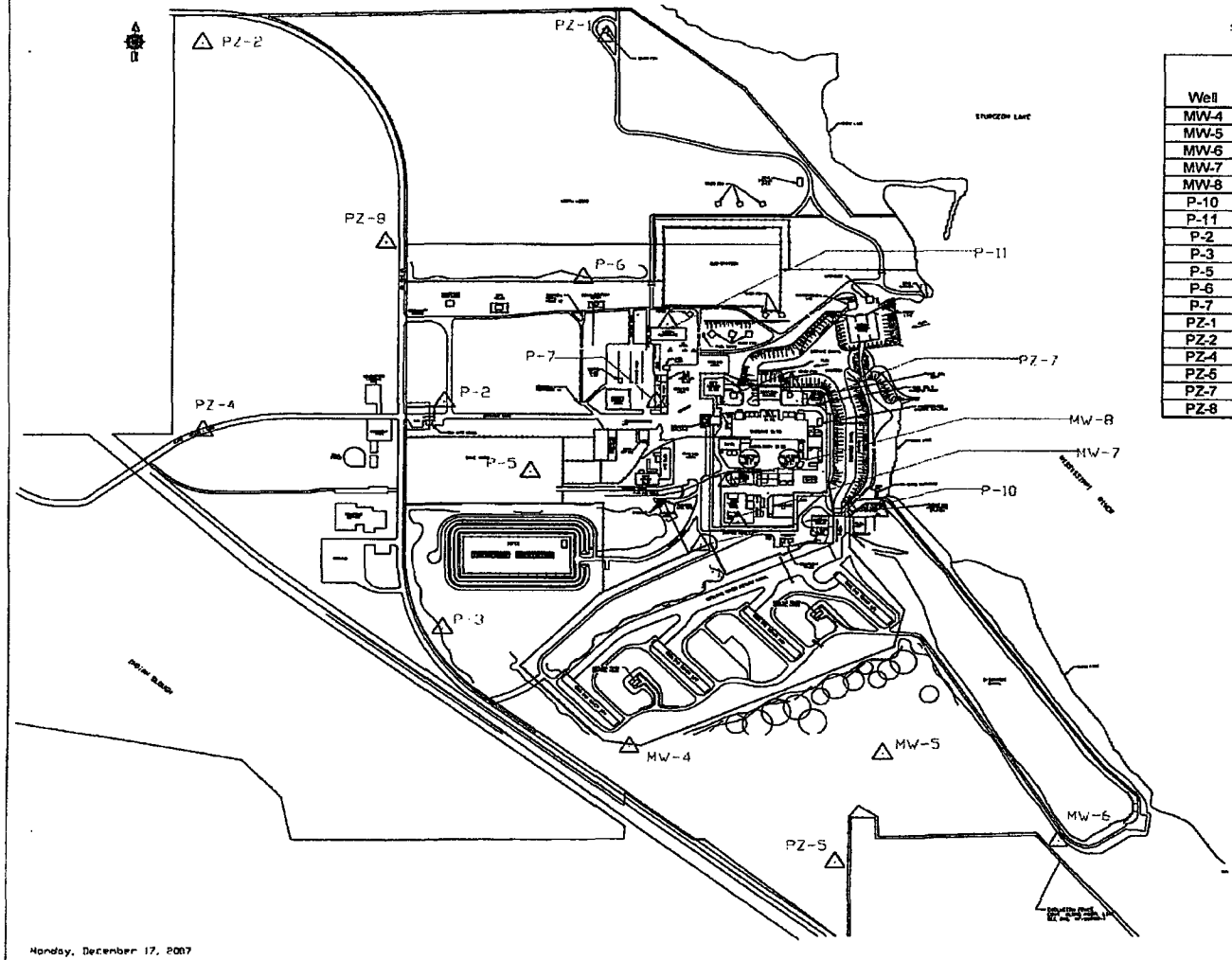
Table E-4.4 Radiological Environmental Monitoring Program , Complete Data Table, 2010 (continued).

	SAMPLE DATES	JAN 2010	FEB 2010	MAR 2010	APR 2010	MAY 2010	JUN 2010	JUL 2010	AUG 2010	SEP 2010	OCT 2010	NOV 2010	DEC 2010
CODE	SAMPLE LOCATIONS	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L
	ONSITE STORAGE TANKS												
11 CST	Storage tank					<19				30			
21 CST	Storage tank					<19				<19			
22 CST	Storage tank						20			26			
U1/U2 Demin Header	Storage tank					<19				<19			
Septic System	Storage tank	48	93	69	178		112	116	89	76	109	55	61

Table E- 4.5. Results of the analyses for iron-55, nickel-63, strontium-90, isotopic plutonium, americium-241 and isotopic curium in three samples.

Location	P-10	MW-7	Old Admin Bldg. Run off
Collection Date	07-14-10	07-14-10	07-29-10
Lab Code	PXW-4164	PXW-4165	PXW-4166
Isotope		Concentration (µCi/mL)	
Fe-55	< 7.4 E-07	< 8.4 E-07	< 7.3 E-07
Ni-63	< 1.2 E-08	< 8.1 E-09	< 7.9 E-09
Sr-90	< 4.6 E-10	< 4.6 E-10	< 4.4 E-10
Pu-238	< 1.5 E-10	< 9.6 E-11	< 8.4 E-11
Pu-239/240	< 1.5 E-10	< 1.9 E-10	< 8.4 E-11
Am-241	< 2.5 E-10	< 2.5 E-10	< 2.5 E-10
Cm-242	< 6.0 E-11	< 5.7 E-11	< 9.0 E-11
Cm-243/244	< 1.6 E-10	< 8.0 E-11	< 5.2 E-11

The error given is the probable counting error with a 95% confidence level. Less than (<), value is based on a 4.66 sigma counting error for the background sample.



Survey by Johnson & Scofield Inc
November 21, 2007

Well	North	East	Top of Riser Pipe Elev
MW-4	592236	2355090	693.02
MW-5	592201	2356566	686.83
MW-6	591642	2357597	682.33
MW-7	593685	2355714	695.54
MW-8	593944	2355654	697.47
P-10	593538	2355497	693.16
P-11	594949	2355297	698.19
P-2	594449	2354002	697.72
P-3	592998	2353997	698.19
P-5	594002	2354501	695.51
P-6	595250	2354802	699.3
P-7	594449	2355235	697.97
PZ-1	596790	2354934	682.91
PZ-2	596743	2352589	689.05
PZ-4	594262	2352598	696.53
PZ-5	591502	2356299	695.93
PZ-7	594469	2356158	697.85
PZ-8	595471	2353662	696.52