



Monticello Nuclear Generating Plant
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Monticello, MN 55362

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U.S. Nuclear Regulatory Commission
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Monticello Nuclear Generating Plant
Docket 50-263
Renewed Facility Operating License No. DPR-22

2014 Annual Radiological Environmental Operating Report

Pursuant to 10 CFR 50, Appendix I, Section IV.B.2, IV.B.3, IV.C and, in accordance with Monticello Nuclear Generating Plant (MNGP) Technical Specifications 5.6.1, the Northern States Power Company, a Minnesota corporation (NSPM), d/b/a Xcel Energy, is submitting the Annual Radiological Environmental Operating Report, "Radiological Environmental Monitoring Programs," for year 2014.

Summary of Commitments

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

A handwritten signature in black ink, appearing to read 'Peter A. Gardner'.

Peter A. Gardner
Site Vice President, Monticello Nuclear Generating Plant
Northern States Power Company – Minnesota

Enclosures (1)

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

ENCLOSURE 1

**RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
JANUARY 1 – DECEMBER 31, 2014**



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

ANNUAL REPORT
TO THE
UNITED STATES NUCLEAR REGULATORY COMMISSION

Radiological Environmental Monitoring Program

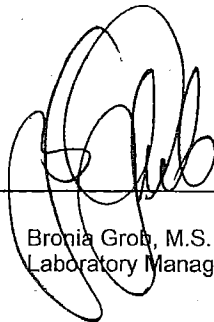
January 1 to December 31, 2014

Prepared under Contract by

ENVIRONMENTAL, Inc.
Midwest Laboratory

Project No. 8010

Approved:



Bronia Grob, M.S.
Laboratory Manager

PREFACE

The staff of Environmental, Inc., Midwest Laboratory was responsible for the acquisition of data presented in this report. Samples were collected by personnel of the Monticello Nuclear Generating Plant, operated by Northern States Power Co. -Minnesota for XCEL Energy Corporation. This report was prepared by Environmental, Inc., Midwest Laboratory.

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1.0 INTRODUCTION

This report summarizes and interprets results of the Radiological Environmental Monitoring Program (REMP) conducted by Environmental, Inc., Midwest Laboratory for the Monticello Nuclear Generating Plant, Monticello, Minnesota, during the period January - December, 2014. 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, 2014a) available at the Monticello Nuclear Generating Plant, Chemistry and Radiation Protection Department.

The Monticello Nuclear Generating Plant is a boiling water reactor with a nominal generating capacity of 670 MWe. It is located on the Mississippi River in Wright County, Minnesota, owned by Xcel Energy Corporation and operated by Northern States Power Co.-Minnesota. Initial criticality was achieved on December 10, 1970. Full power was achieved March 5, 1971 and commercial operation began on June 30, 1971.

2.0 SUMMARY

The Radiological Environmental Monitoring Program (REMP) required by the U.S. Nuclear Regulatory Commission (NRC) Technical Specifications and the Offsite Dose Calculation Manual (ODCM) for the Monticello Nuclear Generating Plant is described. Results for the year 2014 are summarized and discussed.

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

3.0 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (REMP)

3.1 Program Design and Data Interpretation

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

Sources of environmental radiation include the following:

- (1) Natural background radiation arising from cosmic rays and primordial radionuclides;
- (2) Fallout from atmospheric nuclear detonations;
- (3) Releases from nuclear power plants;
- (4) Industrial and medical radioactive waste; and
- (5) Fallout from nuclear accidents.

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

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

An additional interpretive technique involves analyses for specific radionuclides present in environmental samples collected from the Plant site. The Plant's monitoring program includes analyses for tritium and iodine-131. Most samples are also analyzed for gamma-emitting isotopes with results for the following groups quantified: zirconium-95, cesium-137, cerium-144, beryllium-7, and potassium-40. The first three gamma-emitting isotopes were selected as radiological impact indicators because of the different characteristic proportions in which they appear in the fission product mix produced by a nuclear reactor and that produced by a nuclear detonation. Each of the three isotopes is produced in roughly equivalent amounts by a reactor: each constitutes about 10% of the total activity of fission products 10 days after reactor shutdown. On the other hand, 10 days after a nuclear explosion, the contributions of zirconium-95, cerium-144, and cesium-137 to the activity of the resulting debris are in the approximate ratio 4:1:0.03 (Eisenbud, 1963). Beryllium-7 is of cosmogenic origin and potassium-40 is a naturally-occurring isotope. They were chosen as calibration monitors and should not be considered as radiological impact indicators. The other group quantified consists of niobium-95, ruthenium-103 and -106, cesium-134, barium-lanthanum-140, and cerium-141. These isotopes are released in small quantities by nuclear power plants, but to date their major source of injection into the general environment has been atmospheric nuclear testing. Nuclides of the final group, manganese-54, iron-59, cobalt-58 and -60, and zinc-65, are activation products and arise from activation of corrosion products. They are typical components of a nuclear power plant's effluents, but are not produced in significant quantities by nuclear detonations.

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

3.2 Program Description

The sampling and analysis schedule for the Radiological Environmental Monitoring Program (REMP) at the Monticello Plant is summarized in Table 5.1 and briefly reviewed below. Table 5.2 defines the sampling location codes used in Table 5.1 and specifies for each location its type (indicator or control) and its distance, direction, and sector relative to the plant site. To assure that sampling is carried out in a reproducible manner, detailed sampling procedures have been prescribed (Monticello Generating Plant REMP Surveillances, Current Revision). Maps of sampling locations are included in Appendix D.

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

Ambient gamma radiation is monitored at forty locations, using $\text{CaSO}_4:\text{Dy}$ dosimeters with four sensitive areas at each location: fourteen in an inner ring in the general area of the site boundary, sixteen in the outer ring within 4-5 mile radius, six at special interest locations and four control locations, outside a 10 mile radius from the plant. They are replaced and measured quarterly.

As substitute for dairy sampling, pasture grass and vegetation are collected from locations M-41, M-42 and M-43 (C). The samples are analyzed for iodine-131 and other gamma emitting isotopes.

Vegetables, corn and potatoes are collected annually if fields are irrigated by water in which liquid radioactive effluent has been discharged. Analysis is done for gamma-emitting isotopes.

Ground water is monitored by quarterly collections from three off-site locations (one control and two indicators) and one on-site Plant well. To prevent possible groundwater contamination due to plant operations, samples from nineteen on-site monitoring wells are collected and analyzed for tritium and gamma emitting isotopes. The Ground Water Monitoring Program is further described in Appendix E.

Quarterly collections of storm water runoff were added to monitor another possible pathway to the groundwater aquifer. The samples are also analyzed for tritium and gamma emitting isotopes.

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

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

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

3.3 Program Execution

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

(1) Air Particulates / Air Iodine:

M-01, No air particulate / air iodine sample was available from for the week ending May 14, 2014, the sampler the sampler was found off due to a tripped GFCI.

M-05, No air particulate for the week ending May 28, 2014, due to the filter paper shifting within the sample holder.

M-01, No air particulate / air iodine sample was available from for the week ending August 27, 2014, the sampler the sampler was found off due to a tripped GFCI.

(2) Surface Water:

Surface water was not collected at location M-08 for the months of January, February, March, and December, 2014, or for the weeks of 11/19/14 and 11/26/14 due to unsafe ice conditions.

(3) Well Water:

Well water was not collected at location MW-27 in January, 2014. No water was available from the outside tap.

(4) TLD's:

TLD samples were found missing for the first quarter at location M-I-08 and for the fourth quarter at location M-2-C.

(5) Invertebrates:

Water conditions did not allow collection at location M-08 for Fall 2014.

Deviations from the program are summarized in Table 5.3.

3.4 Program Modifications

Milk sampling was dropped from the REMP in 2013. The indicator location M-16 discontinued dairy operations.

Modifications to the Groundwater monitoring program are detailed in Appendix E.

Broad Leaf Vegetable sampling was removed from the REMP program in 2014. This requirement specified I-131 analysis of one broad leaf vegetable from the highest D/Q garden and had been unobtainable since 2011. This requirement was above and beyond the guidance in NUREG 1302 and was removed in ODCM-07.01, Revision 23.

3.5 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 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. Dept 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, 2012). The QA Program includes participation in Interlaboratory Comparison (crosscheck) Programs. Results obtained in the crosscheck programs are presented in Appendix A.

3.6 Land Use Census

In accordance with the MNGP Chemistry Manual, Procedure I.05.41, "Annual Land Use Census and Critical Receptor Identification", a land use census shall be conducted and shall identify the location of the nearest milk animal, the nearest residence, and the nearest garden of greater than 500 ft² producing fresh leafy vegetables, in each of the 16 meteorological sectors within a distance of 5 miles. The census shall also identify the locations of all milk animals and all 500 ft² or greater gardens producing broad leaf vegetation in each of the meteorological sectors within a distance of three miles. This census shall be conducted at least once per year between the dates of May 1 and October 31. New locations shall be added to the radiation environmental monitoring program within 30 days and sampling locations having lower calculated doses or a lower dose commitment may be deleted from this monitoring program after October 31 of the year in which the land use census was conducted.

The 2014 land use census was conducted between September 15 and September 24, 2014.

This is the second year using improved GPS software. The GPS software more accurately plots the distance and direction of identified locations. This improved GPS software resulted in slight changes to distance and directional values. There were three sectors in which the highest D/Q values increased by greater than 20%. The highest D/Q value for gardens in three sectors changed due to a closer residence planting a garden in 2014 where there was no garden in 2013. There were no sectors where the highest D/Q values for the nearest residence changed by more than 20%. There currently are no milking animals within a five mile radius of the plant. Vegetation sampling is currently being performed in lieu of milk sampling.

Details of the land use census are contained in the Land Use Census and Critical Receptor Report, Monticello Nuclear Generating Plant, Chemistry and Radiation Protection Department.

4.0 RESULTS AND DISCUSSION

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

All results are summarized in Table 5.4 in a format recommended by the Nuclear Regulatory Commission in Regulatory Guide 4.8. For each type of analysis of each sampled medium, this table lists the mean and range for all indicator locations and for all control locations. The locations with the highest mean and range are also shown.

4.1 Atmospheric Nuclear Detonations and Nuclear Accidents

There were no reported accidents involving significant release to the environment at nuclear reactor facilities in 2014. The Fukushima Daiichi nuclear accident occurred March 11, 2011.

There were no reported atmospheric nuclear tests in 2014. The last reported test was conducted on October 16, 1980 by the People's Republic of China.

4.2 Summary of Preoperational Data

The following constitutes a summary of preoperational studies conducted at the Monticello Nuclear Generating Plant during the years 1968 to 1970, to determine background levels expected in the environment, and provided, where applicable, as a means for comparison with present day levels. Strict comparisons, however, are difficult to make, since background levels of radiation were much higher in these years due to radioactive fallout from the atmosphere. Gross beta measurements in fallout averaged 20,600 pCi/m³ in 1969 and 12,000 pCi/m³ in 1970. These levels are reflected throughout the various media tested.

In the air environment, ambient gamma radiation (TLDs) averaged 9.1 mRem/4 weeks during preoperational studies (1970). Gross beta in air particulates in 1969 and 1970 averaged 0.20 pCi/m³. Present day levels have stabilized at around 0.025 pCi/m³. Airborne radioiodine remained below detection levels of 0.03 pCi/m³.

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

The aqueous environment was monitored by testing of river water, bottom sediments, fish, aquatic vegetation, and periphyton. Specific location comparison of drinking, river, and well water concentrations for tritium and gross beta are not possible. However, tritium background levels, measured at seven separate locations from 1968 to 1970, averaged 970 pCi/L. Present day environmental samples measure below detection levels. Values for gross beta, measured from 1968 to 1970, averaged 9.8 pCi/L in upstream and downstream Mississippi River water, 4.4 pCi/L for well waters, and 18.6 pCi/L for lake waters. Gamma emitters were below the lower limit of detection (LLD). In shoreline sediments, gross beta background levels in 1970 averaged 49.8 pCi/g for both upstream and downstream samples. Cs-137 activity averaged 0.10 pCi/g for both upstream and downstream samples. Low levels of Cs-137, occasionally observed today can still be attributed to residual activity from atmospheric fallout. Gross beta levels in fish flesh averaged 5.3 pCi/g in 1968 and 1969. Cs-137, measured in 1969 and 1970, averaged 0.044 pCi/g. Gross beta background levels, in 1970, for aquatic vegetation, algae, and periphyton samples measured 86.7 pCi/g, 76.5 pCi/g, and 28.1 pCi/g respectively.

4.3 Program Findings

Results obtained show background levels of radioactivity in environmental samples collected outside of the Site Protected Area in 2014. The trace levels of strontium-90 and cesium-137, still measurable in soil and sediment samples, are generally attributed to deposition of fallout from previous decades.

Tritium was identified in some groundwater samples collected within the site Protected Area.

Ambient Radiation (TLD's)

Ambient radiation was measured in the general area of the site boundary, at an outer ring 4 - 5 mi. distant from the Plant, at special interest areas and at four control locations. The means were similar for both inner and outer rings (13.5 and 12.9 mRem/91 days, respectively). The mean for special interest locations was 13.2 mRem/91 days and the mean for the control locations was 14.3 mRem/91 days. Dose rates measured at the inner and outer ring locations were similar to those observed from 1999 through 2014 and are tabulated below. No plant effect on ambient gamma radiation is indicated (Figure 5-1).

<u>Year</u>	<u>Inner Ring</u>	<u>Outer Ring</u>
<u>Dose rate (mRem/91 days)</u>		
1999	15.1	14.3
2000	15.1	14.5
2001	14.3	13.7
2002	15.9	14.8
2003	15.6	15.0
2004	16.0	15.4
2005	15.6	15.2
2006	16.5	15.6
2007	16.1	15.1
2008	15.2	14.6
2009	14.9	14.4
2010	14.7	14.3
2011	14.8	14.3
2012	16.2	15.5
2013	14.4	14.0
2014	13.5	12.9

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

Airborne Particulates

The average annual gross beta concentrations in airborne particulates were almost identical at both indicator and control locations (0.027 and 0.028 pCi/m³, respectively), similar to levels observed from 1998 through 2012. The results are tabulated below.

<u>Year</u>	<u>Indicators</u>	<u>Control</u>
<u>Concentration (pCi/m³)</u>		
1999	0.023	0.025
2000	0.027	0.026
2001	0.027	0.026
2002	0.028	0.028
2003	0.027	0.027
2004	0.024	0.024
2005	0.025	0.025
2006	0.024	0.025
2007	0.027	0.028
2008	0.028	0.029
2009	0.029	0.030
2010	0.026	0.026
2011	0.029	0.027
2012	0.032	0.031
2013	0.029	0.032
2014	0.027	0.028

Average annual gross beta concentrations in airborne particulates.

Typically, the highest average readings occur during the months of January and December, and the first and fourth quarters, as observed in 1999 through 2014.

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 0.065 pCi/m³ 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/m³ in all samples.

River Water and Drinking Water

Tritium activity measured below 500 pCi/L in all samples. Gross beta activity in Minneapolis drinking water averaged 2.8 pCi/L and was similar to average levels observed from 1998 through 2012. Gross beta averages are tabulated below.

<u>Year</u>	<u>Gross Beta (pCi/L)</u>		<u>Year</u>	<u>Gross Beta (pCi/L)</u>
1999	2.2		2007	2.8
2000	2.5		2008	2.1
2001	2.5		2009	2.3
2002	2.9		2010	2.9
2003	3.0		2011	2.2
2004	2.7		2012	2.4
2005	2.8		2013	2.6
2006	2.1		2014	2.8

Average annual concentrations; Gross beta in drinking water.

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

Well Water

At the four indicator and control locations, tritium measured below 500 pCi/L for all samples. Gamma isotopic results were below detection limits.

The data for 2014 were consistent with previous year's results and no plant operational effects were indicated.

Pasture Grass

Pasture grass was collected in July, August and September, 2014. Iodine-131 concentrations measured below 0.038 pCi/g wet weight in all samples. With the exceptions of naturally-occurring beryllium-7 and potassium-40, no other gamma-emitting isotopes were detected.

Crops

A vegetation collection was not required for 2014. No crops, within five miles of the plant, were found using irrigation water from the Mississippi River.

Fish

Fish were collected in June and September. Flesh was separated from the bones and analyzed by gamma spectroscopy. Only naturally-occurring potassium-40 was found in the upstream and downstream samples (2.71 and 2.76 pCi/g wet weight, respectively). Other gamma-emitting isotopes remained below detection limits. There was no indication of a plant effect.

Invertebrates

Samples were collected in August and October, 2014, and analyzed by gamma spectroscopy. All gamma-emitting isotopes, with the exception of naturally-occurring potassium-40 were below detection limits. There was no indication of any plant effect.

Shoreline Sediments

Upstream, downstream and downstream recreational area shoreline sediment collections were made in August and October, 2014, and analyzed for gamma-emitting isotopes. Low levels of cesium-137 were detected in two downstream samples (M-15), at an average concentration of 0.0047 pCi/g dry weight. Low levels of cesium-137 were also detected at one of the two control samples at a concentration of 0.028 pCi/gdry as well as at one of the two recreation area samples at a concentration of 0.059 pC/gdry. Similar levels of activity and distribution have been observed since 1978, and are indicative of the influence of fallout deposition. Naturally-occurring beryllium-7 and potassium-40 were also detected. There was no indication of a plant effect.

Ground Water Monitoring Program

Monitoring Wells (on-site)

Measurable tritium above 500 pCi/L was detected in 15 of 118 samples collected from the nineteen on-site monitoring wells. The activities ranged from 505 to 5,911 pCi/L, Which is a decline from the level observed in 2013. The highest activities were observed at well MW-09A.

Gamma isotopic measurements were below detection limits.

Stormwater Run-off (on-site)

Measureable tritium above 500 pCi//Lwas detected at one of the four stormwater runoff samples submitted for analysis in 2014. Gamma isotopic analysis results measured below detection limits.

5.0 FIGURES AND TABLES

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

Medium	No.	Location Codes (and Type) ^a	Collection Type and Frequency ^b	Analysis Type and Frequency ^c
Ambient radiation (TLDs)	40	M-01A - M-14A, M-01B - M-16B M-01S - M-06S, M-01C - M-04C	C/Q	Ambient gamma
Airborne Particulates	5	M-1(C), M-2, M-3, M-4, M-5	C/W	GB, GS (QC of each location)
Airborne Iodine	5	M-1(C), M-2, M-3, M-4, M-5	C/W	I-131
Pasture grass, Vegetation ^d	3	M-41, M-42, M-43(C)	3x/year	GS
Surface water	2	M-8(C), M-9	G/W	GS(MC), H-3(QC)
Drinking water	1	M-14	G/W	GB(MC), I-131(MC) GS (MC), H-3 (QC)
Well water	4	M-11, M-12, M-27, M-43(C)	G/Q	H-3, GS
On-site monitoring wells	5	M-36 to M-40	G/Q	H-3, GS
	19	M-33 to M-35, M-44 to M-54	G/M	H-3, GS
Edible cultivated crops ^e -				
Corn	1	M-19	G/A	GS
Potatoes	1	M-21	G/A	GS
Fish (two species, edible portion)	2	M-8(C), M-9	G/SA	GS
Periphyton or invertebrates	2	M-8(C), M-9	G/SA	GS
Shoreline sediment	3	M-8(C), M-9, M-15	G/SA	GS

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

^b Collection type is coded as follows: C/ = continuous, G/ = grab. Collection frequency is coded as follows:

W= weekly, M = monthly, Q = quarterly, SA = semiannually, A = annually.

^c Analysis type is coded as follows: GB = gross beta, GS = gamma spectroscopy, H-3 = tritium, I-131 = iodine-131.

Analysis frequency is coded as follows: MC = monthly composite, QC = quarterly composite.

^d Pasture grass and vegetation collections added to supplement dairy sampling.

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

Table 5.2. Sampling locations, Monticello Nuclear Generating Plant.

Code	Type ^a	Collection Site	Sample Type ^b	Distance and Direction from Reactor
M-1	C	Air Station M-1	AP, AI	11.0 mi @ 307°/NW
M-2		Air Station M-2	AP, AI	0.8 mi @ 140°/SE
M-3		Air Station M-3	AP, AI	0.6 mi @ 104°/ESE
M-4		Air Station M-4	AP, AI	0.8 mi @ 147°/SSE
M-5		Air Station M-5	AP, AI	2.6 mi @ 134°/SE
M-8	C	Upstream of Plant Intake	SW, SS, BO, F	< 1000' upstream
M-9		Downstream of Plant Discharge	SW, SS, BO, F	< 1000' downstream
M-11		City of Monticello	WW	3.3 mi @ 127°/SE
M-12		Plant Well #11	WW	0.26 mi @ 252°/WSW
M-14		City of Minneapolis	DW	37.0 mi @ 132°/SE
M-15		Montissippi Park	SS	1.27 mi @ 114°/ESE
M-19		River Irrigated Corn Field ^c	VE	
M-21		River Irrigated Potato Field ^c	VE	
M-27		Wise residence ^c	VE, WW	0.64 mi @ 207°/SSW
M-33		Monitoring Well #1	WW	593' @ 299°/WNW
M-34		Monitoring Well #2	WW	749' @ 301°/WNW
M-35		Monitoring Well #3	WW	770' @ 305°/NW
M-36		Monitoring Well #4	WW	0.1 mi @ 25°/NNE
M-37		Monitoring Well #5	WW	0.1 mi @ 253°/WSW
M-38		Monitoring Well #6	WW	229' @ 228°/SW
M-39		Monitoring Well #7	WW	0.2 mi @ 66°/ENE
M-40		Monitoring Well #8	WW	0.3 mi @ 150°/SSE
M-41		Training Center	VE	0.8 mi @ 151°/SSE
M-42		Biology Station Road	VE	0.6 mi @ 134°/SE
M-43	C	Imholte Farm	VE, WW	12.3 mi @ 313°/NW
M-44		Monitoring Well #9	WW	0.1 mi @ 310°/NW
M-45		Monitoring Well #10	WW	0.1 mi @ 292°/WNW
M-46		Monitoring Well #11	WW	0.1 mi @ 283°/WNW
M-47		Monitoring Well #12A	WW	0.1 mi @ 330°/NW
M-48		Monitoring Well #12B	WW	0.1 mi @ 326°/NW
M-49		Monitoring Well #13A	WW	0.12 mi @ 316°/NW
M-50		Monitoring Well #13B	WW	0.12 mi @ 316°/NW
M-51		Monitoring Well #9B	WW	0.1 mi @ 310°/NW
M-52		Monitoring Well #14	WW	0.17 mi @ 306°/NW
M-53		Monitoring Well #15A	WW	751' @ 14°/NNE
M-54		Monitoring Well #15B	WW	750' @ 14°/NNE
			Storm water Runoff	

Table 5.2. Sampling locations, Monticello Nuclear Generating Plant.

Code	Type ^a	Collection Site	Sample Type ^b	Distance and Direction from Reactor
General Area of the Site Boundary				
M-01A		Sherburne Ave. So.	TLD	0.75 mi @ 353°/N
M-02A		Sherburne Ave. So.	TLD	0.79 mi @ 23°/NNE
M-03A		Sherburne Ave. So.	TLD	1.29 mi @ 56°/NE
M-04A		Biology Station Road	TLD	0.5 mi @ 92°/E
M-05A		Biology Station Road	TLD	0.48 mi @ 122°/ESE
M-06A		Biology Station Road	TLD	0.54 mi @ 138°/SE
M-07A		County Road 75	TLD	0.47 mi @ 158°/SSE
M-08A		County Road 75	TLD	0.45 mi @ 175°/S
M-09A		County Road 75	TLD	0.38 mi @ 206°/SSW
M-10A		County Road 75	TLD	0.38 mi @ 229°/SW
M-11A		County Road 75	TLD	0.4 mi @ 237°/WSW
M-12A		County Road 75	TLD	0.5 mi @ 262°/W
M-13A		North Boundary Road	TLD	0.89 mi @ 322°/NW
M-14A		North Boundary Road	TLD	0.78 mi @ 335°/NNW
Approximately 4 to 5 miles Distant from the Plant				
M-01B		Sherco #1 Air Station	TLD	4.65 mi @ 01°/N
M-02B		County Road 11	TLD	4.4 mi @ 18°/NNE
M-03B		County Road 73 & 81	TLD	4.3 mi @ 51°/NE
M-04B		County Road 73 (196th St.)	TLD	4.2 mi @ 67°/ENE
M-05B		City of Big Lake	TLD	4.3 mi @ 89°/E
M-06B		County Road 14 and 196th St.	TLD	4.3 mi @ 117°/ESE
M-07B		Monte Industrial Drive	TLD	4.3 mi @ 136°/SE
M-08B		Residence, Hwy 25 & Davidson Ave.	TLD	4.6 mi @ 162°/SSE
M-09B		Weinand Farm	TLD	4.7 mi @ 178°/S
M-10B		Reisewitz Farm, Acacia Ave.	TLD	4.2 mi @ 204°/SSW
M-11B		Vanlith Farm, 97th Ave.	TLD	4.0 mi @ 228°/SW
M-12B		Lake Maria State Park	TLD	4.2 mi @ 254°/WSW
M-13B		Bridgewater Station	TLD	4.1 mi @ 270°/W
M-14B		Anderson Residence, Cty Rd. 111	TLD	4.3 mi @ 289°/WNW
M-15B		Red Oak Wild Bird Farm	TLD	4.3 mi @ 309°/NW
M-16B		Sand Plain Research Farm	TLD	4.4 mi @ 341°/NNW

Table 5.2. Sampling locations, Monticello Nuclear Generating Plant.

Code	Type ^a	Collection Site	Sample Type ^b	Distance and Direction from Reactor
Special Interest Locations				
M-01S		Osowski Fun Market	TLD	0.66 mi @ 241°/WSW
M-02S		Krone Residence	TLD	0.5 mi @ 220°/SW
M-03S		Big Oaks Park	TLD	1.53 mi @ 103°/ESE
M-04S		Pinewood School	TLD	2.3 mi @ 131°/SE
M-05S		Rivercrest Christian Academy	TLD	3.0 mi @ 118°/ESE
M-06S		Monte Public Works	TLD	2.6 mi @ 134°/SE
M-01C	C	Kirchenbauer Farm	TLD	11.5 mi @ 323°/NW
M-02C	C	County Roads 4 and 15	TLD	11.2 mi @ 47°/NE
M-03C	C	County Rd 19 and Jason Ave.	TLD	11.6 mi @ 130°/SE
M-04C	C	Maple Lake Water Tower	TLD	10.3 mi @ 226°/ SW
Protected Area				
ISFSI-1		ISFSI-1 (neutron) and I-01 (gamma)	TLD	NE corner of ISFSI
ISFSI-2		ISFSI-2 (neutron) and I-02 (gamma)	TLD	North side of ISFSI, center
ISFSI-3		ISFSI-3 (neutron) and I-03 (gamma)	TLD	NW corner of ISFSI
ISFSI-4		ISFSI-4 (neutron) and I-04 (gamma)	TLD	West side of ISFSI, middle
ISFSI-5		ISFSI-5 (neutron) and I-05 (gamma)	TLD	West side of ISFSI, at center of array
ISFSI-6		ISFSI-6 (neutron) and I-06 (gamma)	TLD	SW corner of ISFSI
ISFSI-7		ISFSI-7 (neutron) and I-07 (gamma)	TLD	South side of ISFSI, center
ISFSI-8		ISFSI-8 (neutron) and I-08 (gamma)	TLD	SE corner of ISFSI
ISFSI-9		ISFSI-9 (neutron) and I-09 (gamma)	TLD	East side of ISFSI, at center of array
ISFSI-10		ISFSI-10 (neutron) and I-10 (gamma)	TLD	East side of ISFSI, middle
ISFSI-11		ISFSI-11 (neutron) and I-11 (gamma)	TLD	OCA fence south, on exit road
ISFSI-12		ISFSI-12 (neutron) and I-12 (gamma)	TLD	OCA fence middle, on exit road
ISFSI-13		ISFSI-13 (neutron) and I-13 (gamma)	TLD	OCA fence north, on exit road
ISFSI-14		ISFSI-14 (neutron)	TLD	Posted with TLD M12A
ISFSI-15		ISFSI-15 (neutron)	TLD	Posted with TLD M10A
ISFSI-16		ISFSI-16 (neutron)	TLD	Posted with TLD M02S
Neutron Control A	C		TLD	Posted with TLD M03C
Neutron Control B	C		TLD	Posted with TLD M04C
Neutron Control C	C		TLD	Posted with TLD M02C
Neutron Control D	C		TLD	Posted with TLD M01C
^a "C" denotes control location. All other locations are indicators.				
^b Sample Codes:				
AP	Airborne particulates	F	Fish	
AI	Airborne iodine	SW	River Water	
BS	Bottom (river) sediments	SS	Shoreline Sediments	
BO	Bottom organisms	TLD	Thermoluminescent Dosimeter	
DW	Drinking Water	VE	Vegetation / vegetables	
		WW	Well Water	
^c Collected only if the plant discharges radioactive effluent into the river, then only from river irrigated fields.				

