ENCLOSURE 1

RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
JANUARY 1 – DECEMBER 31, 2013

100 pages follow

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XCEL ENERGY CORPORATION

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

ANNUAL REPORT
TO THE
UNITED STATES NUCLEAR REGULATORY COMMISSION

Radiological Environmental Monitoring Program

January 1 to December 31, 2013

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ENVIRONMENTAL, Inc.
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PREFACE

The staff of Environmental, Inc., Midwest Laboratory was responsible for the acquisition of data presented in this report. Samples were collected by personnel of the Monticello Nuclear Generating Plant, operated by 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, 2013. 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 600 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 2013 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 $CaSO_4$:Dy dosimeters with four sensitive areas at each location: fourteen in an inner ring in the general area of the site boundary, sixteen in the outer ring within 4-5 mile radius, six at special interest locations and four control locations, outside a 10 mile radius from the plant. They are replaced and measured quarterly.

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 for the week ending January 16, 2013, the sampler failed due to a faulty toggle switch.

M-01, A partial air particulate / air iodine sample (54 m^3) was collected for the week ending May 1, 2013, due to sampler failure. No air particulate / air iodine sample was available for the week ending May 8, 2013, due to sampler failure. The vacuum pump was replaced.

M-02, No air particulate sample was collected for the week ending November 27, 2013, the filter was misaligned in the holder.

(2) Surface Water:

Surface water was not collected at location M-08 for the months of January, February, March and December, 2013, due to unsafe ice conditions.

(3) Well Water:

Well water was not collected at location MW-27 in January, 2013. No water was available from the outside tap.

(4) Drinking Water (M-14):

No sample was available for the January 13, 2013 collection. The sample was damaged in shipment. The drinking water sample for May 7, 2013 was lost during shipping.

No drinking water sample was available November 18, 2013. The sample was missed.

(5) Milk

There was no goat milk available from locations M-16 and M-17 in 2013. Goats are no longer milked at location M-16, the herd has been sold.

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.

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 cabbage and natural vegetation and concentrations of airborne iodine-131 in charcoal samples were determined by gamma spectroscopy.

Tritium concentrations are determined by liquid scintillation.

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

Environmental, Inc., Midwest Laboratory has a comprehensive quality control/quality assurance program designed to assure the reliability of data obtained. Details of the QA Program are presented elsewhere (Environmental, Inc., Midwest Laboratory, 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 ft^2 producing fresh leafy vegetables, in each of the 16 meteorological sectors within a distance of 5 miles. The census shall also identify the locations of all milk animals and all 500 ft^2 or greater gardens producing broad leaf vegetation in each of the meteorological sectors within a distance of three miles. This census shall be conducted at least once per year between the dates of May 1 and October 31. New locations shall be added to the radiation environmental monitoring program within 30 days and sampling locations having lower calculated doses or a lower dose commitment may be deleted from this monitoring program after October 31 of the year in which the land use census was conducted.

The 2013 land use census was conducted between September 10 and September 16, 2013.

Closer gardens were identified in the E and S sectors, resulting in revised D/Q values greater than 20%. Improved GPS software resulted in slight changes to sector assignments. The highest D/Q value for nearest garden was calculated in the SE sector. The highest D/Q location for nearest resident did not change from the 2012 census. There were no milk animals found within a five mile radius of the plant. The goat milk farm in the SSE sector has sold off the herd.

A new site for critical receptor was identified in the 2013 census, located in the SE sector, 1.1 miles from the plant. The Offsite Dose Calculation Manual (ODCM) will be revised to reflect the changes.

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 2013. The Fukushima Daiichi nuclear accident occurred March 11, 2011.

There were no reported atmospheric nuclear tests in 2013. 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/m^3 in 1969 and 12,000 pCi/m^3 in 1970. These levels are reflected throughout the various media tested.

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

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 2013. 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 (14.4 and 14.0 mRem/91 days, respectively). The mean for special interest locations was 14.0 mRem/91 days and the mean for the control locations was 15.5 mRem/91 days. Dose rates measured at the inner and outer ring locations were similar to those observed from 1998 through 2012 and are tabulated below. No plant effect on ambient gamma radiation is indicated (Figure 5-1).