Table 5.3 Missed Collections and Analyses.

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
SW	Gamma	M-008	January '14	Water frozen entire month; no composite.	None Required
WW	Gamma, H-3	M-027	1/15/2014	Residence vacant	Removed from program. Added New Location (Hasbrouck Residence)
SW	Gamma	M-008	February '14	Water frozen entire month; no composite.	None Required
SW	Gamma	M-009	February '14	Water frozen entire month; no composite.	None Required
TLD	Gamma	M-I-08	1st Qtr '14	TLD missing in field.	Replaced TLD
SW	Gamma	M-008	March '14	Water frozen entire month; no composite.	None Required
SW	H-3	M-008	March '14	Water frozen entire quarter; no composite.	None Required
AP/AI	Beta, I-131	M-001	5/14/2014	Sampler found off; GFCI tripped.	Breaker reset.
AP	Beta	M-005	5/28/2014	Filter paper shifted in holder.	Changed sample head configuration to open heads.
AP	Beta	M-004	7/30/2014	Filter paper shifted in holder.	Changed sample head configuration to open heads.
AP/AI	Beta, I-131	M-001	8/27/2014	Sampler found off; GFCI tripped.	Breaker reset.
BO	Gamma	M-008	Fall'14	Water conditions did not allow Collection.	None required.
SW	Gamma	M-008	11/19/2014	Water frozen.	None required.
SW	Gamma	M-008	11/26/2014	Water frozen.	None required.
SW	Gamma	M-008	December '14	Water frozen entire month; no composite.	None Required
TLD	Gamma	M-2C	4th Qtr '14	TLD missing in field.	Replaced TLD

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

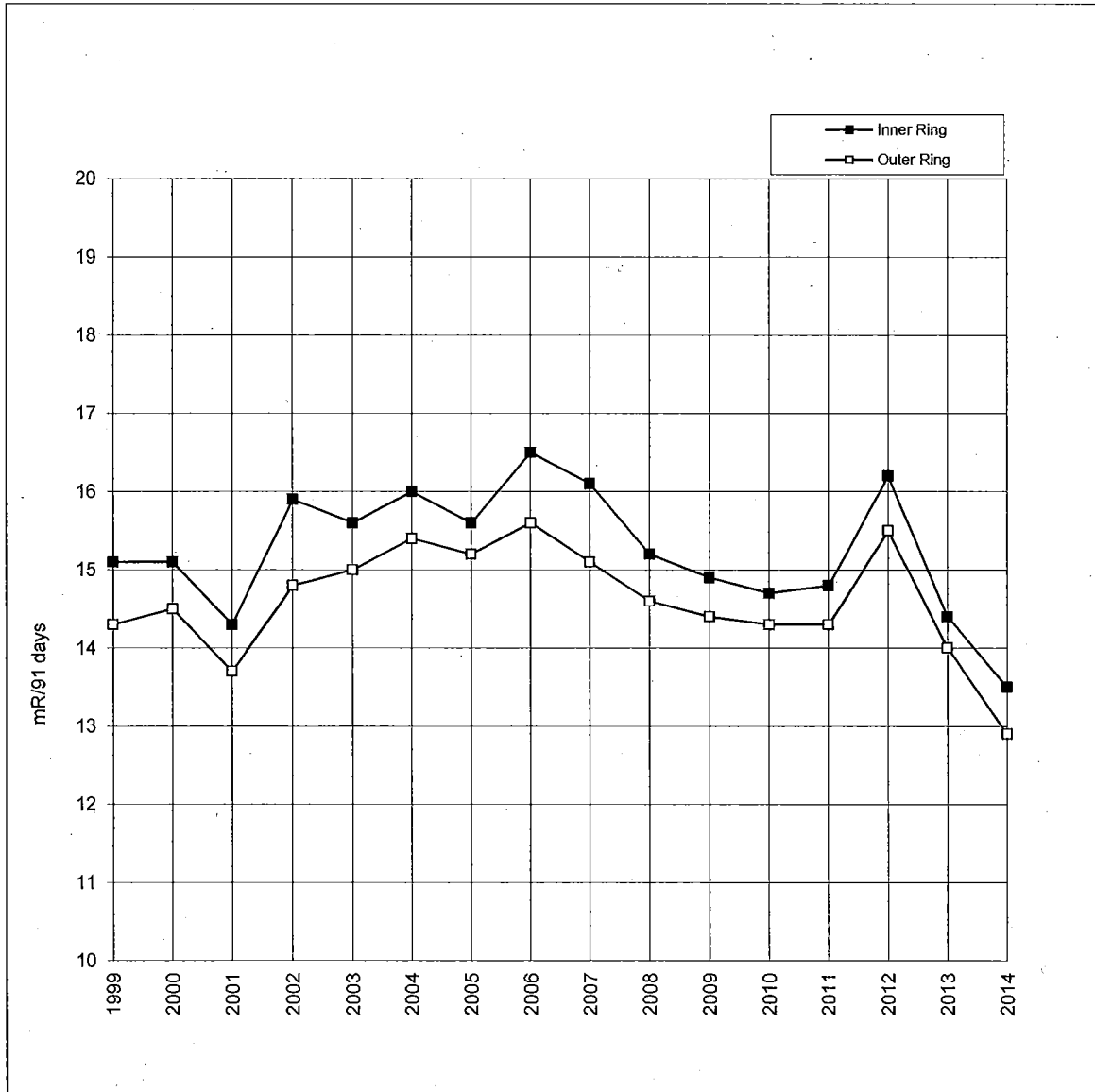


Figure 5-2. Airborne Particulates; analysis for gross beta, average mean of all indicator locations versus control location.

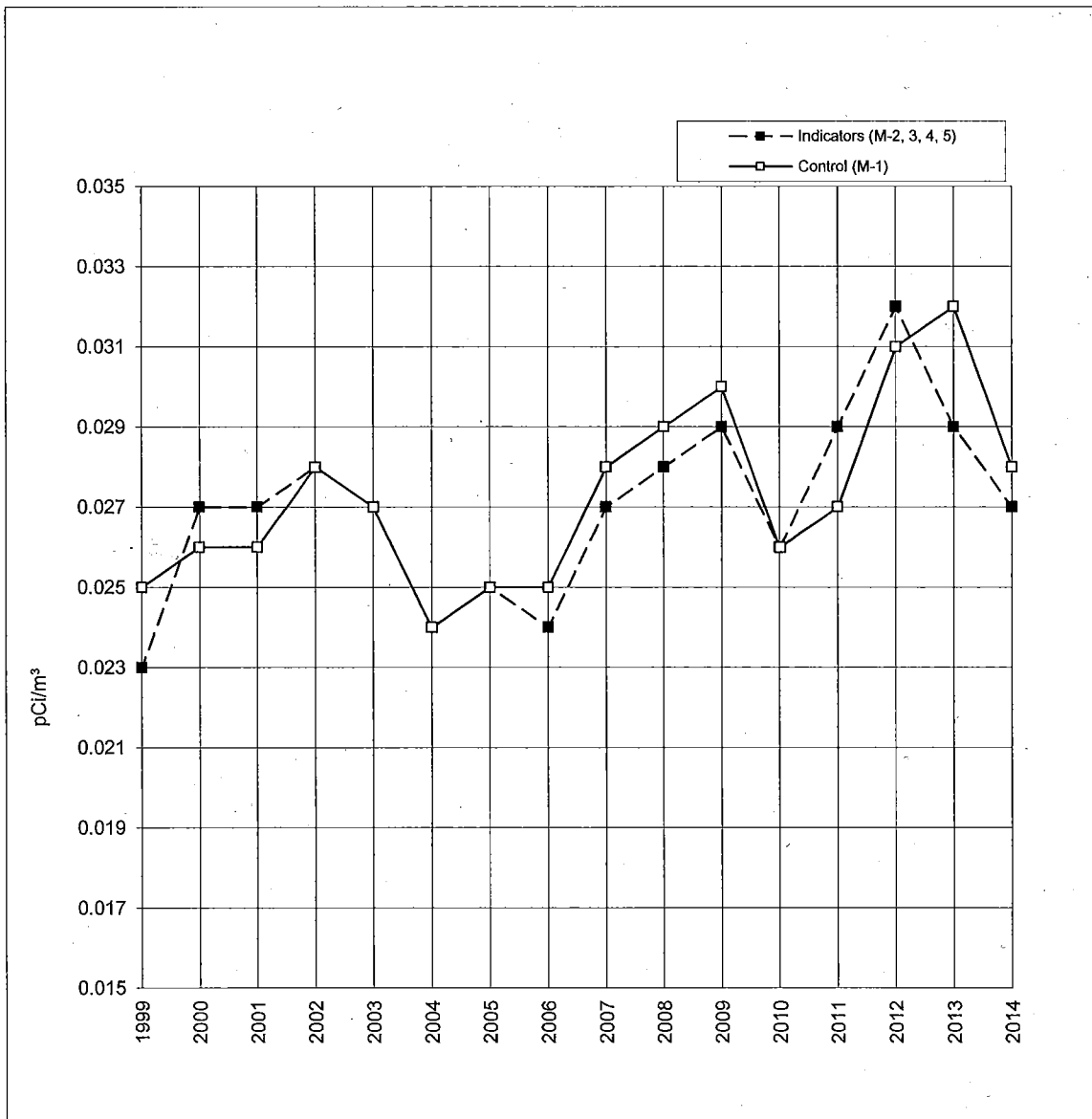


Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility Monticello Nuclear Generating Plant Docket No. 50-263
 Location of Facility Wright, Minnesota Reporting Period January-December, 2014
 (County, State)

Sample Type (Units)	Type and Number of Analyses ^a	LLD ^b	Indicator Locations Mean (F) ^c Range ^c	Location with Highest Annual Mean		Control Locations Mean (F) ^c Range ^c	Number Non-Routine Results ^e
				Location ^d	Mean (F) ^c Range ^c		
Direct Radiation							
TLD (Inner Ring, General Area at Site Boundary) mRem/91 days)	Gamma 56	3.0	13.5 (56/56) (8.0-18.0)	M-13A 0.89 mi @ 322°/NW	14.5 (4/4) (11.2-17.0)	(See Control below.)	0
TLD (Outer Ring, 4-5 mi. distant) mRem/91 days)	Gamma 64	3.0	12.9 (64/64) (10.2-17.1)	M-14B 4.3 mi @ 289°/WNW	14.4 (4/4) (11.4-17.1)	(See Control below.)	0
TLD (Special Interest Areas) mRem/91 days)	Gamma 24	3.0	13.2 (24/24) (9.3-17.5)	M-06S, Mont. Pub. Wks. 2.6 mi @ 134°/SE	15.6 (4/4) (14.5-17.5)	(See Control below.)	0
TLD (Control) mRem/91 days)	Gamma 15	3.0	None	M-01C 11.5 mi @ 323°/NW	14.4 (4/4) (10.5-17.5)	14.3 (15/15) (10.5-17.5)	0
Airborne Pathway							
Airborne Particulates (pCi/m ³)	GB 257	0.002	0.027 (207/207) (0.006-0.061)	M-5, Air Station 2.6 mi @ 134°/SE	0.029 (51/51) (0.011-0.059)	0.028 (50/50) (0.005-0.056)	0
	GS 20						
	Be-7	0.015	0.065 (16/16) (0.037-0.081)	M-5, Air Station 2.6 mi @ 134°/SE	0.072 (4/4) (0.057-0.081)	0.068 (4/4) (0.045-0.082)	0
	Mn-54	0.0009	< LLD	-	-	< LLD	0
	Co-58	0.0011	< LLD	-	-	< LLD	0
	Co-60	0.0008	< LLD	-	-	< LLD	0
	Zn-65	0.0015	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.0015	< LLD	-	-	< LLD	0
	Ru-103	0.0014	< LLD	-	-	< LLD	0
	Ru-106	0.0077	< LLD	-	-	< LLD	0
	Cs-134	0.0011	< LLD	-	-	< LLD	0
	Cs-137	0.0010	< LLD	-	-	< LLD	0
	Ba-La-140	0.0042	< LLD	-	-	< LLD	0
	Ce-141	0.0023	< LLD	-	-	< LLD	0
Ce-144	0.0055	< LLD	-	-	< LLD	0	
Airborne Iodine (pCi/m ³)	I-131 257	0.03	< LLD	-	-	< LLD	0

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				Location ^d	Mean (F) ^c Range ^c		
Waterborne Pathway							
River Water (pCi/L)	H-3 7	500	< LLD	-	-	< LLD	0
	GS 19						
	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 33		< LLD	-	-	< LLD	0
Drinking Water (pCi/L)	GB 12	1.0	2.8 (9/12) (1.2-3.6)	M-14, Minneapolis 37.0 mi. @ 132° /SE	2.8 (9/12) (1.2-3.6)	None	0
	I-131 12	1.0	< LLD	-	-	None	0
	H-3 1	500	< 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 46		< LLD	-	-	None	0	
Well Water (pCi/L)	H-3 15	500	< LLD	-	-	< LLD	0
	GS 15						
	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 48		< LLD	-	-	< LLD	0

Table 5.4 Radiological Environmental Monitoring Program Summary

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				Location ^d	Mean (F) ^c Range ^c		
Waterborne Pathway							
Invertebrates (pCi/g wet)	GS 3						
	Be-7	0.57	< LLD	-	-	< LLD	0
	K-40	0.91	< LLD	-	-	< LLD	0
	Mn-54	0.046	< LLD	-	-	< LLD	0
	Fe-59	0.13	< LLD	-	-	< LLD	0
	Co-58	0.068	< LLD	-	-	< LLD	0
	Co-60	0.052	< LLD	-	-	< LLD	0
	Zn-65	0.09	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.07	< LLD	-	-	< LLD	0
	Ru-103	0.075	< LLD	-	-	< LLD	0
	Ru-106	0.39	< LLD	-	-	< LLD	0
	Cs-134	0.041	< LLD	-	-	< LLD	0
	Cs-137	0.049	< LLD	-	-	< LLD	0
	Ba-La-140	0.41	< LLD	-	-	< LLD	0
Ce-144	0.24	< LLD	-	-	< LLD	0	
Shoreline Sediments (pCi/g dry)	GS 6						
	Be-7	0.27	< LLD	-	-	< LLD	0
	K-40	0.10	10.73 (4/4) (10.09-11.46)	M-15, Montissippi Park 1.27 mi @ 114°/ESE	10.89 (2/2) (10.32-11.46)	9.12 (2/2) (8.98-9.25)	0
	Mn-54	0.018	< LLD	-	-	< LLD	0
	Fe-59	0.068	< LLD	-	-	< LLD	0
	Co-58	0.027	< LLD	-	-	< LLD	0
	Co-60	0.016	< LLD	-	-	< LLD	0
	Zn-65	0.045	< LLD	-	-	< LLD	0
	Nb-95	0.044	< LLD	-	-	< LLD	0
	Zr-95	0.042	< LLD	-	-	< LLD	0
	Ru-103	0.030	< LLD	-	-	< LLD	0
	Ru-106	0.16	< LLD	-	-	< LLD	0
	Cs-134	0.015	< LLD	-	-	< LLD	0
	Cs-137	0.016	0.047 (3/4) (0.033-0.059)	M-15, Montissippi Park 1.27 mi @ 114°/ESE	0.059 (1/2)	0.028 (1/3)	0
Ba-La-140	0.11	< LLD	-	-	< LLD	0	
Ce-144	0.12	< LLD	-	-	< LLD	0	

Table 5.4 Radiological Environmental Monitoring Program Summary

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 (County, State)

Sample Type (Units)	Type and Number of Analyses ^a	LLD ^b	Indicator Locations Mean (F) ^c Range ^c	Location with Highest Annual Mean		Control Locations Mean (F) ^c Range ^c	Number Non-Routine Results ^e
				Location ^d	Mean (F) ^c Range ^c		
Ingestion Pathway							
Vegetation (Pasture Grass, Weeds, Leaves) (pCi/gwet)	GS 9 Mn-54 Fe-59 Co-58 Co-60 Zn-65 Nb-95 I-131 Cs-134 Cs-137	0.012 0.031 0.013 0.014 0.029 0.015 0.038 0.014 0.013	< LLD < LLD < LLD < LLD < LLD < LLD < LLD < LLD < LLD	- - - - - - - - -	- - - - - - - - -	< LLD < LLD < LLD < LLD < LLD < LLD < LLD < LLD < LLD	0 0 0 0 0 0 0 0 0
Fish (pCi/g wet)	GS 4 K-40 Mn-54 Fe-59 Co-58 Co-60 Zn-65 Zr-Nb-95 Cs-134 Cs-137 Ba-La-140 Ce-144	0.10 0.019 0.059 0.023 0.017 0.034 0.055 0.019 0.018 0.199 0.140	2.76 (1/1) (2.76-2.76) < LLD < LLD < LLD < LLD < LLD < LLD < LLD < LLD < LLD < LLD	M-09, Downstream < 1000' of discharge - - - - - - - - - -	2.76 (1/1) (2.76-2.76) - - - - - - - - - -	2.71 (3/3) (2.47-3.04) < LLD < LLD < LLD < LLD < LLD < LLD < LLD < LLD < LLD < LLD	0 0 0 0 0 0 0 0 0 0 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 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 times the typical preoperational value for the medium or location.

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APPENDIX A

INTERLABORATORY COMPARISON PROGRAM RESULTS

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

January, 2014 through December, 2014

Appendix A

Interlaboratory Comparison Program Results

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

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

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

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 > 100 pCi/liter or kg	5.0 pCi/liter 5% of known value
Strontium-89 ^b	5 to 50 pCi/liter or kg > 50 pCi/liter or kg	5.0 pCi/liter 10% of known value
Strontium-90 ^b	2 to 30 pCi/liter or kg > 30 pCi/liter or kg	5.0 pCi/liter 10% of known value
Potassium-40	≥ 0.1 g/liter or kg	5% of known value
Gross alpha	≤ 20 pCi/liter > 20 pCi/liter	5.0 pCi/liter 25% of known value
Gross beta	≤ 100 pCi/liter > 100 pCi/liter	5.0 pCi/liter 5% of known value
Tritium	≤ 4,000 pCi/liter > 4,000 pCi/liter	± 1σ = 169.85 x (known) ^{0.0933} 10% of known value
Radium-226,-228	≥ 0.1 pCi/liter	15% of known value
Plutonium	≥ 0.1 pCi/liter, gram, or sample	10% of known value
Iodine-131, Iodine-129 ^b	≤ 55 pCi/liter > 55 pCi/liter	6 pCi/liter 10% of known value
Uranium-238, Nickel-63 ^b Technetium-99 ^b	≤ 35 pCi/liter > 35 pCi/liter	6 pCi/liter 15% of known value
Iron-55 ^b	50 to 100 pCi/liter > 100 pCi/liter	10 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)			Acceptance
			Laboratory Result ^b	ERA Result ^c	Control Limits	
ERW-1384	4/7/2014	Sr-89	40.29 ± 5.76	36.70	27.50 ± 43.60	Pass
ERW-1384	4/7/2014	Sr-90	24.08 ± 2.35	26.50	19.20 ± 30.90	Pass
ERW-1385	4/7/2014	Ba-133	78.23 ± 3.93	87.90	74.00 ± 96.70	Pass
ERW-1385	4/7/2014	Co-60	62.75 ± 3.53	64.20	57.80 ± 73.10	Pass
ERW-1385	4/7/2014	Cs-134	44.97 ± 3.99	44.30	35.50 ± 48.70	Pass
ERW-1385	4/7/2014	Cs-137	88.54 ± 4.93	89.10	80.20 ± 101.00	Pass
ERW-1385	4/7/2014	Zn-65	249.1 ± 10.4	235.0	212.0 - 275.0	Pass
ERW-1388	4/7/2014	Gr. Alpha	56.70 ± 2.47	61.00	31.90 ± 75.80	Pass
ERW-1388	4/7/2014	Gr. Beta	32.10 ± 1.20	33.00	21.40 ± 40.70	Pass
ERW-1391	4/7/2014	I-131	25.52 ± 1.12	25.70	21.30 ± 30.30	Pass
ERW-1394	4/7/2014	Ra-226	12.30 ± 0.61	12.40	9.26 ± 14.30	Pass
ERW-1394	4/7/2014	Ra-228	5.08 ± 1.16	4.26	2.46 ± 5.86	Pass
ERW-1394	4/7/2014	Uranium	10.76 ± 0.74	10.20	7.95 ± 11.80	Pass
ERW-1397	4/7/2014	H-3	8982 ± 279	8770	7610 - 9650	Pass
ERW-5382	10/6/2014	Sr-89	29.40 ± 5.32	31.40	22.80 ± 38.10	Pass
ERW-5382	10/6/2014	Sr-90	19.19 ± 1.85	21.80	15.60 ± 25.70	Pass
ERW-5385	10/6/2014	Ba-133	43.54 ± 4.54	49.10	40.30 ± 54.50	Pass
ERW-5385	10/6/2014	Cs-134	81.95 ± 7.49	89.80	73.70 ± 98.80	Pass
ERW-5385	10/6/2014	Cs-137	95.76 ± 5.50	98.80	88.90 ± 111.00	Pass
ERW-5385	10/6/2014	Co-60	90.25 ± 2.77	92.10	82.90 ± 104.00	Pass
ERW-5385	10/6/2014	Zn-65	327.4 ± 23.3	310.0	279.0 - 362.0	Pass
ERW-5388	10/6/2014	Gr. Alpha	30.88 ± 8.05	37.60	19.40 ± 46.10	Pass
ERW-5388	10/6/2014	G. Beta	20.47 ± 4.75	27.40	17.30 ± 35.30	Pass
ERW-5392	10/6/2014	I-131	19.58 ± 2.35	20.30	16.80 ± 24.40	Pass
ERW-5394	10/6/2014	Ra-226	15.10 ± 1.81	14.70	11.00 ± 16.90	Pass
ERW-5394	10/6/2014	Ra-228	4.42 ± 0.86	4.31	2.50 ± 5.92	Pass
ERW-5394	10/6/2014	Uranium	5.51 ± 0.37	5.80	4.34 ± 6.96	Pass
ERW-5397	10/6/2014	H-3	6876 ± 383	6880	5940 - 7570	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. Thermoluminescent Dosimetry, (TLD, CaSO₄: Dy Cards).

Lab Code	Date	Description	mR			Acceptance
			Known Value	Lab Result ± 2 sigma	Control Limits	
<u>Environmental, Inc.</u>						
2014-1	5/15/2014	50 cm.	26.83	34.43 ± 3.76	18.78 - 34.88	Pass
2014-1	5/15/2014	60 cm.	18.63	22.20 ± 1.16	13.04 - 24.22	Pass
2014-1	5/15/2014	70 cm.	13.69	14.74 ± 0.80	9.58 - 17.80	Pass
2014-1	5/15/2014	75 cm.	11.93	12.68 ± 1.05	8.35 - 15.51	Pass
2014-1	5/15/2014	80 cm.	10.48	11.81 ± 0.91	7.34 - 13.62	Pass
2014-1	5/15/2014	90 cm.	8.28	7.72 ± 0.71	5.80 - 10.76	Pass
2014-1	5/15/2014	100 cm.	6.71	6.46 ± 0.71	4.70 - 8.72	Pass
2014-1	5/15/2014	110 cm.	5.54	5.25 ± 1.03	3.88 - 7.20	Pass
2014-1	5/15/2014	120 cm.	4.66	4.76 ± 0.48	3.26 - 6.06	Pass
2014-1	5/15/2014	135 cm.	3.68	2.87 ± 0.46	2.58 - 4.78	Pass
2014-1	5/15/2014	150 cm.	2.98	2.30 ± 0.15	2.09 - 3.87	Pass
2014-1	5/15/2014	165 cm.	2.46	2.09 ± 0.28	1.72 - 3.20	Pass
2014-1	5/15/2014	180 cm.	2.07	1.75 ± 0.21	1.45 - 2.69	Pass
<u>Environmental, Inc.</u>						
2014-2	12/9/2014	30 cm.	77.04	84.03 ± 8.47	53.90 - 100.20	Pass
2014-2	12/9/2014	30 cm.	77.04	83.74 ± 12.02	53.90 - 100.20	Pass
2014-2	12/9/2014	60 cm.	19.26	20.39 ± 2.37	13.50 - 25.00	Pass
2014-2	12/9/2014	60 cm.	19.26	20.33 ± 1.19	13.50 - 25.00	Pass
2014-2	12/9/2014	120 cm.	4.82	5.15 ± 0.20	3.40 - 6.30	Pass
2014-2	12/9/2014	120 cm.	4.82	5.20 ± 0.45	3.40 - 6.30	Pass
2014-2	12/9/2014	150 cm.	3.08	3.84 ± 0.61	2.20 - 4.00	Pass
2014-2	12/9/2014	150 cm.	3.08	3.17 ± 0.38	2.20 - 4.00	Pass
2014-2	12/9/2014	150 cm.	3.08	3.31 ± 0.32	2.00 - 4.00	Pass
2014-2	12/9/2014	180 cm.	2.14	2.27 ± 0.51	1.50 - 2.80	Pass
2014-2	12/9/2014	180 cm.	2.14	2.23 ± 0.12	1.50 - 2.80	Pass
2014-2	12/9/2014	180 cm.	2.14	2.74 ± 0.48	1.50 - 2.80	Pass
2014-2	12/9/2014	180 cm.	2.14	1.97 ± 0.41	1.50 - 2.80	Pass

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

Lab Code ^b	Date	Analysis	Concentration (pCi/L) ^a			Acceptance
			Laboratory results 2s, n=1 ^c	Known Activity	Control Limits ^d	
SPW-1011	1/13/2014	Ra-228	35.47 ± 2.55	30.85	21.60 - 40.11	Pass
SPAP-103	1/13/2014	Gr. Beta	43.91 ± 0.34	44.82	26.89 - 62.75	Pass
SPAP-105	1/13/2014	Cs-134	2.46 ± 0.67	2.82	1.69 - 3.95	Pass
SPAP-105	1/13/2014	Cs-137	102.4 ± 2.7	99.9	89.9 - 109.9	Pass
SPW-107	1/13/2014	H-3	62,380 ± 707	62,246	49,797 - 74,695	Pass
SPW-129	1/15/2014	Cs-134	69.90 ± 3.71	78.00	68.00 - 88.00	Pass
SPW-129	1/15/2014	Cs-137	84.36 ± 7.06	75.77	65.77 - 85.77	Pass
SPW-129	1/15/2014	Sr-90	39.48 ± 1.52	39.20	31.36 - 47.04	Pass
SPW-130	1/15/2014	Ni-63	255.8 ± 3.8	204.0	142.8 - 265.2	Pass
SPW-133	1/15/2014	C-14	3153 ± 15	4737	2842 - 6632	Pass
SPMI-135	1/15/2014	Cs-134	76.80 ± 4.04	78.00	68.00 - 88.00	Pass
SPMI-135	1/15/2014	Cs-137	80.44 ± 6.63	75.80	65.80 - 85.80	Pass
W-12014	1/20/2014	Gr. Alpha	19.69 ± 0.41	20.00	10.00 - 30.00	Pass
W-12014	1/20/2014	Gr. Beta	30.35 ± 0.33	30.90	20.90 - 40.90	Pass
SPW-297	1/29/2014	Tc-99	104.2 ± 1.7	107.8	75.5 - 140.2	Pass
SPW-657	2/25/2014	Ra-226	15.84 ± 0.45	16.70	11.69 - 21.71	Pass
SPW-1127	3/26/2014	U-238	43.28 ± 2.56	41.72	29.20 - 54.24	Pass
SPW-1917	3/28/2014	Pu-238	27.37 ± 2.13	23.80	14.28 - 33.32	Pass
SPW-1786	4/25/2014	Tc-99	531.1 ± 8.7	539.15	377.41 - 700.90	Pass
SPW-2168	5/21/2014	Cs-134	70.90 ± 5.81	69.50	59.50 - 79.50	Pass
SPW-2168	5/21/2014	Cs-137	79.72 ± 6.49	75.17	65.17 - 85.17	Pass
SPW-2168	5/21/2014	Sr-89	83.35 ± 5.05	72.85	58.28 - 87.42	Pass
SPW-2168	5/21/2014	Sr-90	33.37 ± 1.52	38.87	31.10 - 46.64	Pass
SPMI-2170	5/21/2014	Cs-134	64.15 ± 4.93	69.50	59.50 - 79.50	Pass
SPMI-2170	5/21/2014	Cs-137	76.21 ± 6.91	75.17	65.17 - 85.17	Pass
SPMI-2170	5/21/2014	Sr-89	65.82 ± 4.89	72.85	58.28 - 87.42	Pass
SPMI-2170	5/21/2014	Sr-90	40.90 ± 1.59	38.87	31.10 - 46.64	Pass
SPW-2792	6/18/2014	U-238	44.80 ± 1.54	41.70	29.19 - 54.21	Pass
SPW-2796	6/18/2014	C-14	3495 ± 9	4,737	2,842 - 6632	Pass
WW-2836	6/30/2014	Co-60	131.8 ± 6.9	140.90	126.81 - 154.99	Pass
WW-2836	6/30/2014	Cs-137	143.8 ± 9.1	145.60	131.04 - 160.16	Pass
WW-2836	6/30/2014	H-3	6220 ± 238	6,361	5,089 - 7633	Pass

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

Lab Code ^b	Date	Analysis	Concentration (pCi/L) ^a			Acceptance
			Laboratory results 2s, n=1 ^c	Known Activity	Control Limits ^d	
SPW-3486	7/17/2014	Fe-55	2211 ± 72	2319	1855 - 2783	Pass
SPW-080714	8/7/2014	Gr. Alpha	18.42 ± 0.40	20.10	10.05 - 30.15	Pass
SPW-080714	8/7/2014	Gr. Beta	31.70 ± 0.40	32.40	22.40 - 42.40	Pass
SPW-081214	8/12/2014	Pu-238	22.59 ± 2.15	22.70	18.16 - 27.24	Pass
SPW-4093	8/13/2014	I-131(G)	59.95 ± 6.17	59.62	49.62 - 69.62	Pass
SPW-4093	8/13/2014	Sr-90	39.46 ± 1.55	38.65	28.65 - 48.65	Pass
SPW-4093	8/13/2014	Sr-89	105.5 ± 4.9	115.0	92.0 - 149.5	Pass
SPMI-4095	8/13/2014	I-131(G)	59.92 ± 6.17	59.62	49.62 - 69.62	Pass
SPMI-4095	8/13/2014	I-131	60.05 ± 0.72	59.62	47.70 - 71.54	Pass
SPW-4104	8/13/2014	Ni-63	200.1 ± 3.4	203.2	142.2 - 264.1	Pass
SPW-4106	8/13/2014	H-3	59,597 ± 695	60,261	48209 - 72313	Pass
SPW-4108	8/13/2014	Cs-134	2.45 ± 0.81	2.32	0.00 - 12.32	Pass
SPW-4108	8/13/2014	Cs-137	90.20 ± 3.74	98.56	88.56 - 108.56	Pass
SPAP-4110	8/13/2014	Gr. Beta	43.65 ± 0.11	44.19	34.19 - 54.19	Pass
SPF-4112	8/13/2014	I-131	2.64 ± 0.38	2.86	0.00 - 12.86	Pass
SPF-4112	8/13/2014	Cs-134	0.91 ± 0.03	1.03	0.00 - 11.03	Pass
SPF-4112	8/13/2014	Cs-137	2.61 ± 0.06	2.39	0.00 - 12.39	Pass
SPW-081414	8/14/2014	H-3	14,663 ± 788	17,700	14160 - 21240	Pass
W081614	8/16/2014	Ra-226	14.30 ± 0.37	16.70	11.69 - 21.71	Pass
W082614	8/26/2014	Ra-228	27.18 ± 2.13	30.49	20.49 - 40.49	Pass
SPW-090414	9/4/2014	Gr. Alpha	17.85 ± 0.39	20.10	10.05 - 30.15	Pass
SPW-090414	9/4/2014	Gr. Beta	30.03 ± 0.33	30.90	20.90 - 40.90	Pass
SPW-5124	9/29/2014	Ra-228	32.93 ± 2.38	31.94	21.94 - 41.94	Pass
W100714	10/7/2014	Gr. Alpha	18.56 ± 0.40	20.10	10.05 - 30.15	Pass
W100714	10/7/2014	Gr. Beta	27.71 ± 0.32	30.90	20.90 - 40.90	Pass
W111014	11/10/2014	Gr. Alpha	17.84 ± 0.38	20.10	10.05 - 30.15	Pass
W111014	11/10/2014	Gr. Beta	30.12 ± 0.33	30.90	20.90 - 40.90	Pass
W112514	11/25/2014	Ra-226	16.63 ± 0.41	16.70	11.69 - 21.71	Pass
W120814	12/8/2014	Gr. Alpha	19.29 ± 0.41	20.10	10.05 - 30.15	Pass
W120814	12/8/2014	Gr. Beta	27.93 ± 0.32	30.90	20.90 - 40.90	Pass
SPW-7149	12/26/2014	Ni-63	217.53 ± 3.25	203.10	142.17 - 264.03	Pass

^a Liquid sample results are reported in pCi/Liter, air filters (pCi/m³), charcoal (pCi/charcoal canister), and solid samples (pCi/kg).

^b Laboratory codes : W (Water), MI (milk), AP (air filter), SO (soil), VE (vegetation), CH (charcoal canister), F (fish), U (urine).

^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 ± 2s.

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)		Acceptance Criteria (4.66 σ)
				LLD	Activity ^c	
SPW-1001	Water	1/13/2014	Ra-228	0.74	0.39 ± 0.39	2
SPAP-102	Air Particulate	1/13/2014	Gr. Beta	0.003	0.015 ± 0.003	0.01
SPAP-104	Air Particulate	1/13/2014	Cs-134	0.006	0.005 ± 0.005	0.05
SPAP-104	Air Particulate	1/13/2014	Cs-137	0.004	-0.002 ± 0.005	0.05
SPW-106	Water	1/13/2014	H-3	151.0	115.0 ± 97.0	200
SPW-128	Water	1/15/2014	Cs-134	2.85	0.59 ± 1.46	10
SPW-128	Water	1/15/2014	Cs-137	2.52	0.68 ± 1.64	10
SPW-128	Water	1/15/2014	Sr-90	0.61	0.74 ± 0.36	1
SPW-130	Water	1/15/2014	Ni-63	10.85	1.57 ± 6.60	20
SPW-133	Water	1/15/2014	C-14	13.51	3.10 ± 8.27	200
SPMI-134	Milk	1/15/2014	Cs-134	4.43	0.14 ± 2.46	10
SPMI-134	Milk	1/15/2014	Cs-137	1.92	-2.07 ± 2.48	10
W-12014	Water	1/20/2014	Gr. Alpha	0.48	-0.31 ± 0.31	2
W-12014	Water	1/20/2014	Gr. Beta	0.78	-0.24 ± 0.54	4
SPW-297	Water	1/29/2014	Tc-99	5.63	-4.42 ± 3.34	10
SPW-656	Water	2/25/2014	Ra-226	0.03	0.01 ± 0.02	1
SPW-1126	Water	3/26/2014	U-238	0.13	0.08 ± 0.12	1
SPW-1127	Water	3/26/2014	U-233/234	0.13	0.11 ± 0.13	1
SPW-1127	Water	3/26/2014	U-238	0.00	0.08 ± 0.12	1
SPW-1917	Water	3/28/2014	Pu-238	0.02	0.01 ± 0.01	1
SPW-1785	Water	4/25/2014	Tc-99	5.61	-4.33 ± 3.33	10
SPW-1831	Water	4/30/2014	I-131	0.21	0.07 ± 0.12	0.5
SPW-2167	Water	5/21/2014	Cs-134	2.29	-0.79 ± 1.35	10
SPW-2167	Water	5/21/2014	Cs-137	2.46	0.36 ± 1.48	10
SPW-2167	Water	5/21/2014	I-131(G)	2.77	0.25 ± 1.53	20
SPW-2167	Water	5/21/2014	Sr-89	0.81	0.01 ± 0.62	5
SPW-2167	Water	5/21/2014	Sr-90	0.52	0.03 ± 0.24	1
SPMI-2169	Milk	5/21/2014	Cs-134	4.45	-0.55 ± 2.39	10
SPMI-2169	Milk	5/21/2014	Cs-137	3.91	-0.52 ± 2.60	10
SPMI-2169	Milk	5/21/2014	I-131(G)	4.31	2.57 ± 2.21	20
SPMI-2169	Milk	5/21/2014	Sr-89	0.98	-0.02 ± 0.83	5
SPMI-2169	Milk	5/21/2014	Sr-90	0.61	0.35 ± 0.32	1
SPW-2793	Water	6/18/2014	U-238	0.08	0.02 ± 0.06	1

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

Lab Code	Sample Type	Date	Analysis ^b	Concentration (pCi/L) ^a		
				Laboratory results (4.66σ)		Acceptance Criteria (4.66 σ)
				LLD	Activity ^c	
SPW-3485	Water	7/17/2014	Fe-55	597.6	10.3 ± 363.3	1000
SPW-4092	Water	8/13/2014	I-131(G)	3.59	0.91 ± 1.95	20
SPW-4092	Water	8/13/2014	Cs-134	3.71	-0.31 ± 1.77	10
SPW-4092	Water	8/13/2014	Cs-137	2.71	-2.20 ± 1.98	10
SPW-4092	Water	8/13/2014	Sr-89	0.89	0.11 ± 0.63	5
SPW-4092	Water	8/13/2014	Sr-90	0.52	-0.05 ± 0.23	1
SPMI-4094	Milk	8/13/2014	I-131	0.35	0.03 ± 0.20	0.5
SPMI-4094	Milk	8/13/2014	I-131(G)	4.50	-0.41 ± 2.44	20
SPMI-4094	Milk	8/13/2014	Cs-134	4.30	-0.84 ± 2.02	10
SPMI-4094	Milk	8/13/2014	Cs-137	3.45	0.96 ± 2.51	10
SPMI-4094	Milk	8/13/2014	Sr-89	0.80	-0.19 ± 0.79	5
SPMI-4094	Milk	8/13/2014	Sr-90	0.47	0.71 ± 0.30	1
SPW-4103	Water	8/13/2014	Ni-63	0.12	0.02 ± 0.07	20
SPW-4105	Water	8/13/2014	H-3	138.1	104.1 ± 78.1	200
SPW-4107	Water	8/13/2014	I-131(G)	3.21	-3.68 ± 1.33	20
SPW-4107	Water	8/13/2014	Cs-134	2.72	-0.62 ± 1.49	10
SPW-4107	Water	8/13/2014	Cs-137	2.56	0.75 ± 1.62	10
SPAP-4109	Air Particulate	8/13/2014	Gr. Beta	0.004	-0.003 ± 0.00	0.01
SPF-4111	Fish	8/13/2014	Cs-134	0.01	0.00 ± 0.01	100
SPF-4111	Fish	8/13/2014	Cs-137	0.01	-0.01 ± 0.01	100
SPF-4111	Fish	8/13/2014	Co-60	0.01	0.00 ± 0.01	100
W-081614	Water	8/16/2014	Ra-226	0.04	0.05 ± 0.03	1
W-082614	Water	8/16/2014	Ra-228	0.62	0.29 ± 0.40	2
W-092314	Water	9/23/2014	Ra-226	0.02	0.04 ± 0.02	1
W-5123	Water	9/29/2014	Ra-228	0.70	0.43 ± 0.38	2
W-100714	Water	10/7/2014	Gr. Alpha	0.39	0.04 ± 0.28	2
W-100714	Water	10/7/2014	Gr. Beta	0.76	-0.06 ± 0.53	4
W-111014	Water	11/10/2014	Gr. Alpha	0.39	0.01 ± 0.28	2
W-111014	Water	11/10/2014	Gr. Beta	0.75	-0.25 ± 0.52	4
W-112514	Water	11/25/2014	Ra-226	0.05	0.02 ± 0.03	2
W-120814	Water	12/8/2014	Gr. Alpha	0.42	0.04 ± 0.30	2
W-120814	Water	12/8/2014	Gr. Beta	0.74	-0.42 ± 0.51	4
SPW-7148	Water	12/26/2014	Ni-63	10.80	-1.80 ± 6.50	20

^a Liquid sample results are reported in pCi/Liter, air filters(pCi/m³), 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.

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

Lab Code	Date	Analysis	Concentration (pCi/L) ^a			Acceptance
			First Result	Second Result	Averaged Result	
AP-7829, 7830	1/2/2014	Be-7	0.08 ± 0.02	0.06 ± 0.01	0.07 ± 0.01	Pass
AP-7913, 7914	1/2/2014	Be-7	0.07 ± 0.01	0.06 ± 0.01	0.06 ± 0.01	Pass
AP-7871, 7872	1/3/2014	Be-7	0.05 ± 0.02	0.06 ± 0.01	0.06 ± 0.01	Pass
S-43, 44	1/9/2014	K-40	19.28 ± 0.57	19.24 ± 0.57	19.26 ± 0.40	Pass
SG-64, 65	1/9/2014	Gr. Alpha	686.08 ± 69.97	642.46 ± 65.59	664.27 ± 47.95	Pass
SG-64, 65	1/9/2014	Ra-226	97.30 ± 9.78	92.20 ± 9.27	94.75 ± 6.74	Pass
SG-64, 65	1/9/2014	Ra-228	91.90 ± 9.30	97.10 ± 9.87	94.50 ± 6.78	Pass
S-136, 137	1/13/2014	Be-7	14.90 ± 0.39	14.88 ± 0.38	14.89 ± 0.27	Pass
S-136, 137	1/13/2014	K-40	3.29 ± 0.36	3.93 ± 0.36	3.61 ± 0.25	Pass
WW-220, 221	1/13/2014	H-3	231.85 ± 80.45	273.46 ± 82.47	252.66 ± 57.60	Pass
WW-262, 263	1/21/2014	H-3	294.80 ± 89.80	265.00 ± 88.47	279.90 ± 63.03	Pass
WW-346, 347	1/24/2014	H-3	934.97 ± 118.47	965.59 ± 119.52	950.28 ± 84.14	Pass
SWU-367, 368	1/29/2014	Gr. Beta	0.74 ± 0.38	1.31 ± 0.42	1.02 ± 0.28	Pass
F-409, 410	2/2/2014	Cs-137	0.05 ± 0.02	0.05 ± 0.02	0.05 ± 0.01	Pass
F-409, 410	2/2/2014	Gr. Beta	3.60 ± 0.07	3.72 ± 0.07	3.66 ± 0.05	Pass
AP-7829, 7830	1/2/2014	Be-7	0.08 ± 0.02	0.06 ± 0.01	0.07 ± 0.01	Pass
AP-7913, 7914	1/2/2014	Be-7	0.07 ± 0.01	0.06 ± 0.01	0.06 ± 0.01	Pass
AP-7871, 7872	1/3/2014	Be-7	0.05 ± 0.02	0.06 ± 0.01	0.06 ± 0.01	Pass
S-43, 44	1/9/2014	K-40	19.28 ± 0.57	19.24 ± 0.57	19.26 ± 0.40	Pass
SG-64, 65	1/9/2014	Gr. Alpha	686.08 ± 69.97	642.46 ± 65.59	664.27 ± 47.95	Pass
SG-64, 65	1/9/2014	Ra-226	97.30 ± 9.78	92.20 ± 9.27	94.75 ± 6.74	Pass
SG-64, 65	1/9/2014	Ra-228	91.90 ± 9.30	97.10 ± 9.87	94.50 ± 6.78	Pass
S-136, 137	1/13/2014	Be-7	14.90 ± 0.39	14.88 ± 0.38	14.89 ± 0.27	Pass
S-136, 137	1/13/2014	K-40	3.29 ± 0.36	3.93 ± 0.36	3.61 ± 0.25	Pass
WW-220, 221	1/13/2014	H-3	231.85 ± 80.45	273.46 ± 82.47	252.66 ± 57.60	Pass
WW-262, 263	1/21/2014	H-3	294.80 ± 89.80	265.00 ± 88.47	279.90 ± 63.03	Pass
WW-346, 347	1/24/2014	H-3	934.97 ± 118.47	965.59 ± 119.52	950.28 ± 84.14	Pass
SWU-367, 368	1/29/2014	Gr. Beta	0.74 ± 0.38	1.31 ± 0.42	1.02 ± 0.28	Pass
F-409, 410	2/2/2014	Cs-137	0.05 ± 0.02	0.05 ± 0.02	0.05 ± 0.01	Pass
F-409, 410	2/2/2014	Gr. Beta	3.60 ± 0.07	3.72 ± 0.07	3.66 ± 0.05	Pass
WW-491, 492	2/6/2014	H-3	474.00 ± 101.10	583.10 ± 105.30	528.55 ± 72.99	Pass
WW-575, 576	2/13/2014	H-3	196.69 ± 82.94	154.68 ± 80.89	175.69 ± 57.93	Pass
W-617, 618	2/14/2014	H-3	526.29 ± 97.65	579.51 ± 99.77	552.90 ± 69.80	Pass
SWU-743, 744	2/25/2014	Gr. Beta	1.61 ± 0.65	1.73 ± 0.71	1.67 ± 0.48	Pass
S-700, 701	2/26/2014	K-40	21.32 ± 0.64	21.15 ± 0.59	21.24 ± 0.44	Pass
S-806, 807	3/4/2014	K-40	24.79 ± 0.57	24.17 ± 0.59	24.48 ± 0.41	Pass
SG-928, 929	3/11/2014	Ac-228	6.78 ± 0.34	6.94 ± 0.35	6.86 ± 0.24	Pass
SG-928, 929	3/11/2014	Bi-214	5.32 ± 0.20	5.34 ± 0.22	5.33 ± 0.15	Pass
SG-928, 929	3/11/2014	K-40	4.79 ± 0.80	6.24 ± 1.01	5.52 ± 0.64	Pass
SG-928, 929	3/11/2014	Pb-212	2.70 ± 0.09	2.75 ± 0.09	2.73 ± 0.06	Pass
SG-928, 929	3/11/2014	Pb-214	5.39 ± 0.17	5.53 ± 0.17	5.46 ± 0.12	Pass
SG-928, 929	3/11/2014	Th-228	6.10 ± 2.07	4.76 ± 1.93	5.43 ± 1.42	Pass
SG-928, 929	3/11/2014	Tl-208	0.92 ± 0.06	0.91 ± 0.06	0.92 ± 0.04	Pass

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

Lab Code	Date	Analysis	Concentration (pCi/L) ^a			Acceptance
			First Result	Second Result	Averaged Result	
S-2119, 2120	3/12/2014	Ac-228	0.76 ± 0.20	0.73 ± 0.21	0.75 ± 0.15	Pass
S-2119, 2120	3/12/2014	Cs-137	0.13 ± 0.05	0.11 ± 0.05	0.12 ± 0.04	Pass
S-2119, 2120	3/12/2014	K-40	17.48 ± 1.48	18.39 ± 1.53	17.94 ± 1.06	Pass
S-2119, 2120	3/12/2014	Pb-214	0.73 ± 0.18	0.63 ± 0.12	0.68 ± 0.11	Pass
F-1594, 1595	3/16/2014	Cs-137	0.02 ± 0.01	0.03 ± 0.02	0.03 ± 0.01	Pass
SO-1115, 1116	3/18/2014	Cs-137	0.06 ± 0.01	0.06 ± 0.00	0.06 ± 0.00	Pass
SO-1115, 1116	3/18/2014	Gr. Beta	23.30 ± 2.10	24.40 ± 2.20	23.85 ± 1.52	Pass
SO-1115, 1116	3/18/2014	K-40	12.63 ± 0.18	12.84 ± 0.15	12.74 ± 0.12	Pass
SO-1115, 1116	3/18/2014	U-233/4	0.11 ± 0.02	0.12 ± 0.02	0.12 ± 0.01	Pass
SO-1115, 1116	3/18/2014	U-238	0.13 ± 0.02	0.14 ± 0.02	0.14 ± 0.01	Pass
S-1033, 1034	3/19/2014	Ac-228	0.99 ± 0.20	1.13 ± 0.26	1.06 ± 0.16	Pass
S-1033, 1034	3/19/2014	Bi-214	1.02 ± 0.18	0.98 ± 0.16	1.00 ± 0.12	Pass
S-1033, 1034	3/19/2014	Cs-137	0.15 ± 0.04	0.14 ± 0.04	0.15 ± 0.03	Pass
S-1033, 1034	3/19/2014	K-40	15.39 ± 1.19	15.13 ± 1.19	15.26 ± 0.84	Pass
S-1033, 1034	3/19/2014	Pb-214	1.09 ± 0.13	0.88 ± 0.17	0.99 ± 0.11	Pass
S-1033, 1034	3/19/2014	Tl-208	0.36 ± 0.05	0.31 ± 0.05	0.34 ± 0.04	Pass
W-1094, 1095	3/23/2014	Ra-226	0.30 ± 0.20	0.70 ± 0.20	0.50 ± 0.14	Pass
W-1094, 1095	3/23/2014	Ra-228	1.10 ± 0.79	1.13 ± 0.86	1.12 ± 0.58	Pass
AP-1197, 1198	3/27/2014	Be-7	0.17 ± 0.08	0.14 ± 0.08	0.15 ± 0.05	Pass
AP-1698, 1699	3/31/2014	Be-7	0.06 ± 0.02	0.07 ± 0.02	0.07 ± 0.01	Pass
E-1218, 1219	4/1/2014	Gr. Beta	1.57 ± 0.04	1.57 ± 0.04	1.57 ± 0.03	Pass
E-1218, 1219	4/1/2014	K-40	1.26 ± 0.14	1.31 ± 0.18	1.29 ± 0.11	Pass
SWU-1260, 1261	4/1/2014	Gr. Beta	2.81 ± 0.51	2.94 ± 0.50	2.88 ± 0.36	Pass
AP-1615, 1616	4/1/2014	Be-7	0.07 ± 0.01	0.07 ± 0.02	0.07 ± 0.01	Pass
AP-1657, 1658	4/2/2014	Be-7	0.07 ± 0.01	0.08 ± 0.01	0.07 ± 0.01	Pass
AP-1804, 1805	4/3/2014	Be-7	0.05 ± 0.02	0.06 ± 0.01	0.06 ± 0.01	Pass
P-1489, 1490	4/7/2014	H-3	582.31 ± 101.85	505.07 ± 98.72	543.69 ± 70.92	Pass
BS-1531, 1532	4/16/2014	K-40	0.51 ± 0.19	0.58 ± 0.23	0.54 ± 0.15	Pass
S-1909, 1910	4/22/2014	K-40	14.71 ± 0.54	14.78 ± 0.53	14.75 ± 0.38	Pass
SWU-1867, 1868	4/29/2014	Gr. Beta	2.28 ± 0.40	1.67 ± 0.35	1.98 ± 0.27	Pass
AP-1930, 1931	5/1/2014	Be-7	0.16 ± 0.09	0.19 ± 0.11	0.17 ± 0.07	Pass
SL-1888, 1889	5/1/2014	Be-7	0.80 ± 0.04	0.76 ± 0.08	0.78 ± 0.05	Pass
SL-1888, 1889	5/1/2014	Cs-137	0.01 ± 0.00	0.01 ± 0.00	0.01 ± 0.00	Pass
SL-1888, 1889	5/1/2014	Gr. Beta	11.57 ± 0.72	12.67 ± 0.78	12.12 ± 0.53	Pass
SL-1888, 1889	5/1/2014	K-40	1.04 ± 0.05	1.00 ± 0.09	1.02 ± 0.05	Pass
SO-1972, 1973	5/1/2014	Cs-137	0.12 ± 0.03	0.10 ± 0.02	0.11 ± 0.02	Pass
SO-1972, 1973	5/1/2014	Gr. Alpha	7.51 ± 3.24	9.09 ± 3.63	8.30 ± 2.43	Pass
SO-1972, 1973	5/1/2014	Gr. Beta	29.89 ± 3.25	31.42 ± 3.04	30.66 ± 2.23	Pass
SO-1972, 1973	5/1/2014	K-40	20.45 ± 0.85	20.88 ± 0.76	20.66 ± 0.57	Pass
W-617, 618	5/8/2014	H-3	175.13 ± 83.82	177.17 ± 83.92	176.15 ± 59.31	Pass
AP-2077, 2078	5/8/2014	Be-7	0.23 ± 0.11	0.18 ± 0.11	0.20 ± 0.08	Pass

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

Lab Code	Date	Analysis	Concentration (pCi/L) ^a			Acceptance
			First Result	Second Result	Averaged Result	
S-2205, 2206	5/15/2014	Be-7	0.50 ± 0.19	0.70 ± 0.18	0.60 ± 0.13	Pass
S-2205, 2206	5/15/2014	K-40	33.60 ± 0.79	33.52 ± 0.70	33.56 ± 0.53	Pass
VE-2184, 2185	5/19/2014	Be-7	0.62 ± 0.18	0.53 ± 0.17	0.58 ± 0.12	Pass
VE-2184, 2185	5/19/2014	K-40	5.30 ± 0.44	5.14 ± 0.44	5.22 ± 0.31	Pass
DW-50102, 50103	5/20/2014	Ra-226	7.07 ± 0.76	8.31 ± 0.90	7.69 ± 0.59	Pass
DW-50102, 50103	5/20/2014	Ra-228	5.44 ± 0.85	6.02 ± 0.67	5.73 ± 0.54	Pass
SW-2226, 2227	5/21/2014	H-3	14318.00 ± 347.00	14350.00 ± 347.00	14334.00 ± 245.37	Pass
DW-50087, 50088	5/21/2014	Gr. Alpha	1.76 ± 1.09	2.67 ± 1.01	2.22 ± 0.74	Pass
DW-50090, 50091	5/21/2014	Ra-226	0.61 ± 0.09	0.47 ± 0.09	0.54 ± 0.06	Pass
DW-50090, 50091	5/21/2014	Ra-228	0.97 ± 0.41	1.26 ± 0.52	1.12 ± 0.33	Pass
DW-50098, 50099	5/21/2014	Gr. Alpha	13.04 ± 1.36	10.76 ± 1.26	11.90 ± 0.93	Pass
AP-2289, 2290	5/22/2014	Be-7	0.14 ± 0.08	0.24 ± 0.10	0.19 ± 0.06	Pass
PM-3174, 3175	5/28/2014	K-40	30.68 ± 1.30	32.64 ± 1.24	31.66 ± 0.90	Pass
G-2415, 2416	6/2/2014	Be-7	0.73 ± 0.16	0.62 ± 0.28	0.68 ± 0.16	Pass
G-2415, 2416	6/2/2014	Gr. Beta	5.89 ± 0.09	5.90 ± 0.09	5.89 ± 0.06	Pass
G-2415, 2416	6/2/2014	K-40	5.30 ± 0.49	5.19 ± 0.65	5.25 ± 0.41	Pass
WW-2541, 2542	6/4/2014	H-3	5107.00 ± 223.00	5029.00 ± 222.00	5068.00 ± 157.33	Pass
SW-2817, 2818	6/16/2014	H-3	13303.00 ± 336.00	13130.00 ± 334.00	13216.50 ± 236.88	Pass
SS-2943, 2944	6/24/2014	K-40	11.49 ± 0.79	11.81 ± 0.70	11.65 ± 0.53	Pass
S-3048, 3049	6/27/2014	K-40	42.51 ± 1.31	40.04 ± 1.39	41.28 ± 0.95	Pass
SWT-3216, 3217	7/1/2014	Gr. Beta	2.27 ± 0.94	2.53 ± 1.05	2.40 ± 0.70	Pass
AP-3699,3700	7/3/2014	Be-7	0.06 ± 0.01	0.07 ± 0.02	0.07 ± 0.01	Pass
S-3300, 3301	7/8/2014	K-40	4.85 ± 0.97	5.91 ± 1.17	5.38 ± 0.76	Pass
S-3300, 3301	7/8/2014	Ac-228	10.23 ± 0.43	10.18 ± 0.32	10.21 ± 0.27	Pass
S-3300, 3301	7/8/2014	Ra-226	70.14 ± 2.37	72.01 ± 2.38	71.08 ± 1.68	Pass
VE-3237,3238	7/8/2014	K-40	2.54 ± 0.27	2.63 ± 0.24	2.59 ± 0.18	Pass
CF-3384,3385	7/14/2014	K-40	11.10 ± 0.58	10.69 ± 0.60	10.90 ± 0.42	Pass
S-3447,3448	7/16/2014	K-40	19.63 ± 0.64	21.03 ± 0.96	20.33 ± 0.58	Pass
WW-3573,3574	7/18/2014	H-3	381.58 ± 85.76	401.30 ± 86.67	391.44 ± 60.96	Pass
VE-3594,3595	7/22/2014	K-40	3.04 ± 0.19	3.21 ± 0.15	3.13 ± 0.12	Pass
WW-3762,3763	7/25/2014	H-3	315.47 ± 87.02	327.30 ± 87.56	321.39 ± 61.72	Pass
SWT-3867, 3868	7/29/2014	Gr. Beta	1.10 ± 0.53	1.51 ± 0.58	1.31 ± 0.39	Pass
S-3804, 3805	7/30/2014	Ac-228	0.67 ± 0.11	0.61 ± 0.10	0.64 ± 0.07	Pass
S-3804, 3805	7/30/2014	Pb-214	0.56 ± 0.05	0.51 ± 0.04	0.54 ± 0.03	Pass
LW-3931, 3932	7/31/2014	Gr. Beta	1.04 ± 0.40	0.95 ± 0.41	1.00 ± 0.29	Pass

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

Lab Code	Date	Analysis	Concentration (pCi/L) ^a			Acceptance
			First Result	Second Result	Averaged Result	
G-3952,3953	8/4/2014	K-40	5.42 ± 0.42	5.35 ± 0.34	5.38 ± 0.27	Pass
G-3952,3953	8/4/2014	Be-7	1.29 ± 0.19	1.24 ± 0.16	1.27 ± 0.13	Pass
G-3952,3953	8/4/2014	Gr. Beta	8.53 ± 0.20	8.63 ± 0.20	8.58 ± 0.14	Pass
G-3952,3953	8/4/2014	H-3	140.16 ± 93.50	127.25 ± 92.99	133.70 ± 65.94	Pass
WW-4036, 4037	8/5/2014	H-3	190.60 ± 82.60	164.70 ± 81.30	177.65 ± 57.95	Pass
VE-4204,4205	8/11/2014	K-40	6.28 ± 0.38	6.60 ± 0.37	6.44 ± 0.27	Pass
WW-4394,4395	8/13/2014	H-3	1540.26 ± 136.52	1499.15 ± 135.43	1519.71 ± 96.15	Pass
VE-4183,4184	8/14/2014	K-40	5.70 ± 0.41	5.73 ± 0.34	5.72 ± 0.27	Pass
AV-4455, 4456	8/22/2014	Be-7	286.67 ± 102.30	251.99 ± 98.94	269.33 ± 71.16	Pass
AV-4455, 4456	8/22/2014	K-40	2547.90 ± 255.70	2201.40 ± 203.90	2374.65 ± 163.52	Pass
WW-4500, 4501	8/26/2014	H-3	347.00 ± 100.00	321.00 ± 98.00	334.00 ± 70.01	Pass
AP-090214A/B	9/2/2014	Gr. Beta	0.03 ± 0.04	0.03 ± 0.04	0.03 ± 0.00	Pass
SG-5089, 5090	9/19/2014	Ac-228	8.26 ± 0.63	9.48 ± 0.68	8.87 ± 0.46	Pass
SG-5089, 5090	9/19/2014	Bi-214	4.71 ± 0.29	4.41 ± 0.31	4.56 ± 0.21	Pass
SG-5194,5	10/1/2014	Gr. Alpha	276.20 ± 9.51	258.60 ± 9.26	267.40 ± 6.64	Pass
SG-5194,5	10/1/2014	Pb-214	43.56 ± 0.73	43.94 ± 0.78	43.75 ± 0.53	Pass
SG-5194,5	10/1/2014	Ac-228	59.90 ± 1.37	62.80 ± 1.73	61.35 ± 1.10	Pass
S-5632,3	10/8/2014	K-40	19.28 ± 0.88	17.94 ± 0.89	18.61 ± 0.63	Pass
S-5632,3	10/8/2014	Cs-137	0.15 ± 0.03	0.13 ± 0.03	0.14 ± 0.02	Pass
S-5632,3	10/8/2014	Tl-208	0.32 ± 0.03	0.34 ± 0.03	0.33 ± 0.02	Pass
S-5632,3	10/8/2014	Pb-212	0.92 ± 0.05	0.92 ± 0.05	0.92 ± 0.03	Pass
S-5632,3	10/8/2014	Pb-214	1.25 ± 0.08	1.09 ± 0.09	1.17 ± 0.06	Pass
S-5632,3	10/8/2014	Bi-212	1.25 ± 0.29	1.34 ± 0.47	1.29 ± 0.27	Pass
S-5632,3	10/8/2014	Ac-228	1.08 ± 0.14	1.10 ± 0.14	1.09 ± 0.10	Pass
DW-50243,4	10/13/2014	Gr. Alpha	2.99 ± 0.94	4.98 ± 1.17	3.99 ± 0.75	Pass
AP-101414A/B	10/14/2014	Gr. Beta	0.02 ± 0.00	0.02 ± 0.00	0.02 ± 0.00	Pass
SG-5590,1	10/15/2014	Pb-214	80.30 ± 8.08	73.40 ± 7.51	76.85 ± 5.52	Pass
SG-5590,1	10/15/2014	Ac-228	64.50 ± 1.87	62.80 ± 1.15	63.65 ± 1.10	Pass
DW-50251,2	10/16/2014	Ra-226	0.55 ± 0.13	0.32 ± 0.10	0.44 ± 0.08	Pass
U-5842,3	10/20/2014	H-3	7376 ± 949	7342 ± 947	7359 ± 670	Pass
CF-6074,5	10/21/2014	H-3	7509 ± 283	7969 ± 291	7739 ± 203	Pass
CF-6074,5	10/21/2014	K-40	3.09 ± 0.31	3.30 ± 0.38	3.20 ± 0.25	Pass

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

Lab Code	Date	Analysis	Concentration (pCi/L) ^a			Acceptance
			First Result	Second Result	Averaged Result	
VE-6269,70	11/3/2014	K-40	6.25 ± 0.54	6.56 ± 0.49	6.41 ± 0.36	Pass
VE-6269,70	11/3/2014	Be-7	0.81 ± 0.28	0.74 ± 0.18	0.77 ± 0.17	Pass
SO-6500,1	11/5/2014	Sr-90	0.07 ± 0.03	0.07 ± 0.02	0.07 ± 0.02	Pass
SO-6500,1	11/5/2014	Gr. Alpha	11.77 ± 1.73	12.18 ± 1.62	11.98 ± 1.19	Pass
SO-6500,1	11/5/2014	Gr. Beta	26.69 ± 1.62	24.19 ± 1.13	25.44 ± 0.99	Pass
SO-6500,1	11/5/2014	U-233/4	0.14 ± 0.04	0.14 ± 0.05	0.14 ± 0.03	Pass
SO-6500,1	11/5/2014	U-238	0.18 ± 0.05	0.13 ± 0.04	0.15 ± 0.03	Pass
SO-6500,1	11/5/2014	Th-228	0.47 ± 0.11	0.34 ± 0.06	0.41 ± 0.06	Pass
SO-6500,1	11/5/2014	Th-230	0.38 ± 0.07	0.29 ± 0.05	0.34 ± 0.04	Pass
SO-6500,1	11/5/2014	Th-232	0.41 ± 0.08	0.41 ± 0.06	0.41 ± 0.05	Pass
SO-6500,1	11/5/2014	Bi-214	0.75 ± 0.02	0.78 ± 0.02	0.77 ± 0.01	Pass
SO-6500,1	11/5/2014	Pb-214	0.78 ± 0.08	0.86 ± 0.09	0.82 ± 0.06	Pass
SO-6500,1	11/5/2014	Ac-228	1.02 ± 0.11	1.13 ± 0.13	1.08 ± 0.09	Pass
SO-6500,1	11/5/2014	Cs-137	0.40 ± 0.01	0.39 ± 0.01	0.39 ± 0.01	Pass
DW-50262,3	11/10/2014	Gr. Alpha	8.95 ± 1.26	7.84 ± 1.24	8.40 ± 0.88	Pass
DW-50264,5	11/10/2014	Ra-226	3.89 ± 0.24	3.71 ± 0.20	3.80 ± 0.16	Pass
DW-50264,5	11/10/2014	Ra-228	2.96 ± 0.63	2.33 ± 0.59	2.65 ± 0.43	Pass
AP-120214A/B	12/2/2014	Gr. Beta	0.03 ± 0.00	0.03 ± 0.00	0.03 ± 0.00	Pass
AP-120814A/B	12/8/2014	Gr. Beta	0.03 ± 0.01	0.03 ± 0.01	0.03 ± 0.00	Pass
SG-7068,9	12/19/2014	Pb-214	4.27 ± 0.23	4.38 ± 0.33	4.33 ± 0.20	Pass
SG-7068,9	12/19/2014	Ac-228	2.72 ± 0.36	3.27 ± 0.49	3.00 ± 0.30	Pass
S-7152,3	12/25/2014	K-40	20.83 ± 0.88	20.16 ± 0.62	20.49 ± 0.54	Pass

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

Lab Code ^b	Date	Analysis	Laboratory result	Concentration ^a		Acceptance
				Known Activity	Control Limits ^c	
MAW-1140	2/1/2014	Gr. Alpha	0.77 ± 0.06	0.85	0.26 - 1.44	Pass
MAW-1140	2/1/2014	Gr. Beta	4.31 ± 0.08	4.19	2.10 - 6.29	Pass
MAW-1142	2/1/2014	I-129	-0.01 ± 8.00	0.00	NA	Pass
MAW-1184	2/1/2014	Fe-55	0.40 ± 3.20	0.00	-0.01 - 2.00	Pass
MAW-1184	2/1/2014	H-3	345.10 ± 10.60	321.00	225.00 - 417.00	Pass
MAW-1184	2/1/2014	Ni-63	32.40 ± 3.20	34.00	23.80 - 44.20	Pass
MAW-1184 ^f	2/1/2014	Pu-238	1.28 ± 0.12	0.83	0.58 - 1.08	Fail
MAW-1184 ^f	2/1/2014	Pu-239/240	0.91 ± 0.10	0.68	0.47 - 0.88	Fail
MAW-1184	2/1/2014	Sr-90	7.00 ± 0.70	8.51	5.96 - 11.06	Pass
MAW-1184	2/1/2014	Tc-99	8.10 ± 0.60	10.30	7.20 - 13.40	Pass
MAW-1184	2/1/2014	U-233/234	0.20 ± 0.07	0.23	0.16 - 0.29	Pass
MAW-1184	2/1/2014	U-238	1.25 ± 0.18	1.45	1.02 - 1.89	Pass
MAW-1184	2/1/2014	Co-57	27.86 ± 0.38	27.50	19.30 - 35.80	Pass
MAW-1184	2/1/2014	Co-60	15.99 ± 0.27	16.00	11.20 - 20.80	Pass
MAW-1184	2/1/2014	Cs-134	21.85 ± 0.54	23.10	16.20 - 30.00	Pass
MAW-1184	2/1/2014	Cs-137	28.74 ± 0.49	28.90	20.20 - 37.60	Pass
MAW-1184	2/1/2014	K-40	1.80 ± 2.00	0.00	0.00 - 10.00	Pass
MAW-1184	2/1/2014	Mn-54	14.06 ± 0.40	13.90	9.70 - 18.10	Pass
MAW-1184	2/1/2014	Zn-65	0.00 ± 0.19	0.00	-0.01 - 0.00	Pass
MAVE-1148	2/1/2014	Co-57	11.63 ± 0.19	10.10	7.10 - 13.10	Pass
MAVE-1148	2/1/2014	Co-60	7.28 ± 0.18	6.93	4.85 - 9.01	Pass
MAVE-1148	2/1/2014	Cs-134	6.29 ± 0.29	6.04	4.23 - 7.85	Pass
MAVE-1148	2/1/2014	Cs-137	5.18 ± 0.20	4.74	3.32 - 6.16	Pass
MAVE-1148	2/1/2014	Mn-54	9.22 ± 0.26	8.62	6.03 - 11.21	Pass
MAVE-1148	2/1/2014	Zn-65	8.59 ± 0.40	7.86	5.50 - 10.22	Pass
MAAP-1151	2/1/2014	Am-241	0.09 ± 0.02	0.09	0.06 - 0.12	Pass
MAAP-1151 ^d	2/1/2014	Co-57	1.60 ± 0.05	0.00	NA	Fail
MAAP-1151	2/1/2014	Co-60	1.38 ± 0.08	1.39	0.97 - 1.81	Pass
MAAP-1151	2/1/2014	Cs-134	1.75 ± 0.11	1.91	1.34 - 2.48	Pass
MAAP-1151	2/1/2014	Cs-137	1.81 ± 0.10	1.76	1.23 - 2.29	Pass
MAAP-1151	2/1/2014	Mn-54	0.01 ± 0.03	0.00	NA	Pass
MAAP-1151 ^f	2/1/2014	Pu-238	0.08 ± 0.02	0.00	NA	Fail
MAAP-1151	2/1/2014	Pu-239/240	0.10 ± 0.02	0.08	0.05 - 0.10	Pass
MAAP-1151	2/1/2014	Zn-65	-0.24 ± 0.09	0.00	-0.50 - 1.00	Pass

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

Lab Code ^b	Date	Analysis	Laboratory result	Concentration ^a		Acceptance
				Known Activity	Control Limits ^c	
MAAP-1151	2/1/2014	U-233/234	0.03 ± 0.01	0.02	0.01 - 0.03	Pass
MAAP-1151	2/1/2014	U-238	0.13 ± 0.02	0.13	0.09 - 0.17	Pass
MAAP-1151	2/1/2014	Sr-90	1.11 ± 0.14	1.18	0.83 - 1.53	Pass
MAAP-1154	2/1/2014	Gr. Alpha	0.56 ± 0.06	1.77	0.53 - 3.01	Pass
MAAP-1154	2/1/2014	Gr. Beta	0.98 ± 0.06	0.77	0.39 - 1.16	Pass
MASO-1146	2/1/2014	Co-57	1064.50 ± 3.60	966.00	676.00 - 1256.00	Pass
MASO-1146	2/1/2014	Co-60	1.70 ± 0.50	1.22	NA ^e	Pass
MASO-1146 ^g	2/1/2014	Cs-134	6.10 ± 1.80	0.00	NA	Fail
MASO-1146	2/1/2014	Cs-137	1364.30 ± 5.30	1238.00	867.00 - 1609.00	Pass
MASO-1146	2/1/2014	K-40	728.90 ± 15.90	622.00	435.00 - 809.00	Pass
MASO-1146	2/1/2014	Mn-54	1588.00 ± 6.00	1430.00	1001.00 - 1859.00	Pass
MASO-1146	2/1/2014	Zn-65	763.50 ± 6.80	695.00	487.00 - 904.00	Pass
MASO-1146	2/1/2014	Am-241	68.20 ± 9.00	68.00	47.60 - 88.40	Pass
MASO-1146	2/1/2014	Ni-63	4.80 ± 15.30	0.00	NA	Pass
MASO-1146 ^f	2/1/2014	Pu-238	140.60 ± 15.50	96.00	67.00 - 125.00	Fail
MASO-1146 ^f	2/1/2014	Pu-239/240	102.00 ± 13.10	76.80	53.80 - 99.80	Fail
MASO-1146	2/1/2014	Sr-90	1.23 ± 1.37	0.00	NA	Pass
MASO-1146	2/1/2014	Tc-99	-0.30 ± 12.00	0.00	NA	Pass
MASO-1146 ^h	2/1/2014	U-233/234	22.90 ± 3.00	81.00	57.00 - 105.00	Fail
MASO-1146 ^h	2/1/2014	U-238	32.00 ± 3.60	83.00	58.00 - 108.00	Fail
MASO-4439	8/1/2014	Am-241	65.90 ± 6.70	85.50	59.90 - 111.20	Pass
MASO-4439	8/1/2014	Ni-63	771.62 ± 23.29	980.00	686.00 - 1274.00	Pass
MASO-4439	8/1/2014	Pu-239/240	55.63 ± 5.81	58.60	41.00 - 76.20	Pass
MASO-4439	8/1/2014	Sr-90	778.34 ± 17.82	858.00	601.00 - 1115.00	Pass
MASO-4439	8/1/2014	Tc-99	458.20 ± 9.20	589.00	412.00 - 766.00	Pass
MASO-4439	8/1/2014	Cs-134	520.60 ± 7.09	622.00	435.00 - 809.00	Pass
MASO-4439	8/1/2014	Co-57	1135.00 ± 7.40	1116.00	781.00 - 1451.00	Pass
MASO-4439	8/1/2014	Co-60	768.20 ± 7.70	779.00	545.00 - 1013.00	Pass
MASO-4439	8/1/2014	Mn-54	1050.70 ± 12.60	1009.00	706.00 - 1312.00	Pass
MASO-4439	8/1/2014	Zn-65	407.89 ± 15.03	541.00	379.00 - 703.00	Pass
MAW-4431	8/1/2014	Am-241	0.79 ± 0.08	0.88	0.62 - 1.14	Pass
MAW-4431	8/1/2014	Cs-137	18.62 ± 0.54	18.40	12.90 - 23.90	Pass
MAW-4431	8/1/2014	Co-57	24.85 ± 0.42	24.70	17.30 - 32.10	Pass
MAW-4431	8/1/2014	Co-60	12.27 ± 0.38	12.40	8.70 - 16.10	Pass
MAW-4431	8/1/2014	H-3	207.20 ± 10.60	208.00	146.00 - 270.00	Pass
MAW-4431 ⁱ	8/1/2014	Fe-55	55.10 ± 14.80	31.50	22.10 - 41.00	Fail
MAW-4431	8/1/2014	Mn-54	14.36 ± 0.53	14.00	9.80 - 18.20	Pass
MAW-4431	8/1/2014	Zn-65	11.46 ± 0.78	10.90	7.60 - 14.20	Pass

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

Lab Code ^b	Date	Analysis	Laboratory result	Concentration ^a		Acceptance
				Known Activity	Control Limits ^c	
MAW-4431	8/1/2014	Tc-99	6.10 ± 0.50	6.99	4.89 - 9.09	Pass
MAW-4431	8/1/2014	Pu-238	0.59 ± 0.07	0.62	0.43 - 0.80	Pass
MAW-4431	8/1/2014	U-233/234	0.22 ± 0.04	0.21	0.14 - 0.27	Pass
MAW-4431	8/1/2014	U-238	1.25 ± 0.10	1.42	0.99 - 1.85	Pass
MAW-4493	8/1/2014	Gr. Alpha	0.93 ± 0.07	1.40	0.42 - 2.38	Pass
MAW-4493	8/1/2014	Gr. Beta	6.31 ± 1.35	6.50	3.25 - 9.75	Pass
MAAP-4433	8/1/2014	Am-241	0.06 ± 0.02	0.07	0.05 - 0.09	Pass
MAAP-4433	8/1/2014	Pu-238	0.10 ± 0.03	0.11	0.08 - 0.14	Pass
MAAP-4433	8/1/2014	Pu-239/240	0.04 ± 0.02	0.05	0.03 - 0.06	Pass
MAAP-4433	8/1/2014	Sr-90	0.74 ± 0.10	0.70	0.49 - 0.91	Pass
MAAP-4433	8/1/2014	U-233/234	0.03 ± 0.01	0.04	0.03 - 0.05	Pass
MAAP-4433	8/1/2014	U-238	0.21 ± 0.03	0.25	0.18 - 0.33	Pass
MAAP-4444	8/1/2014	Sr-89	7.82 ± 0.52	9.40	6.60 - 12.20	Pass
MAAP-4444	8/1/2014	Sr-90	0.76 ± 0.10	0.76	0.53 - 0.99	Pass
MAVE-4436	8/1/2014	Cs-134	7.49 ± 0.18	7.38	5.17 - 9.59	Pass
MAVE-4436	8/1/2014	Co-57	11.20 ± 0.19	9.20	6.40 - 12.00	Pass
MAVE-4436	8/1/2014	Co-60	6.84 ± 0.17	6.11	4.28 - 7.94	Pass
MAVE-4436	8/1/2014	Mn-54	8.11 ± 0.26	7.11	4.97 - 9.23	Pass
MAVE-4436	8/1/2014	Zn-65	7.76 ± 0.43	6.42	4.49 - 8.35	Pass

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

^b Laboratory codes as follows: MAW (water), MAAP (air filter), MASO (soil), MAVE (vegetation).

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

^d Interference from Eu-152 resulted in misidentification of Co-57.

^e Provided in the series for "sensitivity evaluation". MAPEP does not provide control limits.

^f The high bias on the plutonium crosscheck samples was traced to contamination from a newly purchased standard.

The results of reanalysis with replacement tracer purchased from NIST:

MAW-1184	Pu-238	0.68 ± 0.10	Bq / L
MAW-1184	Pu-239/240	0.66 ± 0.10	Bq / L
MASO-1146	Pu-238	95.15 ± 8.98	Bq / kg
MASO-1146	Pu-239/240	67.21 ± 7.54	Bq / kg

Insufficient sample remained to reanalyze the Air filter sample(MAAP-1151). High bias results due to same contaminated tracer

^g False positive test. Long sample counting time lead to interference from naturaling occurring Bi-214 in sample matrix with a close spectral energy.

^h 80% of participating laboratories were outside the acceptable range.

Parallel reanalysis was run on ERA spiked sample with acceptable results.

ⁱ Result of reanalysis Fe-55 32.63 ± 16.30 Bq / L

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

Lab Code ^b	Date	Analysis	Concentration (pCi/L) ^b			Acceptance
			Laboratory Result ^c	ERA Result ^d	Control Limits	
ERAP-1044	3/17/2014	Am-241	54.2 ± 3.0	59.7	36.8 - 80.8	Pass
ERAP-1044	3/17/2014	Co-60	1177.9 ± 14.3	1120.0	867.0 - 1400.0	Pass
ERAP-1044	3/17/2014	Cs-134	1010.5 ± 15.8	1010.0	643.0 - 1250.0	Pass
ERAP-1044	3/17/2014	Cs-137	938.3 ± 45.7	828.0	622.0 - 1090.0	Pass
ERAP-1044	3/17/2014	Fe-55	142.3 ± 87.3	240.0	74.4 - 469.0	Pass
ERAP-1044	3/17/2014	Gr. Alpha	52.3 ± 0.5	46.0	15.4 - 71.4	Pass
ERAP-1044	3/17/2014	Gr. Beta	64.4 ± 2.6	53.8	34.0 - 78.4	Pass
ERAP-1044	3/17/2014	Mn-54	< 4.9	0.0	NA	Pass
ERAP-1044	3/17/2014	Pu-238	63.0 ± 2.6	56.3	38.6 - 74.0	Pass
ERAP-1044	3/17/2014	Pu-239/240	52.8 ± 1.9	48.6	35.2 - 63.5	Pass
ERAP-1044	3/17/2014	Sr-90	81.4 ± 1.6	78.9	38.6 - 118.0	Pass
ERAP-1044	3/17/2014	U-233/234	30.4 ± 1.7	36.4	22.6 - 54.9	Pass
ERAP-1044	3/17/2014	U-238	30.4 ± 1.4	36.1	23.3 - 49.9	Pass
ERAP-1044	3/17/2014	Uranium	62.0 ± 3.5	74.3	41.1 - 113.0	Pass
ERAP-1044	3/17/2014	Zn-65	852.2 ± 26.1	667.0	478.0 - 921.0	Pass
ERSO-1050	3/17/2014	Am-241	426.6 ± 155.5	399.0	233.0 - 518.0	Pass
ERSO-1050	3/17/2014	Ac-228	1260.0 ± 107.0	1240.0	795.0 - 1720.0	Pass
ERSO-1050	3/17/2014	Bi-212	1331.9 ± 309.7	1240.0	330.0 - 1820.0	Pass
ERSO-1050	3/17/2014	Bi-214	1804.5 ± 50.4	1960.0	1180.0 - 2820.0	Pass
ERSO-1050	3/17/2014	Co-60	6738.8 ± 167.6	6830.0	4620.0 - 9400.0	Pass
ERSO-1050	3/17/2014	Cs-134	3262.9 ± 108.8	3390.0	2220.0 - 4070.0	Pass
ERSO-1050	3/17/2014	Cs-137	8538.6 ± 55.0	8490.0	6510.0 - 10900.0	Pass
ERSO-1050	3/17/2014	K-40	11241.3 ± 296.6	10500.0	7660.0 - 14100.0	Pass
ERSO-1050	3/17/2014	Mn-54	< 21.6	0.0	NA	Pass
ERSO-1050	3/17/2014	Pb-212	1119.6 ± 26.1	1240.0	812.0 - 1730.0	Pass
ERSO-1050	3/17/2014	Pb-214	1861.7 ± 54.9	2070.0	1210.0 - 3090.0	Pass
ERSO-1050 ^e	3/17/2014	Pu-238	1085.5 ± 167.7	578.0	348.0 - 797.0	Fail
ERSO-1050 ^e	3/17/2014	Pu-239/240	681.6 ± 128.6	471.0	308.0 - 651.0	Fail
ERSO-1050	3/17/2014	Sr-90	2338.0 ± 144.0	2780.0	1060.0 - 4390.0	Pass
ERSO-1050	3/17/2014	Th-234	3474.9 ± 226.0	3360.0	1060.0 - 6320.0	Pass
ERSO-1050	3/17/2014	U-233/234	3319.5 ± 250.2	2780.0	1060.0 - 4390.0	Pass
ERSO-1050	3/17/2014	U-238	3375.6 ± 252.6	3360.0	2080.0 - 4260.0	Pass
ERSO-1050	3/17/2014	Uranium	6810.6 ± 551.1	6910.0	3750.0 - 9120.0	Pass
ERSO-1050	3/17/2014	Zn-65	5968.0 ± 226.1	5400.0	4300.0 - 7180.0	Pass

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

Lab Code ^b	Date	Analysis	Concentration (pCi/L) ^b		Control Limits	Acceptance
			Laboratory Result ^c	ERA Result ^d		
ERVE-1051	3/17/2014	Am-241	1532.0 ± 149.5	1490.0	911.0 - 1980.0	Pass
ERVE-1051	3/17/2014	Cm-244	519.8 ± 94.6	516.0	253.0 - 804.0	Pass
ERVE-1051	3/17/2014	Co-60	981.2 ± 41.8	926.0	639.0 - 1290.0	Pass
ERVE-1051	3/17/2014	Cs-134	701.4 ± 58.6	646.0	415.0 - 839.0	Pass
ERVE-1051	3/17/2014	Cs-137	961.9 ± 46.3	880.0	638.0 - 1220.0	Pass
ERVE-1051	3/17/2014	K-40	32789.7 ± 758.2	31900.0	23000.0 - 44800.0	Pass
ERVE-1051	3/17/2014	Mn-54	< 25.9	0.0	NA	Pass
ERVE-1051	3/17/2014	Pu-238	2724.1 ± 259.4	2110.0	1260.0 - 2890.0	Pass
ERVE-1051	3/17/2014	Pu-239/240	4361.4 ± 323.4	3740.0	2300.0 - 5150.0	Pass
ERVE-1051	3/17/2014	Sr-90	2405.7 ± 263.2	2580.0	1470.0 - 3420.0	Pass
ERVE-1051	3/17/2014	U-233/234	1612.2 ± 162.0	1760.0	1160.0 - 2260.0	Pass
ERVE-1051	3/17/2014	U-238	1574.3 ± 159.6	1750.0	1170.0 - 2220.0	Pass
ERVE-1051	3/17/2014	Uranium	3255.4 ± 356.7	3580.0	2430.0 - 4460.0	Pass
ERVE-1051	3/17/2014	Zn-65	1124.1 ± 101.2	919.0	663.0 - 1290.0	Pass
ERW-1054	3/17/2014	Am-241	104.6 ± 3.4	114.0	76.8 - 153.0	Pass
ERW-1054	3/17/2014	Co-60	1195.2 ± 18.9	1270.0	1100.0 - 1490.0	Pass
ERW-1054	3/17/2014	Cs-134	1474.9 ± 47.5	1660.0	1220.0 - 1910.0	Pass
ERW-1054	3/17/2014	Cs-137	2591.0 ± 23.4	2690.0	2280.0 - 3220.0	Pass
ERW-1054	3/17/2014	Mn-54	< 4.3	0.0	NA	Pass
ERW-1054	3/17/2014	Pu-238	54.1 ± 3.6	44.1	32.6 - 54.9	Pass
ERW-1054	3/17/2014	Pu-239/240	185.9 ± 17.6	160.0	124.0 - 202.0	Pass
ERW-1054	3/17/2014	U-233/234	74.8 ± 6.3	82.4	61.9 - 106.0	Pass
ERW-1054	3/17/2014	U-238	76.4 ± 7.8	81.8	62.4 - 100.0	Pass
ERW-1054	3/17/2014	Uranium	154.3 ± 14.6	168.0	123.0 - 217.0	Pass
ERW-1054	3/17/2014	Zn-65	1818.5 ± 56.4	1800.0	1500.0 - 2270.0	Pass
ERW-1055 ^f	3/17/2014	Fe-55	636.3 ± 176.0	1200.0	716.0 - 1630.0	Fail
ERW-1055	3/17/2014	Gr. Alpha	120.9 ± 3.5	133.0	47.2 - 206.0	Pass
ERW-1055	3/17/2014	Gr. Beta	141.6 ± 2.3	174.0	99.6 - 258.0	Pass
ERW-1055	3/17/2014	Sr-90	873.9 ± 56.9	890.0	580.0 - 1180.0	Pass
ERW-1060	3/17/2014	H-3	5818.0 ± 230.0	5580.0	3740.0 - 7960.0	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: ERW (water), ERAP (air filter), ERSO (soil), ERVE (vegetation). Results are reported in units of pCi/L, except for air filters (pCi/Filter), vegetation and soil (pCi/kg).

^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 The high bias on the plutonium crosscheck samples was traced to contamination from a newly purchased standard.

The results of reanalysis with replacement tracer purchased from NIST:

ERSO-1050	Pu-238	634.7 ± 98.50	Bq / kg
ERSO-1050	Pu-239/240	451.8 ± 82.80	Bq / kg

^f An error in the efficiency calculation was found. The result of recalculation was 932 pCi/L.

The sample was repeated, result of reanalysis, 1066 pCi/L.

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 = 2σ 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, \dots, x_n are defined as follows:

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

- 4.2 Values below the highest lower limit of detection are not included in the average.
- 4.3 If all values in the averaging group are less than the highest LLD, the highest LLD is reported.
- 4.4 If all but one of the values are less than the highest LLD, the single value x and associated two sigma error is reported.
- 4.5 In rounding off, the following rules are followed:
- 4.5.1. If the number following those to be retained is less than 5, the number is dropped, and the retained 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

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 x 10 ⁻³	Strontium-89	8,000
Gross beta	1	Strontium-90	500
Iodine-131 ^b	2.8 x 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 x 10 ⁶

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

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

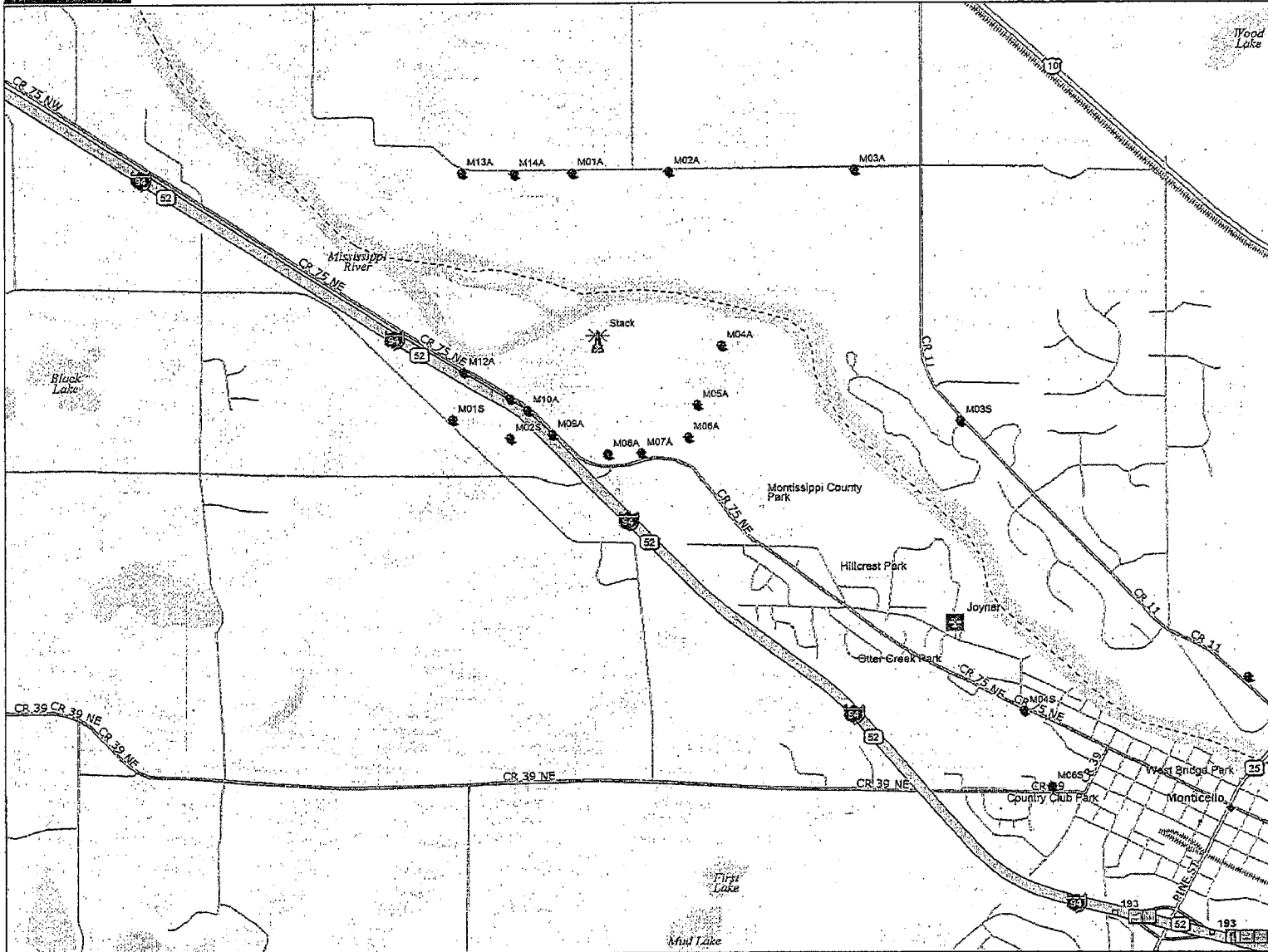
^c A natural radionuclide.

APPENDIX D

Sampling Location Maps

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

D-2



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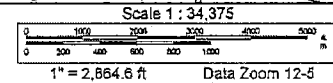


Figure D-2, Sample Collection and Analysis Program: TLD locations, Outer Ring. (Table 5.2)

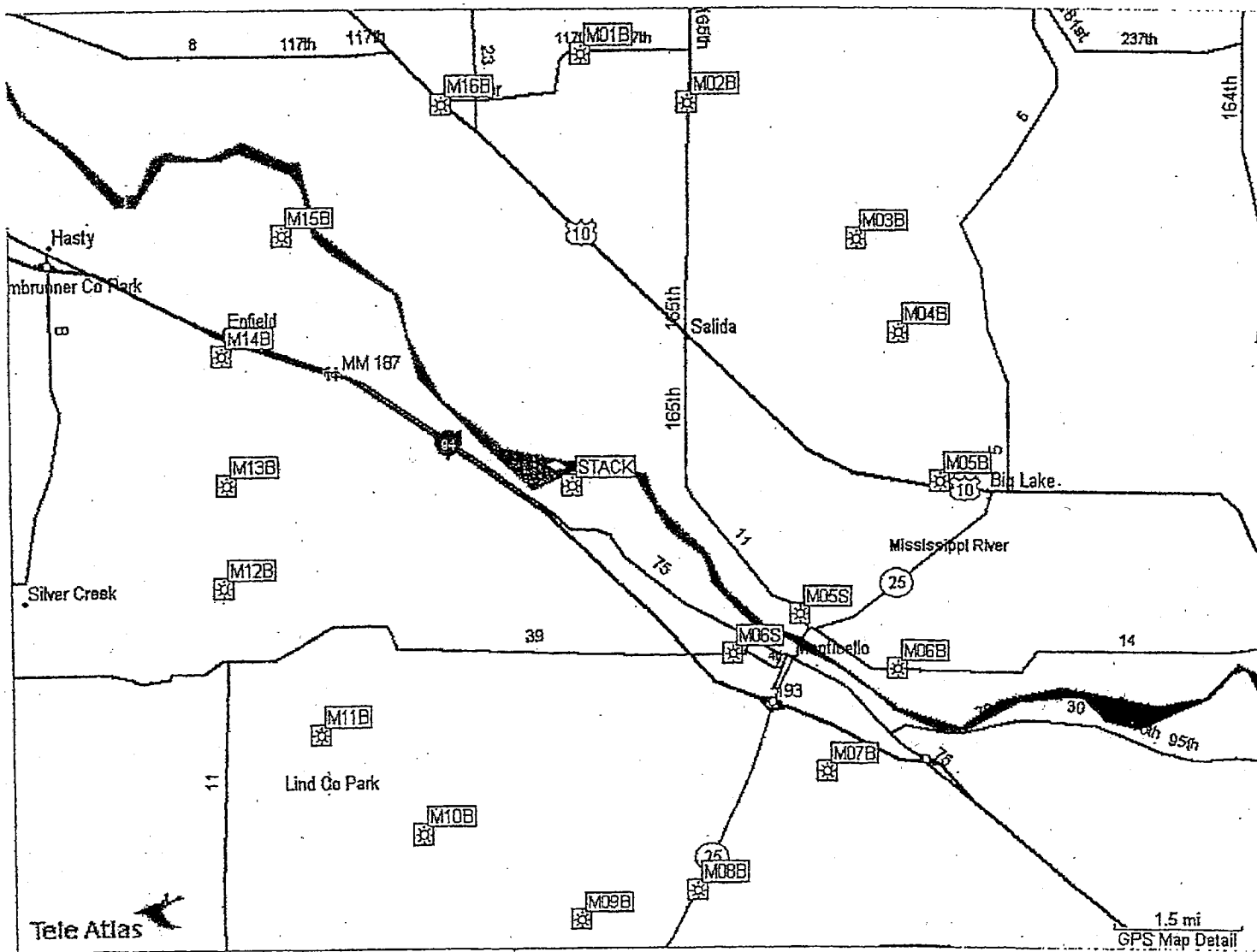
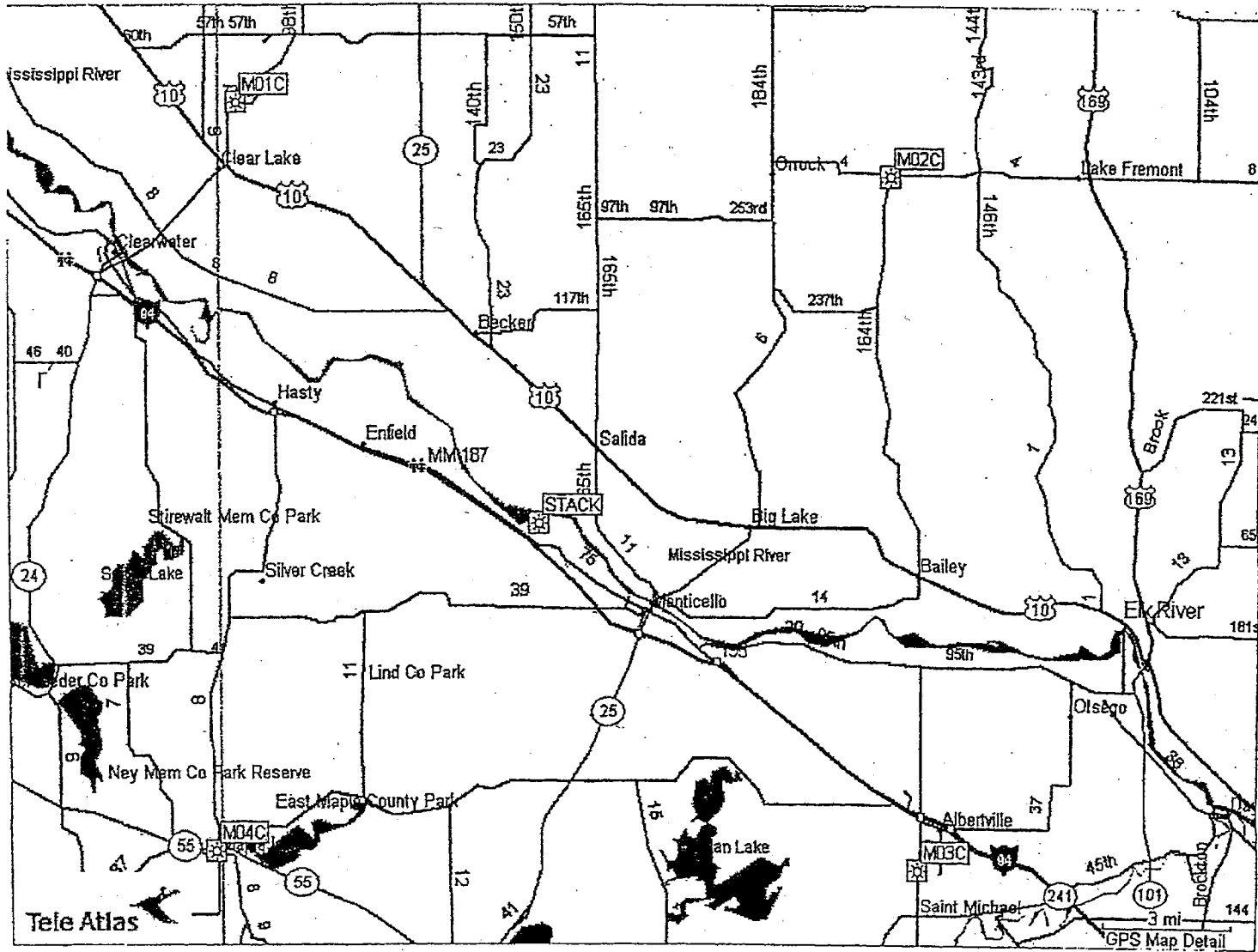


Figure D-3, Sample Collection and Analysis Program: TLD locations, Controls. (Table 5.2)



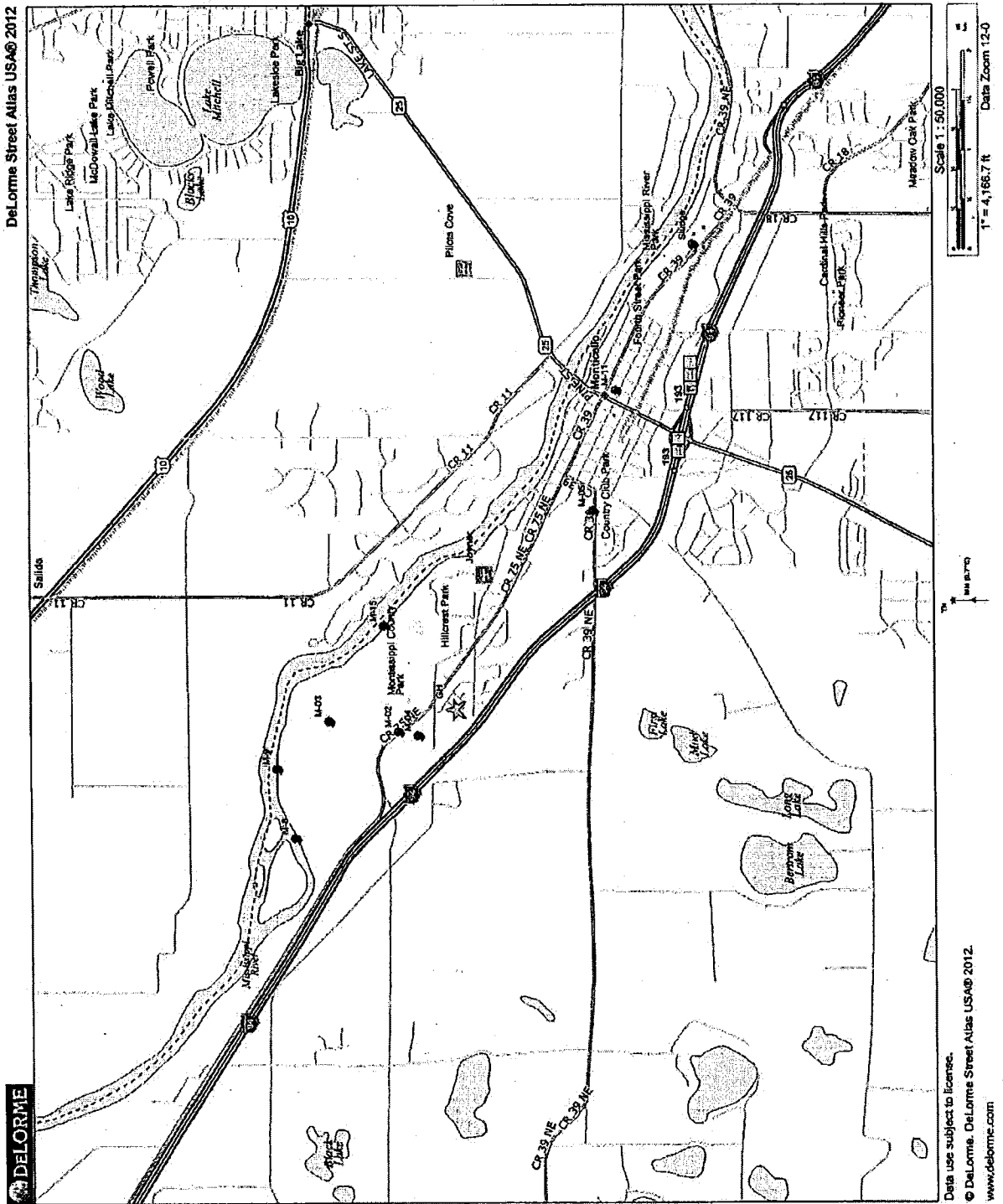


Figure D-4, Sample Collection and Analysis Program: Radiological Environmental Monitoring Program, Sludge, Ground Water and Shoreline sampling locations. (Table 5.2)

APPENDIX E

Ground Water Monitoring Well Samples

1.0 INTRODUCTION

This appendix to the Radiological Environmental Monitoring Program Annual Report to the United States Nuclear Regulatory Commission summarizes and interprets results of the Ground Water Monitoring Program samples taken at the Monticello Nuclear Plant, Monticello, Minnesota, during the period January – December 2014. This sampling program was established in October of 2006 following the industry initiative on ground water monitoring.

Complete data tables for each period and sampling location, are provided in a reference document, (Environmental, Inc., Midwest Laboratory, "Complete Analyses Data Tables, January – December, 2014") available at the Monticello Nuclear Generating Plant, Chemistry and Radiation Protection Department.

2.0 SUMMARY

The Ground Water Sampling Program was established following industry events where tritium was discovered in ground water surrounding commercial nuclear facilities. This program is described and the results for 2014 are summarized and discussed.

Program findings for 2014 detected low levels of tritium in monitoring wells located on the plant property. With the exception of monitoring wells MW-9A and MW-13A, tritium measured at or near expected natural background levels. No tritium was detected in four samples of storm water runoff collected from storm water outfall sample point SD-006 or the two samples collected from the sewer lift station. The 2014 sample results (excluding MW-9A and MW-13A) all measured below the required limit of 500 pCi/L. Measurements for 2014 were below the Environmental Protection Agency's drinking water standard of 20,000 pCi/L and present no harm to members of the public.

None of the samples monitored for gamma-emitting isotopes showed activity greater than the LLD. A summation of the analytical data for both ground water monitoring wells and storm water runoff samples is provided in Table E-3.

3.0 Ground Water 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 MNGP. For this purpose, water samples are collected and analyzed for tritium content.

3.2 Program Description

The sampling and analysis schedule for the Ground Water Monitoring Program is summarized in Table E-1 and briefly reviewed below. Table E-2 defines the additional sample locations and codes for the Ground Water Sampling Program.

Sampling from the groundwater monitoring wells was conducted monthly at fourteen locations and quarterly for five locations.

3.3 Program Execution

The Program was executed as described with the following exceptions:

Additional analyses for gamma emitting isotopes were performed on samples from each of the nineteen monitoring wells. The results are summarized in Table E-3. Results of individual analyses are reported in Table E-4.

3.4 Program Modifications

There were no additional on-site monitoring wells added to the ground water program in 2014.

3.5 Results and Discussions

Sampling points in North America have shown tritium concentrations in precipitation may range from 5 pCi/L to 157 pCi/L (Environmental Isotope Data No. 10; World Survey of Isotope Concentration in Precipitation (1988-1991)). Results obtained show tritium in ground water samples at or near expected natural background levels, with the exception of monitoring wells, MW-9A and MW-13A.

Excluding the data from wells MW-9A and MW-13A and SD-006, 2014 sample results all measured below an LLD level of 500 pCi/L, and were similar to averages measured in 2013.

The average for 2014 at location MW-9A was 3296 pCi/L which is a decline from the 2013 average of 5457 pCi/L. The highest level that was observed in 2014 was 5911 pCi/L for the November 2014 sample. Three of the monthly samples were below the LLD of 500 pCi/L. Previous investigations have concluded the activity may be due to a 1981 spill from the Condensate Storage Tanks that had infiltrated the surface and migrated towards MW-9.

The tritium levels observed at location MW-13A for 2014 ranged from a high of 935 pCi/L in January, fell to 715 pCi/L in February, then stayed below 600 pCi/L for the remainder of the first half of the year and then below the LLD of 500 pCi/L for the remainder of the year..

None of the groundwater samples analyzed for gamma-emitting isotopes showed activity greater than LLD.

Table E-1. Sample Collection and Analysis Program, Ground Water.

Medium	Number	Sample Codes	Collection type	Analysis Type
Ground Water Quarterly	35	MW-1, MW-2, MW-3, MW-4, MW-9B, MW-11, MW-12A, MW-12B,	Grab	H-3
Ground Water Monthly	79	MW-9A, MW-10, MW-13A, MW-13B, MW-14, MW-15A MW-15B,	Grab	H-3
Ground Water Annual	79	MW-5, MW-6, MW-7, MW-8	Grab	H-3

Table E-2. Sampling locations for Ground Water Monitoring Wells.

Sample Type	Vendor Code	Well Number	Distance from Stack (miles)	Compass Heading from Stack	Sector
Ground Water	M-33	MW-1	0.11	299	WNW
Ground Water	M-34	MW-2	0.14	301	WNW
Ground Water	M-35	MW-3	0.15	305	NW
Ground Water	M-36	MW-4	0.1	25	NNE
Ground Water	M-37	MW-5	0.1	253	WSW
Ground Water	M-38	MW-6	229 Feet	228	SW
Ground Water	M-39	MW-7	0.2	66	ENE
Ground Water	M-40	MW-8	0.3	150	SSE
Ground Water	M-44	MW-9A	0.1	310	NW
Ground Water	M-51	MW-9B	0.1	310	NW
Ground Water	M-45	MW-10	0.1	292	WNW
Ground Water	M-46	MW-11	0.1	283	WNW
Ground Water	M-47	MW-12A	0.1	330	NW
Ground Water	M-48	MW-12B	0.1	326	NW
Ground Water	M-49	MW-13A	0.12	316	NW
Ground Water	M-50	MW-13B	0.12	316	NW
Ground Water	M-52	MW-14	0.17	306	NW
Ground Water	M-53	MW-15A	0.14	14	NNE
Ground Water	M-54	MW-15B	0.14	14	NNE

Table E-3. Ground Water Monitoring Program Summary.

Name of Facility	<u>Monticello Nuclear Generating Plant</u>	Docket No.	<u>50-263</u>
Location of Facility	<u>Wright, Minnesota</u>	Reporting Period	<u>January-December, 2014</u>
	(County, State)		

Sample Type (Units)	Type and Number of Analyses ^a	LLD ^b	Indicator Locations Mean (F) ^c Range ^c	Location with Highest Annual Mean		Control Locations Mean (F) ^c Range ^c	Number Non-Routine Results ^e
				Location ^d	Mean (F) ^c Range ^c		
Groundwater Monitoring Wells (pCi/L)	H-3 118	500	2227 (15/118) (505-5911)	MW-9A, On-site, 0.1 mi @ 310°NW	3286 (9/12) (1057-5911)	none	0
Stormwater Runoff (pCi/L)	H-3 4	500	604 (1/4)	SD-006 On-site	-	none	0
	GS 4						
	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
	I-131	30	< LLD	-	-	none	0
	Cs-134	10	< LLD	-	-	none	0
	Cs-137	10	< LLD	-	-	none	0
	Ba-La-140	15	< LLD	-	-	none	0
Ce-144	43	< LLD	-	-	none	0	
Sewer Lift Station (pCi/L)	H-3 2	500	< LLD	-	-	none	0
	GS 2						
	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
	I-131	30	< LLD	-	-	none	0
	Cs-134	10	< LLD	-	-	none	0
	Cs-137	10	< LLD	-	-	none	0
	Ba-La-140	15	< LLD	-	-	none	0
Ce-144	43	< LLD	-	-	none	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 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 times the typical operational value for the medium or location.

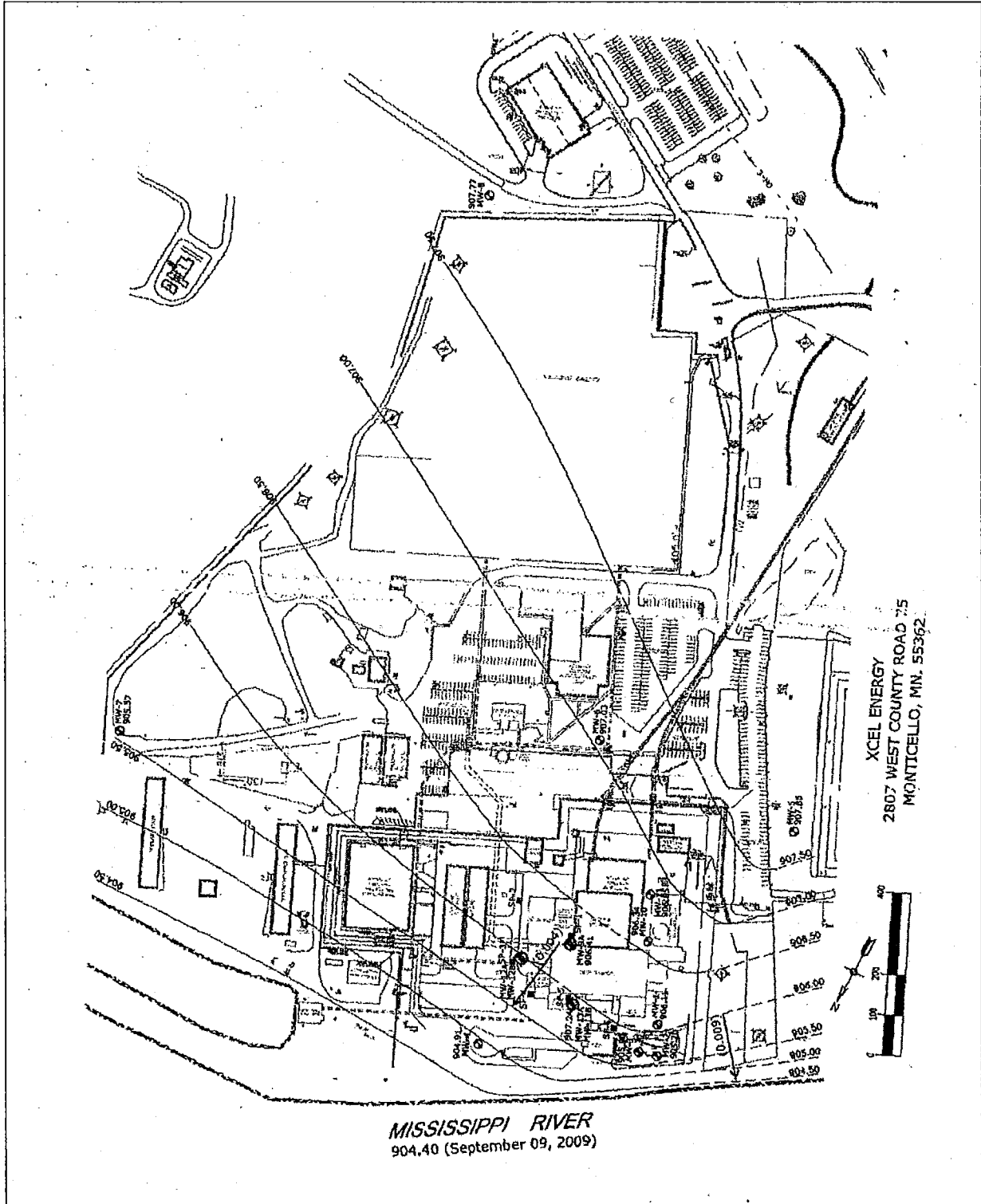


Figure E-1. Sample collection and analysis program: Ground water, On-site monitoring well locations.

Table E-4. Ground water, analyses for tritium and gamma-emitting isotopes.

Lab Code	Collection Date	Concentration (pCi/L)										
		³ H	⁵⁴ Mn	⁵⁹ Fe	⁵⁸ Co	⁶⁰ Co	⁶⁵ Zn	⁹⁵ ZrNb	¹³⁴ Cs	¹³⁷ Cs	¹⁴⁰ BaLa	¹⁴⁴ Ce
<u>Monitoring Well #1 (M-33)</u>												
MWW- 785	02/20/14	< 146	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 24
MWW- 2526	05/27/14	167 ± 81	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 23
MWW- 4538	08/28/14	< 146	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 25
MWW- 6764	11/21/14	< 170	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 23
<u>Monitoring Well #2 (M-34)</u>												
MWW- 787	02/26/14	150 ± 84	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 28
MWW- 2527	05/29/14	< 145	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 22
MWW- 4539	08/28/14	< 153	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 24
MWW- 6748	11/21/14	240 ± 98	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 23
<u>Monitoring Well #3 (M-35)</u>												
MWW- 788	02/26/14	150 ± 78	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 27
MWW- 2528	05/29/14	< 145	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 20
MWW- 4540	08/28/14	169 ± 89	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 48
MWW- 6749	11/21/14	255 ± 99	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 20
<u>Monitoring Well #4 (M-36)</u>												
MWW- 789	02/26/14	< 142	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 27
MWW- 2529	05/27/14	< 145	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 35
MWW- 4541	08/28/14	< 146	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 14
MWW- 6765	11/21/14	186 ± 94	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 22
<u>Monitoring Well #5 (M-37)</u>												
MWW- 4542	08/27/14	< 153	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 37
<u>Monitoring Well #6 (M-38)</u>												
MWW- 4544	08/27/14	< 177	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 39
<u>Monitoring Well #7 (M-39)</u>												
MWW- 4545	08/27/14	< 177	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 29
<u>Monitoring Well #8 (M-40)</u>												
MWW- 4546	08/27/14	< 177	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 21

Table E-4. Ground water, analyses for tritium and gamma-emitting isotopes (continued).

Lab Code	Collection Date	Concentration (pCi/L)										
		³ H	⁵⁴ Mn	⁵⁹ Fe	⁵⁸ Co	⁶⁰ Co	⁶⁵ Zn	⁹⁵ ZrNb	¹³⁴ Cs	¹³⁷ Cs	¹⁴⁰ BaLa	¹⁴⁴ Ce
<u>Monitoring Well #9A (M-44)</u>												
MWW- 319	01/27/14	1057 ± 121										
MWW- 790	02/24/14	1117 ± 118	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 27
MWW- 1113	03/20/14	1479 ± 131										
MWW- 1659	04/22/14	182 ± 82										
MWW- 2530	05/29/14	165 ± 81	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 20
MWW- 2901	06/18/14	346 ± 90										
MWW- 3857	07/28/14	2997 ± 163										
MWW- 5406	08/29/14	3802 ± 203	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 10
MWW- 5408	09/18/14	4028 ± 208										
MWW- 6021	10/21/14	5158 ± 229										
MWW- 6750	11/20/14	5911 ± 279	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 27
MWW- 7232	12/22/14	4024 ± 191										
<u>Monitoring Well #9B (M-51)</u>												
MWW- 791	02/24/14	< 142	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 23
MWW- 2531	05/29/14	316 ± 88	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 33
MWW- 5407	08/29/14	< 159	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15.4	< 14 ^a
MWW- 6751	11/20/14	< 170	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 25
<u>Monitoring Well #10 (M-45)</u>												
MWW- 345	01/24/14	376 ± 97										
MWW- 792	02/20/14	278 ± 85	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 23
MWW- 1132	03/21/14	229 ± 84										
MWW- 1660	04/22/14	283 ± 87										
MWW- 2532	05/29/14	332 ± 89	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 22
MWW- 2903	06/18/14	216 ± 84										
MWW- 3907	07/29/14	273 ± 77										
MWW- 4547	08/28/14	426 ± 104	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 40
MWW- 4962	09/18/14	315 ± 96										
MWW- 5944	10/21/14	331 ± 95										
MWW- 6752	11/21/14	396 ± 107	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 18
MWW- 7175	12/24/14	210 ± 105										
<u>Monitoring Well #11 (M-46)</u>												
MWW- 793	02/20/14	< 142	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 18
MWW- 2533	05/29/14	150 ± 80	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 43
MWW- 4548	08/28/14	< 177	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 25
MWW- 6766	11/21/14	< 170	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 33
<u>Monitoring Well #12A (M-47)</u>												
MWW- 794	02/20/14	< 142	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 20
MWW- 2534	05/27/14	< 145	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 20
MWW- 4549	08/27/14	< 177	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 25
MWW- 6767	11/21/14	< 170	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 23

^a LLD not reached due to age of sample and small sample size; sample counted 60,000 seconds.

Table E-4. Ground water, analyses for tritium and gamma-emitting isotopes (continued).

Lab Code	Collection Date	Concentration (pCi/L)										
		³ H	⁵⁴ Mn	⁵⁹ Fe	⁵⁸ Co	⁶⁰ Co	⁶⁵ Zn	⁹⁵ ZrNb	¹³⁴ Cs	¹³⁷ Cs	¹⁴⁰ BaLa	¹⁴⁴ Ce
<u>Monitoring Well #12B (M-48)</u>												
MWW- 795	02/20/14	< 142	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 28
MWW- 2535	05/27/14	< 145	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 28
MWW- 4550	08/27/14	< 177	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 15
MWW- 6754	11/21/14	< 170	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 34
<u>Monitoring Well #13A (M-49)</u>												
MWW- 346	01/24/14	935 ± 118										
MWW- 796	02/26/14	715 ± 103	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 30
MWW- 1133	03/21/14	553 ± 98										
MWW- 1661	04/22/14	505 ± 96										
MWW- 2536	05/27/14	565 ± 99	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 23
MWW- 2904	06/18/14	565 ± 100										
MWW- 3908	07/29/14	239 ± 75										
MWW- 4551	08/28/14	< 177	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 39
MWW- 4963	09/18/14	262 ± 93										
MWW- 5945	10/21/14	< 148										
MWW- 6768	11/21/14	< 170	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 20
MWW- 7176	12/24/14	< 175										
<u>Monitoring Well #13B (M-50)</u>												
MWW- 348	01/24/14	< 152										
MWW- 797	02/26/14	194 ± 81	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 22
MWW- 1134	03/21/14	221 ± 84										
MWW- 1662	04/22/14	257 ± 85										
MWW- 2537	05/27/14	222 ± 84	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 24
MWW- 2905	06/18/14	231 ± 85										
MWW- 3909	07/29/14	197 ± 73										
MWW- 4552	08/28/14	< 177	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 17
MWW- 4965	09/18/14	< 151										
MWW- 5946	10/21/14	213 ± 89										
MWW- 6769	11/21/14	213 ± 96	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 34
MWW- 7177	12/24/14	< 175										
<u>Monitoring Well #14 (M-52)</u>												
MWW- 349	01/19/14	< 152										
MWW- 798	02/19/14	< 142	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 21
MWW- 1135	03/17/14	< 146										
MWW- 1663	04/21/14	< 146										
MWW- 2538	05/23/14	< 145	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 14
MWW- 3910	07/29/14	< 131										
MWW- 4553	08/19/14	< 178	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 13
MWW- 4966	09/18/14	< 151										
MWW- 5947	10/20/14	< 148										
MWW- 7178	12/15/14	< 183	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 19

Table E-4. Ground water, analyses for tritium and gamma-emitting isotopes (continued).

Lab Code	Collection Date	Concentration (pCi/L)										
		³ H	⁵⁴ Mn	⁵⁹ Fe	⁵⁸ Co	⁶⁰ Co	⁶⁵ Zn	⁹⁵ ZrNb	¹³⁴ Cs	¹³⁷ Cs	¹⁴⁰ BaLa	¹⁴⁴ Ce
<u>Monitoring Well #15A (M-53)</u>												
MWW- 350	01/24/14	< 152										
MWW- 799	02/20/14	< 142	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 22
MWW- 1136	03/21/14	< 146										
MWW- 1664	04/22/14	< 146										
MWW- 2539	05/27/14	< 145	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 26
MWW- 2906	06/18/14	< 148										
MWW- 3912	07/29/14	< 131										
MWW- 4554	08/27/14	< 153	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 18
MWW- 4967	09/18/14	< 151										
MWW- 5949	10/20/14	< 148										
MWW- 6755	11/20/14	< 170	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 26
MWW- 7179	12/24/14	< 175										
<u>Monitoring Well #15B (M-54)</u>												
MWW- 351	01/24/14	180 ± 89										
MWW- 800	02/20/14	170 ± 80	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 30
MWW- 1138	03/21/14	199 ± 83										
MWW- 1665	04/22/14	301 ± 88										
MWW- 2540	05/27/14	210 ± 83	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 29
MWW- 2907	06/18/14	190 ± 83										
MWW- 3913	07/29/14	188 ± 73										
MWW- 4555	08/27/14	192 ± 91	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 29
MWW- 4968	09/18/14	226 ± 91										
MWW- 5950	10/20/14	150 ± 86										
MWW- 6756	11/20/14	183 ± 94	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 19
MWW- 7180	12/24/14	259 ± 108										
<u>Storm Water Run-off (SD-006)</u>												
MXW- 801	02/19/14	604 ± 99	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 10
MXW- 2121	04/18/14	205 ± 82	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 11
MXW- 3533	07/11/14	< 138	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 16
MXW- 6480	11/14/14	< 185	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 9
<u>Sewer Lift Station</u>												
MXW- 2547	06/04/14	< 140	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 39
MW- 7181	12/01/14	< 176	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 17



FINAL REPORT
TO
XCEL ENERGY CORPORATION

RADIOLOGICAL ENVIRONMENTAL
MONITORING PROGRAM (REMP)

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

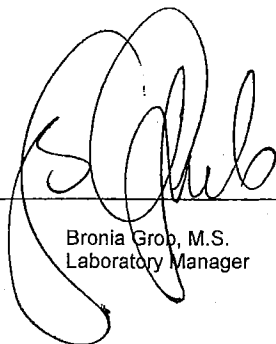
COMPLETE ANALYSES DATA TABLES
January - December, 2014

Prepared under contract by

ENVIRONMENTAL, INC.
MIDWEST LABORATORY

PROJECT NO. 8010

Reviewed and
Approved



Bronia Grob, M.S.
Laboratory Manager

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1.0 INTRODUCTION

The following constitutes the final 2014 report for the Environmental Radiological Monitoring Program conducted at the Monticello Nuclear Generating Plant in Monticello, Minnesota. Results of completed analyses are presented in the attached tables.

All concentrations, except gross beta, are decay corrected to the time of collection.

All samples were collected within the scheduled period unless noted otherwise in the Listing of Missed Samples.

2.0 LISTING OF MISSED SAMPLES

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
SW	Gamma	M-008	January '14	Water frozen entire month; no composite.	
WW	Gamma, H-3	M-027	1/15/2014	No water available from outside tap.	
SW	Gamma	M-008	February '14	Water frozen entire month; no composite.	
SW	Gamma	M-009	February '14	Water frozen entire month; no composite.	
TLD	Gamma	M-I-08	1st Qtr '14	TLD missing in field.	
SW	Gamma	M-008	March '14	Water frozen entire month; no composite.	
SW	H-3	M-008	March '14	Water frozen entire quarter; no composite.	
AP/AI	Beta, I-131	M-001	5/14/2014	Sampler found off; GFCI tripped.	Breaker reset.
AP	Beta	M-005	5/28/2014	Filter paper shifted in holder.	
AP/AI	Beta, I-131	M-001	8/27/2014	Sampler found off; GFCI tripped.	Breaker reset.
SW	Gamma	M-008	December '14	Water frozen entire month; no composite.	
TLD	Gamma	M-2C	4th Qtr '14	TLD missing in field.	

3.0 DATA TABLES

Table 1. Ambient gamma radiation as measured by thermoluminescent dosimeters (TLD's).

Location	mRem/91 days				Cumulative Average	Previous Annual Average
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.		
<u>Indicators (Inner Ring, General Area of Site Boundary)</u>						
M-01A	8.6 ± 1.3	14.6 ± 1.4	17.0 ± 1.3	14.6 ± 1.1	13.7	14.4
M-02A	14.7 ± 1.9	13.7 ± 0.8	14.0 ± 1.0	14.6 ± 0.8	14.2	15.7
M-03A	12.6 ± 1.6	13.1 ± 1.4	15.3 ± 1.4	12.8 ± 1.2	13.4	14.6
M-04A	8.6 ± 1.5	15.9 ± 1.3	11.3 ± 1.0	18.0 ± 1.3	13.5	14.8
M-05A	12.1 ± 0.9	11.6 ± 0.8	14.5 ± 0.6	12.2 ± 0.8	12.6	12.9
M-06A	11.9 ± 1.4	13.9 ± 0.9	16.2 ± 0.9	14.2 ± 0.9	14.0	14.5
M-07A	8.0 ± 0.9	13.4 ± 0.7	11.8 ± 0.8	13.2 ± 1.0	11.6	13.9
M-08A	10.2 ± 1.2	14.2 ± 0.8	14.4 ± 0.7	14.8 ± 0.9	13.4	14.6
M-09A	11.3 ± 0.9	11.8 ± 1.0	14.3 ± 0.7	12.1 ± 1.1	12.4	13.8
M-10A	11.6 ± 0.9	12.5 ± 1.1	14.5 ± 0.7	14.7 ± 0.9	13.4	14.6
M-11A	12.8 ± 0.9	14.4 ± 1.0	16.9 ± 1.1	13.8 ± 1.3	14.5	13.6
M-12A	12.1 ± 1.0	12.9 ± 0.8	16.0 ± 0.8	14.6 ± 0.8	13.9	13.2
M-13A	11.2 ± 1.2	17.0 ± 1.6	13.0 ± 0.9	16.8 ± 1.1	14.5	16.1
M-14A	13.0 ± 1.0	12.7 ± 0.8	15.6 ± 0.8	13.4 ± 0.9	13.7	15.1
Mean ± s.d.	11.3 ± 1.9	13.7 ± 1.5	14.6 ± 1.7	14.3 ± 1.6	13.5	14.4
<u>Indicators (Outer Ring, 4-5 Miles Distant)</u>						
M-01B	10.2 ± 1.1	12.4 ± 1.2	13.1 ± 0.9	13.2 ± 1.2	12.2	14.3
M-02B	10.5 ± 1.0	14.2 ± 1.0	13.3 ± 0.7	13.1 ± 0.8	12.8	15.0
M-03B	10.9 ± 1.3	10.6 ± 0.9	11.9 ± 0.7	11.2 ± 1.0	11.1	12.1
M-04B	10.9 ± 0.9	11.4 ± 0.8	13.4 ± 0.6	11.9 ± 0.8	11.9	13.6
M-05B	11.0 ± 0.9	12.8 ± 0.9	13.2 ± 0.7	12.5 ± 1.1	12.4	14.0
M-06B	10.2 ± 1.1	13.9 ± 1.0	14.2 ± 0.9	15.1 ± 1.1	13.3	14.7
M-07B	14.7 ± 1.1	12.0 ± 1.1	15.3 ± 0.8	12.6 ± 1.2	13.7	13.1
M-08B	12.1 ± 0.8	15.7 ± 1.4	13.5 ± 1.6	15.6 ± 1.0	14.2	15.3
M-09B	10.3 ± 0.8	14.0 ± 1.0	13.8 ± 0.6	14.0 ± 1.0	13.0	14.5
M-10B	12.6 ± 1.4	12.7 ± 1.5	16.0 ± 1.0	13.0 ± 1.1	13.6	15.8
M-11B	11.5 ± 1.1	13.3 ± 1.3	15.4 ± 0.9	13.4 ± 1.0	13.4	14.5
M-12B	12.2 ± 1.3	14.8 ± 1.0	15.3 ± 0.9	14.5 ± 0.9	14.2	14.4
M-13B	10.6 ± 1.2	11.7 ± 1.0	12.5 ± 0.8	12.2 ± 1.0	11.8	13.2
M-14B	11.4 ± 1.1	13.2 ± 0.9	15.8 ± 0.9	17.1 ± 0.9	14.4	13.8
M-15B	10.8 ± 1.0	12.4 ± 0.9	13.5 ± 0.8	11.9 ± 1.1	12.1	13.4
M-16B	10.2 ± 0.9	12.5 ± 0.9	14.6 ± 0.6	11.7 ± 1.1	12.2	13.1
Mean ± s.d.	11.3 ± 1.2	13.0 ± 1.3	14.1 ± 1.2	13.3 ± 1.6	12.9	14.0

Table 1. Ambient gamma radiation as measured by thermoluminescent dosimeters (TLD's),
(continued).

Location	mRem/91 days				Cumulative Average	Previous Annual Average
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.		
<u>Control</u>						
M-01C	10.5 ± 1.5	17.5 ± 1.5	12.9 ± 1.0	16.8 ± 1.3	14.4	16.4
M-02C	11.3 ± 1.0	13.6 ± 1.1	17.3 ± 0.9	ND ^a	14.1	14.0
M-03C	11.1 ± 0.9	16.6 ± 1.0	15.0 ± 0.6	14.6 ± 0.8	14.3	16.4
M-04C	12.0 ± 0.8	15.1 ± 1.2	15.5 ± 1.4	14.0 ± 0.9	<u>14.2</u>	<u>15.1</u>
Mean ± s.d.	11.2 ± 0.6	15.7 ± 1.7	15.2 ± 1.8	15.1 ± 1.4	14.3	15.5
<u>Indicators (Special Interest Areas)</u>						
M-01S	9.4 ± 1.1	9.3 ± 0.8	10.5 ± 0.9	12.0 ± 0.9	10.3	11.6
M-02S	13.0 ± 1.0	10.2 ± 1.3	10.5 ± 0.7	13.2 ± 0.9	11.7	13.5
M-03S	11.9 ± 1.2	14.0 ± 1.0	13.7 ± 0.7	12.5 ± 1.0	13.0	14.7
M-04S	12.0 ± 1.0	15.2 ± 0.9	17.4 ± 1.1	13.9 ± 0.9	14.6	13.4
M-05S	13.3 ± 0.9	12.8 ± 1.5	15.4 ± 0.6	14.9 ± 1.1	14.1	13.8
M-06S	14.5 ± 0.9	17.5 ± 0.9	15.3 ± 0.8	15.3 ± 1.0	<u>15.6</u>	<u>17.1</u>
Mean ± s.d.	12.3 ± 1.7	13.2 ± 3.1	13.8 ± 2.8	13.6 ± 1.3	13.2	14.0
<u>Special TLDs</u>						
M-I-01	46.5 ± 1.2	34.7 ± 1.7	35.7 ± 1.8	27.5 ± 1.6	36.1	64.1
M-I-02	30.3 ± 1.6	31.3 ± 1.0	33.1 ± 1.0	24.3 ± 0.8	29.8	43.1
M-I-03	23.8 ± 1.4	28.3 ± 1.4	28.0 ± 1.5	22.4 ± 1.0	25.6	36.3
M-I-04	31.4 ± 1.1	40.2 ± 2.3	34.4 ± 2.9	36.3 ± 2.6	35.6	31.0
M-I-05	59.0 ± 1.9	66.5 ± 2.8	72.7 ± 1.5	65.3 ± 1.9	65.9	68.0
M-I-06	25.3 ± 1.8	25.0 ± 1.1	27.5 ± 2.3	22.1 ± 0.8	25.0	24.9
M-I-07	21.6 ± 1.0	31.7 ± 1.7	28.7 ± 2.1	28.9 ± 1.4	27.7	30.5
M-I-08	ND ^a	26.1 ± 0.7	28.4 ± 2.0	25.1 ± 1.9	26.6	28.6
M-I-09	58.3 ± 2.5	174.8 ± 7.1	220.1 ± 10.0	229.0 ± 9.9	170.5	113.9
M-I-10	30.1 ± 1.0	33.2 ± 1.7	40.9 ± 0.6	28.6 ± 1.3	33.2	34.3
M-I-11	10.4 ± 1.4	17.2 ± 1.6	12.8 ± 1.2	15.2 ± 1.1	13.9	14.3
M-I-12	13.0 ± 0.8	14.7 ± 0.9	14.7 ± 0.6	13.1 ± 1.1	13.9	15.7
M-I-13	13.6 ± 2.2	13.0 ± 1.1	15.3 ± 1.4	12.2 ± 1.2	<u>13.5</u>	<u>15.8</u>
Mean ± s.d.	30.3 ± 16.5	41.3 ± 42.3	45.6 ± 54.6	42.3 ± 57.7	39.8	40.0

^a"ND" = No data, see Table 2.0, List of Missed Samples.

Table 2. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131^a.

Location: M-1 (C)

Units: pCi/m³

Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	Date Collected	Volume (m ³)	Gross Beta
<u>Required LLD</u>		<u>0.010</u>	<u>Required LLD</u>		<u>0.010</u>
01-08-14	253	0.053 ± 0.005	07-09-14	344	0.020 ± 0.003
01-15-14	288	0.044 ± 0.004	07-16-14	343	0.019 ± 0.003
01-22-14	322	0.029 ± 0.003	07-22-14	292	0.033 ± 0.004
01-29-14	352	0.019 ± 0.003	07-30-14	394	0.018 ± 0.003
02-06-14	407	0.024 ± 0.003	08-06-14	339	0.029 ± 0.003
02-12-14	303	0.026 ± 0.004	08-12-14	294	0.026 ± 0.004
02-19-14	355	0.042 ± 0.004	08-20-14	390	0.028 ± 0.003
02-26-14	354	0.042 ± 0.004	08-27-14		ND ^b
03-04-14	271	0.040 ± 0.004	09-03-14	343	0.019 ± 0.003
03-12-14	401	0.028 ± 0.003	09-10-14	313	0.025 ± 0.003
03-18-14	307	0.022 ± 0.003	09-17-14	311	0.025 ± 0.003
03-26-14	404	0.027 ± 0.003	09-24-14	311	0.042 ± 0.004
04-02-14	319	0.028 ± 0.003	10-01-14	311	0.039 ± 0.004
1st Quarter Mean ± s.d.		0.033 ± 0.010	3rd Quarter Mean ± s.d.		0.027 ± 0.008
04-09-14	319	0.024 ± 0.003	10-08-14	311	0.016 ± 0.003
04-16-14	354	0.022 ± 0.003	10-15-14	311	0.025 ± 0.003
04-23-14	318	0.025 ± 0.003	10-22-14	312	0.024 ± 0.003
04-30-14	354	0.011 ± 0.003	10-29-14	309	0.019 ± 0.003
05-06-14	394	0.005 ± 0.002	11-05-14	325	0.023 ± 0.003
05-14-14		ND ^b	11-12-14	318	0.014 ± 0.003
05-21-14	373	0.022 ± 0.003	11-19-14	321	0.026 ± 0.003
05-28-14	376	0.018 ± 0.003	11-26-14	315	0.040 ± 0.004
06-05-14	435	0.017 ± 0.003	12-03-14	325	0.049 ± 0.004
06-11-14	320	0.023 ± 0.003	12-10-14	351	0.056 ± 0.004
06-18-14	381	0.019 ± 0.003	12-17-14	323	0.055 ± 0.004
06-25-14	337	0.020 ± 0.003	12-23-14	268	0.041 ± 0.004
07-02-14	343	0.015 ± 0.003	12-31-14	369	0.031 ± 0.003
2nd Quarter Mean ± s.d.		0.018 ± 0.006	4th Quarter Mean ± s.d.		0.032 ± 0.014
Cumulative Average					0.028
Previous Annual Average					0.032

^a Iodine-131 concentrations are < 0.03 pCi/m³ unless otherwise noted.^b "ND" = No data, see Table 2.0, Listing of Missed Samples.

Table 3. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131^a.

Location: M-2

Units: pCi/m³

Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	Date Collected	Volume (m ³)	Gross Beta
<u>Required LLD</u>		<u>0.010</u>			<u>0.010</u>
01-08-14	273	0.047 ± 0.005	07-09-14	354	0.021 ± 0.003
01-15-14	327	0.036 ± 0.004	07-16-14	353	0.018 ± 0.003
01-22-14	354	0.024 ± 0.003	07-22-14	300	0.032 ± 0.004
01-29-14	313	0.025 ± 0.003	07-30-14	407	0.019 ± 0.003
02-06-14	392	0.023 ± 0.003	08-06-14	348	0.030 ± 0.003
02-12-14	292	0.030 ± 0.004	08-12-14	303	0.027 ± 0.004
02-19-14	316	0.044 ± 0.004	08-20-14	405	0.027 ± 0.003
02-26-14	288	0.033 ± 0.004	08-27-14	349	0.019 ± 0.003
			09-03-14	354	0.020 ± 0.003
03-04-14	246	0.044 ± 0.005			
03-12-14	359	0.033 ± 0.004	09-10-14	329	0.021 ± 0.003
03-18-14	249	0.023 ± 0.004	09-17-14	351	0.014 ± 0.003
03-26-14	361	0.026 ± 0.003	09-24-14	352	0.031 ± 0.003
04-02-14	289	0.023 ± 0.004	10-01-14	352	0.032 ± 0.003
1st Quarter Mean ± s.d.		0.032 ± 0.009	3rd Quarter Mean ± s.d.		0.024 ± 0.006
04-09-14	289	0.028 ± 0.004	10-08-14	326	0.015 ± 0.003
04-16-14	263	0.027 ± 0.004	10-15-14	354	0.018 ± 0.003
04-23-14	262	0.027 ± 0.004	10-22-14	352	0.017 ± 0.003
04-30-14	263	0.015 ± 0.004	10-29-14	324	0.020 ± 0.003
05-06-14	251	0.009 ± 0.003	11-05-14	357	0.020 ± 0.003
05-14-14	429	0.013 ± 0.002	11-12-14	352	0.019 ± 0.003
05-21-14	353	0.023 ± 0.003	11-19-14	352	0.028 ± 0.003
05-28-14	351	0.019 ± 0.003	11-26-14	348	0.036 ± 0.003
			12-03-14	358	0.040 ± 0.004
06-05-14	405	0.019 ± 0.003			
06-11-14	302	0.016 ± 0.003	12-10-14	351	0.053 ± 0.004
06-18-14	355	0.020 ± 0.003	12-17-14	358	0.047 ± 0.004
06-25-14	379	0.015 ± 0.002	12-23-14	294	0.034 ± 0.004
07-02-14	353	0.015 ± 0.003	12-31-14	376	0.034 ± 0.003
2nd Quarter Mean ± s.d.		0.019 ± 0.006	4th Quarter Mean ± s.d.		0.029 ± 0.012
			Cumulative Average		0.026
			Previous Annual Average		0.028

^a Iodine-131 concentrations are < 0.03 pCi/m³ unless otherwise noted.

Table 4. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131^a.

Location: M-3

Units: pCi/m³

Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	Date Collected	Volume (m ³)	Gross Beta
<u>Required LLD</u>		<u>0.010</u>			<u>0.010</u>
01-08-14	304	0.043 ± 0.004	07-09-14	345	0.020 ± 0.003
01-15-14	325	0.033 ± 0.004	07-16-14	345	0.022 ± 0.003
01-22-14	359	0.028 ± 0.003	07-22-14	293	0.038 ± 0.004
01-29-14	350	0.022 ± 0.003	07-30-14	438	0.018 ± 0.002
02-06-14	472	0.023 ± 0.003	08-06-14	348	0.031 ± 0.003
02-12-14	270	0.032 ± 0.004	08-12-14	303	0.027 ± 0.004
02-19-14	299	0.045 ± 0.004	08-20-14	405	0.029 ± 0.003
02-26-14	271	0.053 ± 0.005	08-27-14	350	0.009 ± 0.002 ^b
			09-03-14	354	0.020 ± 0.003
03-04-14	254	0.043 ± 0.005			
03-12-14	370	0.037 ± 0.004	09-10-14	329	0.024 ± 0.003
03-18-14	276	0.022 ± 0.004	09-17-14	350	0.016 ± 0.003
03-26-14	376	0.031 ± 0.003	09-24-14	352	0.031 ± 0.003
04-02-14	299	0.029 ± 0.004	10-01-14	353	0.032 ± 0.003
1st Quarter Mean ± s.d.		0.034 ± 0.010	3rd Quarter Mean ± s.d.		0.024 ± 0.008
04-09-14	325	0.027 ± 0.003	10-08-14	326	0.016 ± 0.003
04-16-14	296	0.021 ± 0.003	10-15-14	354	0.021 ± 0.003
04-23-14	299	0.027 ± 0.004	10-22-14	352	0.021 ± 0.003
04-30-14	325	0.012 ± 0.003	10-29-14	325	0.021 ± 0.003
05-06-14	283	0.011 ± 0.003	11-05-14	354	0.022 ± 0.003
05-14-14	388	0.014 ± 0.003	11-12-14	355	0.018 ± 0.003
05-21-14	344	0.023 ± 0.003	11-19-14	353	0.030 ± 0.003
05-28-14	342	0.020 ± 0.003	11-26-14	375	0.034 ± 0.003
			12-03-14	358	0.040 ± 0.004
06-05-14	395	0.021 ± 0.003			
06-11-14	294	0.021 ± 0.004	12-10-14	351	0.061 ± 0.004
06-18-14	371	0.018 ± 0.003	12-17-14	358	0.047 ± 0.004
06-25-14	368	0.017 ± 0.003	12-23-14	294	0.036 ± 0.004
07-02-14	344	0.016 ± 0.003	12-31-14	376	0.036 ± 0.003
2nd Quarter Mean ± s.d.		0.019 ± 0.005	4th Quarter Mean ± s.d.		0.031 ± 0.013
			Cumulative Average		0.027
			Previous Annual Average		0.027

^a Iodine-131 concentrations are < 0.03 pCi/m³ unless otherwise noted.^b Filter light.

Table 5. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131^a.

Location: M-4

Units: pCi/m³

Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	Date Collected	Volume (m ³)	Gross Beta
<u>Required LLD</u>		<u>0.010</u>			<u>0.010</u>
01-08-14	279	0.045 ± 0.004	07-09-14	353	0.021 ± 0.003
01-15-14	325	0.035 ± 0.004	07-16-14	352	0.019 ± 0.003
01-22-14	353	0.027 ± 0.003	07-22-14	300	0.031 ± 0.004
01-29-14	325	0.024 ± 0.003	07-30-14	407	0.006 ± 0.002
02-06-14	421	0.024 ± 0.003	08-06-14	348	0.032 ± 0.004
02-12-14	316	0.030 ± 0.004	08-12-14	303	0.024 ± 0.004
02-19-14	369	0.041 ± 0.004	08-20-14	406	0.030 ± 0.003
02-26-14	328	0.051 ± 0.004	08-27-14	350	0.018 ± 0.003
03-04-14	291	0.040 ± 0.004	09-03-14	354	0.021 ± 0.003
03-12-14	388	0.040 ± 0.004	09-10-14	328	0.026 ± 0.003
03-18-14	295	0.026 ± 0.004	09-17-14	351	0.017 ± 0.003
03-26-14	417	0.029 ± 0.003	09-24-14	352	0.033 ± 0.003
04-02-14	368	0.027 ± 0.003	10-01-14	352	0.032 ± 0.003
1st Quarter Mean ± s.d.		<u>0.034 ± 0.009</u>	3rd Quarter Mean ± s.d.		<u>0.024 ± 0.008</u>
04-09-14	341	0.026 ± 0.003	10-08-14	326	0.015 ± 0.003
04-16-14	369	0.022 ± 0.003	10-15-14	353	0.019 ± 0.003
04-23-14	341	0.028 ± 0.003	10-22-14	355	0.019 ± 0.003
04-30-14	342	0.010 ± 0.003	10-29-14	324	0.018 ± 0.003
05-06-14	318	0.011 ± 0.003	11-05-14	355	0.021 ± 0.003
05-14-14	398	0.012 ± 0.002	11-12-14	354	0.018 ± 0.003
05-21-14	352	0.021 ± 0.003	11-19-14	354	0.028 ± 0.003
05-28-14	351	0.018 ± 0.003	11-26-14	347	0.034 ± 0.003
06-05-14	374	0.020 ± 0.003	12-03-14	358	0.038 ± 0.004
06-11-14	300	0.018 ± 0.003	12-10-14	351	0.053 ± 0.004
06-18-14	359	0.016 ± 0.003	12-17-14	385	0.043 ± 0.004
06-25-14	346	0.014 ± 0.003	12-23-14	294	0.032 ± 0.004
07-02-14	352	0.014 ± 0.003	12-31-14	375	0.030 ± 0.003
2nd Quarter Mean ± s.d.		<u>0.018 ± 0.006</u>	4th Quarter Mean ± s.d.		<u>0.029 ± 0.012</u>
Cumulative Average					0.026
Previous Annual Average					0.028

^a Iodine-131 concentrations are < 0.03 pCi/m³ unless otherwise noted.

Table 6. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131^a.

Location: M-5

Units: pCi/m³

Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	Date Collected	Volume (m ³)	Gross Beta
<u>Required LLD</u>		<u>0.010</u>			<u>0.010</u>
01-08-14	279	0.047 ± 0.005	07-09-14	389	0.021 ± 0.003
01-15-14	296	0.039 ± 0.004	07-16-14	358	0.024 ± 0.003
01-22-14	324	0.033 ± 0.004	07-22-14	310	0.035 ± 0.004
01-29-14	292	0.023 ± 0.004	07-30-14	407	0.020 ± 0.003
02-06-14	371	0.028 ± 0.003	08-06-14	348	0.029 ± 0.003
02-12-14	303	0.029 ± 0.004	08-12-14	303	0.022 ± 0.003
02-19-14	295	0.054 ± 0.005	08-20-14	402	0.026 ± 0.003
02-26-14	294	0.052 ± 0.005	08-27-14	354	0.018 ± 0.003
			09-03-14	354	0.022 ± 0.003
03-04-14	275	0.044 ± 0.004			
03-12-14	334	0.038 ± 0.004	09-10-14	298	0.025 ± 0.004
03-18-14	254	0.030 ± 0.004	09-17-14	321	0.016 ± 0.004
03-26-14	336	0.031 ± 0.003	09-24-14	323	0.034 ± 0.004
04-02-14	324	0.028 ± 0.003	10-01-14	294	0.037 ± 0.004
1st Quarter Mean ± s.d.		0.036 ± 0.010	3rd Quarter Mean ± s.d.		0.025 ± 0.007
04-09-14	294	0.028 ± 0.004	10-08-14	294	0.016 ± 0.003
04-16-14	295	0.025 ± 0.004	10-15-14	296	0.026 ± 0.003
04-23-14	294	0.024 ± 0.003	10-22-14	295	0.023 ± 0.003
04-30-14	294	0.015 ± 0.003	10-29-14	292	0.022 ± 0.003
05-06-14	253	0.011 ± 0.003	11-05-14	329	0.019 ± 0.003
05-14-14	441	0.014 ± 0.002	11-12-14	322	0.016 ± 0.003
05-21-14	388	0.021 ± 0.003	11-19-14	296	0.033 ± 0.004
05-28-14		ND ^b	11-26-14	318	0.038 ± 0.004
			12-03-14	328	0.048 ± 0.003
06-05-14	412	0.019 ± 0.003			
06-11-14	332	0.020 ± 0.003	12-10-14	352	0.059 ± 0.004
06-18-14	396	0.022 ± 0.003	12-17-14	328	0.055 ± 0.004
06-25-14	382	0.018 ± 0.003	12-23-14	294	0.037 ± 0.004
07-02-14	388	0.017 ± 0.003	12-31-14	339	0.038 ± 0.004
2nd Quarter Mean ± s.d.		0.019 ± 0.005	4th Quarter Mean ± s.d.		0.033 ± 0.014
			Cumulative Average		0.029
			Previous Annual Average		0.031

^a Iodine-131 concentrations are < 0.03 pCi/m³ unless otherwise noted.^b "ND" = No data, see Table 2.0, Listing of Missed Samples.

Table 7. Airborne particulate data, gross beta analyses, monthly averages, minima and maxima.

January			
Location	Average	Minima	Maxima
Control	0.036	0.019	0.053
M-1	0.036	0.019	0.053
Indicators	0.033	0.022	0.047
M-2	0.033	0.024	0.047
M-3	0.031	0.022	0.043
M-4	0.033	0.024	0.045
M-5	0.035	0.023	0.047

April			
Location	Average	Minima	Maxima
Control	0.020	0.011	0.025
M-1	0.020	0.011	0.025
Indicators	0.023	0.010	0.028
M-2	0.024	0.015	0.028
M-3	0.022	0.012	0.027
M-4	0.022	0.010	0.028
M-5	0.023	0.015	0.028

February			
Location	Average	Minima	Maxima
Control	0.034	0.024	0.042
M-1	0.034	0.024	0.042
Indicators	0.037	0.023	0.054
M-2	0.033	0.023	0.044
M-3	0.038	0.023	0.053
M-4	0.036	0.024	0.051
M-5	0.041	0.028	0.054

May			
Location	Average	Minima	Maxima
Control	0.015	0.005	0.022
M-1	0.015	0.005	0.022
Indicators	0.016	0.009	0.023
M-2	0.016	0.009	0.023
M-3	0.017	0.011	0.023
M-4	0.015	0.011	0.021
M-5	0.015	0.011	0.021

March			
Location	Average	Minima	Maxima
Control	0.029	0.022	0.040
M-1	0.029	0.022	0.040
Indicators	0.032	0.022	0.044
M-2	0.030	0.023	0.044
M-3	0.032	0.022	0.043
M-4	0.032	0.026	0.040
M-5	0.034	0.028	0.044

June			
Location	Average	Minima	Maxima
Control	0.019	0.015	0.023
M-1	0.019	0.015	0.023
Indicators	0.018	0.014	0.022
M-2	0.017	0.015	0.020
M-3	0.019	0.016	0.021
M-4	0.016	0.014	0.020
M-5	0.019	0.017	0.022

Note: unless otherwise specified, samples collected on the first, second or third day of the month are grouped with data of the previous month.

Table 7. Airborne particulate data, gross beta analyses, monthly averages, minima and maxima.

July			
Location	Average	Minima	Maxima
Control	0.022	0.018	0.033
M-1	0.022	0.018	0.033
Indicators	0.023	0.006	0.038
M-2	0.023	0.018	0.032
M-3	0.025	0.018	0.038
M-4	0.019	0.006	0.031
M-5	0.025	0.020	0.033

October			
Location	Average	Minima	Maxima
Control	0.021	0.016	0.025
M-1	0.021	0.016	0.025
Indicators	0.019	0.015	0.026
M-2	0.018	0.015	0.020
M-3	0.020	0.016	0.021
M-4	0.018	0.015	0.019
M-5	0.022	0.016	0.026

August			
Location	Average	Minima	Maxima
Control			
M-1	0.024	0.019	0.028
Indicators	0.022	0.009	0.030
M-2	0.023	0.019	0.027
M-3	0.021	0.009	0.029
M-4	0.023	0.018	0.030
M-5	0.022	0.018	0.026

November			
Location	Average	Minima	Maxima
Control	0.030	0.014	0.049
M-1	0.030	0.014	0.049
Indicators	0.029	0.016	0.048
M-2	0.029	0.019	0.040
M-3	0.029	0.018	0.040
M-4	0.028	0.018	0.038
M-5	0.031	0.016	0.048

September			
Location	Average	Minima	Maxima
Control			
M-1	0.033	0.025	0.042
Indicators	0.026	0.014	0.037
M-2	0.025	0.014	0.032
M-3	0.026	0.016	0.032
M-4	0.027	0.017	0.033
M-5	0.028	0.016	0.037

December			
Location	Average	Minima	Maxima
Control	0.046	0.031	0.056
M-1	0.046	0.031	0.056
Indicators	0.043	0.030	0.061
M-2	0.041	0.034	0.053
M-3	0.045	0.036	0.061
M-4	0.040	0.030	0.053
M-5	0.047	0.037	0.059

Note: unless otherwise specified, samples collected on the first, second or third day of the month are grouped with data of the previous month.

Table 8. Airborne particulates, quarterly composites from each location, analysis for gamma-emitting isotopes.

	Activity (pCi/m ³)				Cumulative Average	Previous Average
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.		
M-1 (C)						
Lab Code	MAP- 1686	MAP- 3703	MAP- 5978	MAP- 7455		
Volume(m ³)	4335	4381	4061	4159		
Be-7	0.073 ± 0.014	0.073 ± 0.011	0.082 ± 0.017	0.045 ± 0.012	0.068	0.067
Mn-54	< 0.0008	< 0.0005	< 0.0008	< 0.0006	<0.0008	<0.0009
Co-58	< 0.0010	< 0.0005	< 0.0006	< 0.0008	<0.0010	<0.0006
Co-60	< 0.0006	< 0.0006	< 0.0004	< 0.0007	<0.0006	<0.0007
Zn-65	< 0.0011	< 0.0005	< 0.0007	< 0.0009	<0.0011	<0.0015
Zr-Nb-95	< 0.0009	< 0.0008	< 0.0015	< 0.0007	<0.0015	<0.0012
Ru-103	< 0.0007	< 0.0008	< 0.0006	< 0.0006	<0.0008	<0.0007
Ru-106	< 0.0063	< 0.0048	< 0.0041	< 0.0073	<0.0063	<0.0091
Cs-134	< 0.0011	< 0.0006	< 0.0008	< 0.0009	<0.0011	<0.0008
Cs-137	< 0.0006	< 0.0005	< 0.0007	< 0.0009	<0.0007	<0.0010
Ba-La-140	< 0.0016	< 0.0019	< 0.0021	< 0.0034	<0.0021	<0.0022
Ce-141	< 0.0014	< 0.0009	< 0.0016	< 0.0018	<0.0016	<0.0016
Ce-144	< 0.0042	< 0.0031	< 0.0046	< 0.0050	<0.0046	<0.0050
M-2						
Lab Code	MAP- 1687	MAP- 3704	MAP- 5979	MAP- 7456		
Volume(m ³)	4059	4254	4557	4503		
Be-7	0.058 ± 0.013	0.078 ± 0.016	0.076 ± 0.013	0.045 ± 0.010	0.064	0.062
Mn-54	< 0.0004	< 0.0008	< 0.0003	< 0.0004	<0.0008	<0.0008
Co-58	< 0.0004	< 0.0010	< 0.0006	< 0.0005	<0.0010	<0.0007
Co-60	< 0.0006	< 0.0008	< 0.0005	< 0.0003	<0.0008	<0.0008
Zn-65	< 0.0015	< 0.0009	< 0.0010	< 0.0011	<0.0015	<0.0009
Zr-Nb-95	< 0.0010	< 0.0010	< 0.0010	< 0.0007	<0.0010	<0.0011
Ru-103	< 0.0008	< 0.0014	< 0.0010	< 0.0005	<0.0014	<0.0008
Ru-106	< 0.0053	< 0.0071	< 0.0077	< 0.0053	<0.0077	<0.0061
Cs-134	< 0.0007	< 0.0010	< 0.0008	< 0.0007	<0.0010	<0.0007
Cs-137	< 0.0006	< 0.0007	< 0.0008	< 0.0005	<0.0008	<0.0006
Ba-La-140	< 0.0011	< 0.0017	< 0.0042	< 0.0009	<0.0042	<0.0020
Ce-141	< 0.0013	< 0.0015	< 0.0014	< 0.0012	<0.0015	<0.0014
Ce-144	< 0.0033	< 0.0037	< 0.0040	< 0.0042	<0.0040	<0.0041

Table 10. River water, analysis of monthly composites for gamma-emitting isotopes.

Location: M-8 (C)

Collection: Weekly

Sample Description and Concentration (pCi/L)					
Period Collected	January	February	March	April ^b	May
Lab Code	NS ^a	NS ^a	NS ^a	MSW-2102	MSW-2712
Mn-54	-	-	-	< 10	< 10
Fe-59	-	-	-	< 30	< 30
Co-58	-	-	-	< 10	< 10
Co-60	-	-	-	< 10	< 10
Zn-65	-	-	-	< 30	< 30
Zr-Nb-95	-	-	-	< 15	< 15
Cs-134	-	-	-	< 10	< 10
Cs-137	-	-	-	< 10	< 10
Ba-La-140	-	-	-	< 15	< 15
Ce-144	-	-	-	< 17	< 30
Period Collected	June	July	August	September	October
Lab Code	MSW-3375	MSW-4305	MSW-4701	MSW-5802	MSW-6594
Mn-54	< 10	< 10	< 10	< 10	< 10
Fe-59	< 30	< 30	< 30	< 30	< 30
Co-58	< 10	< 10	< 10	< 10	< 10
Co-60	< 10	< 10	< 10	< 10	< 10
Zn-65	< 30	< 30	< 30	< 30	< 30
Zr-Nb-95	< 15	< 15	< 15	< 15	< 15
Cs-134	< 10	< 10	< 10	< 10	< 10
Cs-137	< 10	< 10	< 10	< 10	< 10
Ba-La-140	< 15	< 15	< 15	< 15	< 15
Ce-144	< 22	< 23	< 28	< 15	< 24
Period Collected	November ^c	December		Cumulative	Previous
Lab Code	MSW-6806	NS ^a		Average	Annual
					Average
Mn-54	< 10	-		< 10	< 10
Fe-59	< 30	-		< 30	< 30
Co-58	< 10	-		< 10	< 10
Co-60	< 10	-		< 10	< 10
Zn-65	< 30	-		< 30	< 30
Zr-Nb-95	< 15	-		< 15	< 15
Cs-134	< 10	-		< 10	< 10
Cs-137	< 10	-		< 10	< 10
Ba-La-140	< 15	-		< 15	< 15
Ce-144	< 22	-		< 30	< 26

^a "NS" = No sample; see Table 2.0, Listing of Missed Samples.^b Composite of four samples for month; water frozen on 04-02-14.^c Composite of two samples for month; water frozen on 11-19-14 and 11-26-14.

Table 8. Airborne particulates, quarterly composites from each location, analysis for gamma-emitting isotopes.

	Activity (pCi/m ³)				Cumulative Average	Previous Average
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.		
M-3						
Lab Code	MAP- 1688	MAP- 3705	MAP- 5980	MAP- 7457		
Volume(m ³)	4225	4372	4564	4529		
Be-7	0.065 ± 0.010	0.078 ± 0.015	0.075 ± 0.013	0.042 ± 0.010	0.065	0.059
Mn-54	< 0.0004	< 0.0009	< 0.0008	< 0.0006	<0.0009	<0.0007
Co-58	< 0.0005	< 0.0008	< 0.0007	< 0.0006	<0.0008	<0.0006
Co-60	< 0.0004	< 0.0006	< 0.0007	< 0.0005	<0.0007	<0.0005
Zn-65	< 0.0007	< 0.0009	< 0.0005	< 0.0004	<0.0009	<0.0013
Zr-Nb-95	< 0.0006	< 0.0006	< 0.0008	< 0.0004	<0.0008	<0.0011
Ru-103	< 0.0008	< 0.0011	< 0.0011	< 0.0005	<0.0011	<0.0008
Ru-106	< 0.0038	< 0.0057	< 0.0068	< 0.0051	<0.0068	<0.0057
Cs-134	< 0.0005	< 0.0007	< 0.0009	< 0.0006	<0.0009	0.0013
Cs-137	< 0.0004	< 0.0006	< 0.0006	< 0.0005	<0.0006	0.0014
Ba-La-140	< 0.0016	< 0.0015	< 0.0015	< 0.0009	<0.0016	<0.0019
Ce-141	< 0.0012	< 0.0016	< 0.0018	< 0.0009	<0.0018	<0.0018
Ce-144	< 0.0027	< 0.0055	< 0.0052	< 0.0019	<0.0055	<0.0038
M-4						
Lab Code	MAP- 1689	MAP- 3706	MAP- 5981	MAP- 7458		
Volume(m ³)	4474	4541	4555	4530		
Be-7	0.060 ± 0.012	0.071 ± 0.011	0.064 ± 0.012	0.037 ± 0.008	0.058	0.063
Mn-54	< 0.0008	< 0.0004	< 0.0005	< 0.0006	<0.0008	<0.0007
Co-58	< 0.0009	< 0.0008	< 0.0011	< 0.0005	<0.0011	<0.0005
Co-60	< 0.0004	< 0.0004	< 0.0008	< 0.0006	<0.0008	<0.0004
Zn-65	< 0.0006	< 0.0005	< 0.0009	< 0.0010	<0.0009	<0.0006
Zr-Nb-95	< 0.0005	< 0.0007	< 0.0010	< 0.0005	<0.0010	<0.0007
Ru-103	< 0.0004	< 0.0006	< 0.0009	< 0.0007	<0.0009	<0.0007
Ru-106	< 0.0039	< 0.0046	< 0.0060	< 0.0049	<0.0060	<0.0066
Cs-134	< 0.0008	< 0.0007	< 0.0007	< 0.0006	<0.0008	<0.0006
Cs-137	< 0.0003	< 0.0008	< 0.0010	< 0.0004	<0.0010	<0.0005
Ba-La-140	< 0.0017	< 0.0020	< 0.0030	< 0.0013	<0.0030	<0.0019
Ce-141	< 0.0017	< 0.0015	< 0.0012	< 0.0013	<0.0017	<0.0012
Ce-144	< 0.0035	< 0.0035	< 0.0030	< 0.0022	<0.0035	<0.0034

Table 8. Airborne particulates, quarterly composites from each location, analysis for gamma-emitting isotopes.

Activity (pCi/m ³)						
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Cumulative Average	Previous Average
M-5						
Lab Code	MAP- 1690	MAP- 3707	MAP- 5982	MAP- 7459		
Volume(m ³)	3975	4527	4460	4083		
Be-7	0.072 ± 0.014	0.078 ± 0.012	0.081 ± 0.015	0.057 ± 0.012	0.072	0.072
Mn-54	< 0.0008	< 0.0005	< 0.0009	< 0.0005	<0.0009	<0.0011
Co-58	< 0.0006	< 0.0005	< 0.0005	< 0.0008	<0.0006	<0.0009
Co-60	< 0.0004	< 0.0005	< 0.0006	< 0.0005	<0.0006	<0.0007
Zn-65	< 0.0007	< 0.0006	< 0.0008	< 0.0011	<0.0008	<0.0012
Zr-Nb-95	< 0.0010	< 0.0005	< 0.0011	< 0.0006	<0.0011	<0.0010
Ru-103	< 0.0007	< 0.0010	< 0.0011	< 0.0008	<0.0011	<0.0012
Ru-106	< 0.0065	< 0.0050	< 0.0055	< 0.0043	<0.0065	<0.0056
Cs-134	< 0.0008	< 0.0007	< 0.0008	< 0.0007	<0.0008	<0.0006
Cs-137	< 0.0007	< 0.0005	< 0.0007	< 0.0009	<0.0007	<0.0006
Ba-La-140	< 0.0019	< 0.0014	< 0.0016	< 0.0012	<0.0019	<0.0018
Ce-141	< 0.0023	< 0.0013	< 0.0017	< 0.0013	<0.0023	<0.0019
Ce-144	< 0.0039	< 0.0031	< 0.0047	< 0.0029	<0.0047	<0.0048

Table 9. Pasture grass, vegetation, analysis for gamma-emitting isotopes.
Collection: 3x per year

Sample Description and Concentration (pCi/g wet)				Annual Average	Previous Annual Average
Location: M-41 (Training Center)					
Date Collected	07-09-14	08-12-14	09-10-14		
Lab Code	MVE- 3263	MVE- 4169	MVE- 4800		
Mn-54	< 0.009	< 0.006	< 0.010	< 0.010	< 0.010
Fe-59	< 0.031	< 0.023	< 0.024	< 0.031	< 0.026
Co-58	< 0.008	< 0.009	< 0.007	< 0.009	< 0.011
Co-60	< 0.009	< 0.005	< 0.008	< 0.009	< 0.011
Zn-65	< 0.024	< 0.010	< 0.018	< 0.024	< 0.026
Nb-95	< 0.011	< 0.008	< 0.008	< 0.011	< 0.019
I-131	< 0.019	< 0.026	< 0.038	< 0.038	< 0.034
Cs-134	< 0.011	< 0.009	< 0.011	< 0.011	< 0.011
Cs-137	< 0.011	< 0.009	< 0.008	< 0.011	< 0.017
Location: M-42 (Biology Station Road)					
Date Collected	07-09-14	08-12-14	09-10-14		
Lab Code	MVE- 3264	MVE- 4170	MVE- 4801		
Mn-54	< 0.008	< 0.006	< 0.005	< 0.008	< 0.014
Fe-59	< 0.020	< 0.022	< 0.018	< 0.022	< 0.022
Co-58	< 0.008	< 0.006	< 0.008	< 0.008	< 0.013
Co-60	< 0.008	< 0.007	< 0.006	< 0.008	< 0.014
Zn-65	< 0.024	< 0.009	< 0.009	< 0.024	< 0.031
Nb-95	< 0.012	< 0.006	< 0.007	< 0.012	< 0.017
I-131	< 0.023	< 0.024	< 0.030	< 0.030	< 0.034
Cs-134	< 0.011	< 0.009	< 0.009	< 0.011	< 0.016
Cs-137	< 0.008	< 0.010	< 0.008	< 0.010	< 0.017
Location: M-43 (Imholte Farm, Control)					
Date Collected	07-09-14	08-12-14	09-10-14		
Lab Code	MVE- 3265	MVE- 4171	MVE- 4802		
Mn-54	< 0.010	< 0.012	< 0.010	< 0.012	< 0.016
Fe-59	< 0.013	< 0.020	< 0.030	< 0.030	< 0.018
Co-58	< 0.009	< 0.009	< 0.013	< 0.013	< 0.014
Co-60	< 0.006	< 0.014	< 0.010	< 0.014	< 0.011
Zn-65	< 0.013	< 0.014	< 0.029	< 0.029	< 0.022
Nb-95	< 0.007	< 0.015	< 0.013	< 0.015	< 0.015
I-131	< 0.018	< 0.023	< 0.037	< 0.037	< 0.031
Cs-134	< 0.010	< 0.014	< 0.010	< 0.014	< 0.016
Cs-137	< 0.008	< 0.013	< 0.011	< 0.013	< 0.016

Table 10. River water, analysis of monthly composites for gamma-emitting isotopes.

Location: M-8 (C)

Collection: Weekly

Sample Description and Concentration (pCi/L)					
Period Collected	January	February	March	April ^b	May
Lab Code	NS ^a	NS ^a	NS ^a	MSW-2102	MSW-2712
Mn-54	-	-	-	< 10	< 10
Fe-59	-	-	-	< 30	< 30
Co-58	-	-	-	< 10	< 10
Co-60	-	-	-	< 10	< 10
Zn-65	-	-	-	< 30	< 30
Zr-Nb-95	-	-	-	< 15	< 15
Cs-134	-	-	-	< 10	< 10
Cs-137	-	-	-	< 10	< 10
Ba-La-140	-	-	-	< 15	< 15
Ce-144	-	-	-	< 17	< 30
Period Collected	June	July	August	September	October
Lab Code	MSW-3375	MSW-4305	MSW-4701	MSW-5802	MSW-6594
Mn-54	< 10	< 10	< 10	< 10	< 10
Fe-59	< 30	< 30	< 30	< 30	< 30
Co-58	< 10	< 10	< 10	< 10	< 10
Co-60	< 10	< 10	< 10	< 10	< 10
Zn-65	< 30	< 30	< 30	< 30	< 30
Zr-Nb-95	< 15	< 15	< 15	< 15	< 15
Cs-134	< 10	< 10	< 10	< 10	< 10
Cs-137	< 10	< 10	< 10	< 10	< 10
Ba-La-140	< 15	< 15	< 15	< 15	< 15
Ce-144	< 22	< 23	< 28	< 15	< 24
Period Collected	November ^c	December		Cumulative	Previous
Lab Code	MSW-6806	NS ^a		Average	Annual
					Average
Mn-54	< 10	-		< 10	< 10
Fe-59	< 30	-		< 30	< 30
Co-58	< 10	-		< 10	< 10
Co-60	< 10	-		< 10	< 10
Zn-65	< 30	-		< 30	< 30
Zr-Nb-95	< 15	-		< 15	< 15
Cs-134	< 10	-		< 10	< 10
Cs-137	< 10	-		< 10	< 10
Ba-La-140	< 15	-		< 15	< 15
Ce-144	< 22	-		< 30	< 26

^a"NS" = No sample; see Table 2.0, Listing of Missed Samples.^b Composite of four samples for month; water frozen on 04-02-14.^c Composite of two samples for month; water frozen on 11-19-14 and 11-26-14.

Table 10. River water, analysis of monthly composites for gamma-emitting isotopes.

Location: M-9

Collection: Weekly

Sample Description and Concentration (pCi/L)					
Period Collected	January ^a	February	March ^c	April	May
Lab Code	MSW-485	NS ^b	MSW-1451	MSW-2103	MSW-2714
Mn-54	< 10	-	< 10	< 10	< 10
Fe-59	< 30	-	< 30	< 30	< 30
Co-58	< 10	-	< 10	< 10	< 10
Co-60	< 10	-	< 10	< 10	< 10
Zn-65	< 30	-	< 30	< 30	< 30
Zr-Nb-95	< 15	-	< 15	< 15	< 15
Cs-134	< 10	-	< 10	< 10	< 10
Cs-137	< 10	-	< 10	< 10	< 10
Ba-La-140	< 15	-	< 15	< 15	< 15
Ce-144	< 12	-	< 25	< 13	< 26
Period Collected	June	July	August	September	October
Lab Code	MSW-3376	MSW-4306	MSW-4702	MSW-5803	MSW-6595
Mn-54	< 10	< 10	< 10	< 10	< 10
Fe-59	< 30	< 30	< 30	< 30	< 30
Co-58	< 10	< 10	< 10	< 10	< 10
Co-60	< 10	< 10	< 10	< 10	< 10
Zn-65	< 30	< 30	< 30	< 30	< 30
Zr-Nb-95	< 15	< 15	< 15	< 15	< 15
Cs-134	< 10	< 10	< 10	< 10	< 10
Cs-137	< 10	< 10	< 10	< 10	< 10
Ba-La-140	< 15	< 15	< 15	< 15	< 15
Ce-144	< 22	< 18	< 24	< 12	< 16
Period Collected	November	December	Cumulative		Previous Annual
Lab Code	MSW-6807	MSW-7398	Average		Average
Mn-54	< 10	< 10	< 10		< 10
Fe-59	< 30	< 30	< 30		< 30
Co-58	< 10	< 10	< 10		< 10
Co-60	< 10	< 10	< 10		< 10
Zn-65	< 30	< 30	< 30		< 30
Zr-Nb-95	< 15	< 15	< 15		< 15
Cs-134	< 10	< 10	< 10		< 10
Cs-137	< 10	< 10	< 10		< 10
Ba-La-140	< 15	< 15	< 15		< 15
Ce-144	< 33	< 26	< 33		< 29

^a Composite of two samples for month; water frozen on 01-22-14 and 01-29-14.^b "NS" = No sample; see Table 2.0, Listing of Missed Samples.^c Composite of three samples for month; water frozen 03-04-14.

Table 11. Drinking water, City of Minneapolis, M-14, analysis of monthly composites for gross beta, iodine-131, and gamma-emitting isotopes.
Collection: Weekly

Sample Description and Concentration (pCi/L)					
Period Collected	January	February	March	April	May
Lab Code	MDW-406	MDW-875	MDW-1452	MDW-2023	MDW-2598
Gross beta	2.2 ± 1.0	3.4 ± 1.9	3.4 ± 0.8	3.6 ± 1.8	3.5 ± 0.7
I-131	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Mn-54	< 10	< 10	< 10	< 10	< 10
Fe-59	< 30	< 30	< 30	< 30	< 30
Co-58	< 10	< 10	< 10	< 10	< 10
Co-60	< 10	< 10	< 10	< 10	< 10
Zn-65	< 30	< 30	< 30	< 30	< 30
Zr-Nb-95	< 15	< 15	< 15	< 15	< 15
Cs-134	< 10	< 10	< 10	< 10	< 10
Cs-137	< 10	< 10	< 10	< 10	< 10
Ba-La-140	< 15	< 15	< 15	< 15	< 15
Ce-144	< 20	< 19	< 19	< 16	< 26
Period Collected	June	July	August	September	October
Lab Code	MDW-3288	MDW-4046	MDW-4703	MDW-5303	MDW-6360
Gross beta	2.5 ± 1.0	< 0.9	< 1.7	2.3 ± 0.7	3.5 ± 1.1
I-131	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Mn-54	< 10	< 10	< 10	< 10	< 10
Fe-59	< 30	< 30	< 30	< 30	< 30
Co-58	< 10	< 10	< 10	< 10	< 10
Co-60	< 10	< 10	< 10	< 10	< 10
Zn-65	< 30	< 30	< 30	< 30	< 30
Zr-Nb-95	< 15	< 15	< 15	< 15	< 15
Cs-134	< 10	< 10	< 10	< 10	< 10
Cs-137	< 10	< 10	< 10	< 10	< 10
Ba-La-140	< 15	< 15	< 15	< 15	< 15
Ce-144	< 42	< 19	< 15	< 26	< 46
Period Collected	November	December		Cumulative	Previous
Lab Code	MDW-6918	MDW-7289		Average	Average
Gross beta	< 0.9	1.2 ± 0.3		2.8	2.2
I-131	< 1.0	< 1.0		< 1.0	< 1.0
Mn-54	< 10	< 10		< 10	< 10
Fe-59	< 30	< 30		< 30	< 30
Co-58	< 10	< 10		< 10	< 10
Co-60	< 10	< 10		< 10	< 10
Zn-65	< 30	< 30		< 30	< 30
Zr-Nb-95	< 15	< 15		< 15	< 15
Cs-134	< 10	< 10		< 10	< 10
Cs-137	< 10	< 10		< 10	< 10
Ba-La-140	< 15	< 15		< 15	< 15
Ce-144	< 19	< 24		< 46	< 51

Table 12. River water and drinking water, analysis of quarterly composites for tritium.
Collection: Quarterly composites of weekly collections.

Sample Type, Location and Collection Period	Lab Code	Concentration (pCi/L)	
		H-3	
<u>River Water Upstream, M-8 (C)</u>			
1st Quarter	ND ^a		
2nd Quarter	MSW - 3325	< 500	< 137
3rd Quarter	MSW - 5140	< 500	< 149
4th Quarter	MSW - 7401	< 500	< 180
Cumulative Average		< 500	< 165
Previous Annual Average		< 500	< 153
<u>River Water Downstream, M-9</u>			
1st Quarter	MSW - 1453	< 500	< 143
2nd Quarter	MSW - 3326	< 500	< 137
3rd Quarter	MSW - 5141	< 500	< 149
4th Quarter	MSW - 7402	< 500	< 179
Cumulative Average		< 500	< 157
Previous Annual Average		< 500	< 160
<u>Drinking Water Minneapolis, M-14</u>			
1st Quarter	MDW - 1454	< 500	< 143
2nd Quarter	MDW - 3327	< 500	< 137
3rd Quarter	MDW - 5809	< 500	< 151
4th Quarter	MDW - 7288	< 500	< 177
Cumulative Average		< 500	< 157
Previous Annual Average		< 500	< 160

^a"ND" = No data; see Table 2.0, Listing of Missed Samples.

Table 13. Well water, analysis for tritium and gamma-emitting isotopes.

Sample Description and Concentration (pCi/L)												
Date Collected	Lab Code	H-3 (< 500 pCi/L)	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Zr-Nb-95	Cs-134	Cs-137	Ba-La-140	Ce-144
<u>Monticello (M-11)</u>												
1/15/2014	MWW-212	< 142	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 22
4/18/2014	MWW-1602	< 146	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 36
7/16/2014	MWW-3528	< 137	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 36
10/17/2014	MWW-5840	< 150	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 15
Cumulative Averages		< 500	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 36
<u>Plant Well No. 1 (M-12)</u>												
1/15/2014	MWW-213	< 142	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 20
4/18/2014	MWW-1603	< 146	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 23
7/16/2014	MWW-3529	< 137	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 22
10/15/2014	MWW-5685	< 158	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 48
Cumulative Averages		< 500	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 48
<u>Wise (M-27)</u>												
1/15/2014								NS ^a				
4/18/2014	MWW-1604	< 146	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 27
7/16/2014	MWW-3530	< 137	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 19
10/15/2014	MWW-5686	< 158	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 31
Cumulative Averages		< 500	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 31
<u>Imholte (M-43) Control</u>												
1/15/2014	MWW-211	< 142	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 15
4/18/2014	MWW-1605	< 146	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 20
7/16/2014	MWW-3531	< 137	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 38
10/15/2014	MWW-5687	< 158	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 34
Cumulative Averages		< 500	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 38

^a"NS" = No sample, see Table 2.0, Listing of Missed Samples.

Table 14. Fish, analysis of edible portions for gamma-emitting isotopes.
Collection: Semiannually

Sample Description and Concentration (pCi/g wet)				Cumulative Average	Previous Average
<u>Upstream 1000' M-8 (C)</u>					
Date Collected	06-05-14	06-05-14	09-09-14		
Lab Code	MF- 2583	MF- 2585	MF- 4793		
Sample Type	Channel Catfish				
K-40	2.61 ± 0.40	3.04 ± 0.43	2.47 ± 0.38	2.72	3.36
Mn-54	< 0.016	< 0.019	< 0.019	< 0.019	< 0.018
Fe-59	< 0.059	< 0.040	< 0.056	< 0.059	< 0.055
Co-58	< 0.015	< 0.014	< 0.020	< 0.023	< 0.023
Co-60	< 0.013	< 0.017	< 0.020	< 0.020	< 0.022
Zn-65	< 0.024	< 0.034	< 0.026	< 0.034	< 0.037
Nb-95	< 0.032	< 0.057	< 0.035	< 0.057	< 0.027
Zr-95	< 0.035	< 0.055	< 0.028	< 0.055	< 0.035
Cs-134	< 0.018	< 0.016	< 0.018	< 0.019	< 0.018
Cs-137	< 0.013	< 0.016	< 0.020	< 0.020	< 0.020
Ba-La-140	< 0.150	< 0.166	< 0.272	< 0.272	< 0.067
Ce-144	< 0.140	< 0.115	< 0.150	< 0.150	< 0.107
Date Collected	09-09-14				
Lab Code	MF- 4794				
Sample Type	Shorthead Redhorse				
K-40	2.76 ± 0.42				
Mn-54	< 0.010				
Fe-59	< 0.038				
Co-58	< 0.023				
Co-60	< 0.015				
Zn-65	< 0.018				
Nb-95	< 0.027				
Zr-95	< 0.026				
Cs-134	< 0.019				
Cs-137	< 0.018				
Ba-La-140	< 0.199				
Ce-144	< 0.112				

Table 14. Fish, analysis of edible portions for gamma-emitting isotopes.
Collection: Semiannually

Sample Description and Concentration (pCi/g wet)				Cumulative Average	Previous Average
<u>Downstream 1000' M-9</u>					
Date Collected	06-05-14	06-05-14	09-09-14		
Lab Code	MF- 2586	MF- 2587	MF- 4795		
Sample Type	Channel Catfish				
K-40	2.76 ± 0.42	3.25 ± 0.41	3.47 ± 0.39	3.03	3.34
Mn-54	< 0.018	< 0.017	< 0.014	< 0.018	< 0.017
Fe-59	< 0.038	< 0.049	< 0.059	< 0.059	< 0.052
Co-58	< 0.023	< 0.028	< 0.020	< 0.028	< 0.023
Co-60	< 0.015	< 0.021	< 0.015	< 0.021	< 0.013
Zn-65	< 0.018	< 0.018	< 0.020	< 0.035	< 0.030
Nb-95	< 0.027	< 0.043	< 0.034	< 0.043	< 0.021
Zr-95	< 0.026	< 0.046	< 0.041	< 0.046	< 0.039
Cs-134	< 0.020	< 0.016	< 0.017	< 0.020	< 0.014
Cs-137	< 0.012	< 0.017	< 0.015	< 0.017	< 0.017
Ba-La-140	< 0.121	< 0.111	< 0.217	< 0.217	< 0.043
Ce-144	< 0.112	< 0.126	< 0.103	< 0.126	< 0.100
Date Collected	09-09-14				
Lab Code	MF- 4797				
Sample Type	Shorthead Redhorse				
K-40	2.64 ± 0.34				
Mn-54	< 0.012				
Fe-59	< 0.048				
Co-58	< 0.024				
Co-60	< 0.012				
Zn-65	< 0.035				
Nb-95	< 0.034				
Zr-95	< 0.043				
Cs-134	< 0.013				
Cs-137	< 0.012				
Ba-La-140	< 0.161				
Ce-144	< 0.115				

Table 15. Algae or aquatic insects, analysis for gamma-emitting isotopes.
Collection: Semiannually

Sample Description and Concentration (pCi/g wet)		Cumulative Average	Previous Average
<u>Upstream 1000' M-8 (C)^a</u>			
Date Collected	08-08-14		
Lab Code	MBO- 4162	NS ^a	
Be-7	< 0.57	< 0.57	< 0.84
K-40	< 0.84	< 0.84	2.30
Mn-54	< 0.024	< 0.024	< 0.067
Fe-59	< 0.13	< 0.13	< 0.14
Co-58	< 0.068	< 0.068	< 0.073
Co-60	< 0.052	< 0.052	< 0.043
Zn-65	< 0.094	< 0.094	< 0.125
Zr-Nb-95	< 0.064	< 0.064	< 0.133
Ru-103	< 0.075	< 0.075	< 0.092
Ru-106	< 0.39	< 0.39	< 0.56
Cs-134	< 0.040	< 0.040	< 0.059
Cs-137	< 0.049	< 0.049	< 0.057
Ba-La-140	< 0.41	< 0.41	< 0.31
Ce-144	< 0.20	< 0.20	< 0.35
<u>Downstream 1000' M-9</u>			
Date Collected	08-08-14	10-14-14	
Lab Code	MBO- 4164	MBO- 5649	
Be-7	< 0.55	< 0.34	< 0.55
K-40	< 0.91	< 0.78	< 0.91
Mn-54	< 0.046	< 0.033	< 0.046
Fe-59	< 0.13	< 0.029	< 0.13
Co-58	< 0.046	< 0.028	< 0.046
Co-60	< 0.041	< 0.040	< 0.041
Zn-65	< 0.077	< 0.054	< 0.077
Zr-Nb-95	< 0.067	< 0.039	< 0.067
Ru-103	< 0.070	< 0.029	< 0.070
Ru-106	< 0.38	< 0.26	< 0.38
Cs-134	< 0.041	< 0.036	< 0.041
Cs-137	< 0.040	< 0.040	< 0.040
Ba-La-140	< 0.22	< 0.035	< 0.22
Ce-144	< 0.24	< 0.19	< 0.24

^a"NS" = No sample; none sent.

Table 16. Broadleaf vegetation, analysis for iodine-131.
Collection: Annually

Sample Description and Concentration (pCi/g wet)	
Location:	Control (Cabbage)
Date Collected	
Lab Code	ND ^a
Mn-54	-
Fe-59	-
Co-58	-
Co-60	-
Zn-65	-
Nb-95	-
I-131	-
Cs-134	-
Cs-137	-
Location:	M-27 (Cabbage)
Date Collected	
Lab Code	ND ^a
Mn-54	-
Fe-59	-
Co-58	-
Co-60	-
Zn-65	-
Nb-95	-
I-131	-
Cs-134	-
Cs-137	-

^a ND = No data; sample not collected. No river irrigated crops within 5 mile radius.

Table 17. Shoreline (SS) sediments, analysis for gamma-emitting isotopes.
Collection: Semiannually

Sample Description and Concentration (pCi/g dry)			Cumulative Average	Previous Average
<u>Upstream 1000' M-8 (C)</u>				
Date Collected	08-08-14	10-14-14		
Lab Code	MSS- 4172	MSS- 5651		
Be-7	< 0.16	< 0.16	< 0.16	< 0.23
K-40	9.25 ± 0.51	8.98 ± 0.46	9.12	9.96
Mn-54	< 0.016	< 0.016	< 0.016	< 0.014
Fe-59	< 0.052	< 0.040	< 0.052	< 0.043
Co-58	< 0.011	< 0.016	< 0.016	< 0.017
Co-60	< 0.012	< 0.014	< 0.014	< 0.012
Zn-65	< 0.034	< 0.025	< 0.034	< 0.040
Nb-95	< 0.015	< 0.015	< 0.015	< 0.019
Zr-95	< 0.028	< 0.020	< 0.028	< 0.040
Ru-103	< 0.018	< 0.017	< 0.018	< 0.021
Ru-106	< 0.071	< 0.075	< 0.07	< 0.12
Cs-134	< 0.010	< 0.012	< 0.012	< 0.011
Cs-137	< 0.012	0.028 ± 0.012	< 0.012	< 0.016
Ba-La-140	< 0.081	< 0.081	< 0.081	< 0.078
Ce-144	< 0.081	< 0.047	< 0.081	< 0.088
<u>Downstream 1000' M-9</u>				
Date Collected	08-08-14	10-14-14		
Lab Code	MSS- 4173	MSS- 5652		
Be-7	< 0.27	< 0.19	< 0.27	0.42
K-40	11.07 ± 0.53	10.09 ± 0.53	10.58	9.33
Mn-54	< 0.015	< 0.018	< 0.018	< 0.020
Fe-59	< 0.068	< 0.027	< 0.068	< 0.061
Co-58	< 0.027	< 0.016	< 0.027	< 0.024
Co-60	< 0.016	< 0.010	< 0.016	< 0.010
Zn-65	< 0.040	< 0.027	< 0.040	< 0.053
Nb-95	< 0.044	< 0.012	< 0.044	< 0.026
Zr-95	< 0.042	< 0.020	< 0.042	< 0.057
Ru-103	< 0.030	< 0.010	< 0.030	< 0.028
Ru-106	< 0.14	< 0.16	< 0.16	< 0.120
Cs-134	< 0.015	< 0.011	< 0.015	< 0.015
Cs-137	0.033 ± 0.017	0.037 ± 0.018	0.035	< 0.019
Ba-La-140	< 0.11	< 0.061	< 0.11	< 0.059
Ce-144	< 0.12	< 0.11	< 0.12	< 0.11

Table 17. Shoreline (SS) sediments, analysis for gamma-emitting isotopes (continued).

Sample Description and Concentration (pCi/g dry)			Cumulative Average	Previous Average
<u>Montissippi Park M-15</u>				
Date Collected	08-08-14	10-14-14		
Lab Code	MSS- 4174	MSS- 5653		
Be-7	< 0.22	< 0.21	< 0.22	0.27
K-40	11.46 ± 0.59	10.32 ± 0.53	10.89	10.58
Mn-54	< 0.016	< 0.017	< 0.017	< 0.017
Fe-59	< 0.040	< 0.032	< 0.040	< 0.041
Co-58	< 0.017	< 0.015	< 0.017	< 0.022
Co-60	< 0.013	< 0.011	< 0.013	< 0.012
Zn-65	< 0.038	< 0.045	< 0.045	< 0.036
Nb-95	< 0.025	< 0.023	< 0.025	< 0.028
Zr-95	< 0.039	< 0.022	< 0.039	< 0.029
Ru-103	< 0.019	< 0.026	< 0.026	< 0.024
Ru-106	< 0.074	< 0.10	< 0.102	< 0.126
Cs-134	< 0.011	< 0.014	< 0.014	< 0.014
Cs-137	0.059 ± 0.022	< 0.016	0.059	0.035
Ba-La-140	< 0.092	< 0.065	< 0.092	< 0.11
Ce-144	< 0.076	< 0.088	< 0.088	< 0.126