Year	Inner Ring	Outer Ring
	Dose rate (mRem/91 days)	
1998	15.0	14.4
1999	15.1	14.3
2000	15.1	14.5
2001	14.3	13.7
2002	15.9	14.8
2003	15.6	15.0
2004	16.0	15.4
2005	15.6	15.2
2006	16.5	15.6
2007	16.1	15.1
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

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 (0.029 and 0.032 pCi/m^3,respectively), similar to levels observed from 1998 through 2012. The results are tabulated below.

Year	Indicators	Control
	Concentration (pCi/m^3)	
1998	0.023	0.023
1999	0.023	0.025
2000	0.027	0.026
2001	0.027	0.026
2002	0.028	0.028
2003	0.027	0.027
2004	0.024	0.024
2005	0.025	0.025
2006	0.024	0.025
2007	0.027	0.028
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

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 1998 through 2013.

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/m^3 for all locations. All other gamma-emitting isotopes were below their respective LLD limits.

Airborne Iodine

Weekly levels of airborne iodine-131 were below the lower limit of detection (LLD) of 0.03 pCi/m^3 in all samples.

River Water and Drinking Water

Tritium activity measured below 500 pCi/L in all samples. Gross beta activity in Minneapolis drinking water averaged 2.6 pCi/L and was similar to average levels observed from 1998 through 2012. Gross beta averages are tabulated below.

Year	Gross Beta (pCi/L)		Year	Gross Beta (pCi/L)
1998	2.4		2006	2.1
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

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 2013 were consistent with previous years results and no plant operational effects were indicated.

Pasture Grass

Pasture grass was collected in July, August and September, 2013. Iodine-131 concentrations measured below 0.034 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 2013. No crops, within five miles of the plant, were found using irrigation water from the Mississippi River.

Fish

Fish were collected in May 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 (3.27 and 3.19 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, 2013, 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, 2013, and analyzed for gamma-emitting isotopes. Low levels of cesium-137 were detected in two downstream samples (M-15), at an average concentration of 0.0035 pCi/g dry weight. 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 11 of 114 samples collected from the nineteen on-site monitoring wells. The activities ranged from 566 to 15,124 pCi/L, similar or slightly higher than concentrations seen in 2011 and 2012. The highest activities were observed at well MW-09A.

Gamma isotopic measurements were below detection limits.

Stormwater Run-off (on-site)

No tritium was detected in any of the four stormwater runoff samples submitted for analysis in 2013. 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] -				
Leafy Vegetable	2	M-27, Available Producer (C)	G/A	I-131
Corn	1	M-19	G/A	GS
Potatoes	1	M-21	G/A	GS
Fish (one species, edible portion)	2	M-8(C), M-9	G/SA	GS
Periphyton or invertebrates	2	M-8(C), M-9	G/SA	GS
Shoreline sediment	3	M-8(C), M-9, M-15	G/SA	GS

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

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

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

[d] 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 #1	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	[f] 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' @ 304°/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		0.1 mi @ 27°/NE

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 @ 55°/NE
M-04A		Biology Station Road	TLD	0.5 mi @ 86°/E
M-05A		Biology Station Road	TLD	0.48 mi @ 118°/ESE
M-06A		Biology Station Road	TLD	0.54 mi @ 135°/SE
M-07A		County Road 75	TLD	0.5 mi @ 155°/SSE
M-08A		County Road 75	TLD	0.48 mi @ 172°/S
M-09A		County Road 75	TLD	0.38 mi @ 209°/SSW
M-10A		County Road 75	TLD	0.38 mi @ 226°/SW
M-11A		County Road 75	TLD	0.4 mi @ 239°/WSW
M-12A		County Road 75	TLD	0.5 mi @ 262°/W
M-13A		North Boundary Road	TLD	0.89 mi @ 324°/NW
M-14A		North Boundary Road	TLD	0.78 mi @ 334°/NNW
Approximately 4 to 5 miles Distant from the Plant				
M-01B		Sherco #1 Air Station	TLD	4.66 mi @ 02°/N
M-02B		County Road 11	TLD	4.4 mi @ 18°/NNE
M-03B		County Road 73 & 81	TLD	4.3 mi @ 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 @ 242°/WSW
M-02S		Krone Residence	TLD	0.5 mi @ 224°/SW
M-03S		Big Oaks Park	TLD	1.53 mi @ 102°/ESE
M-04S		Pinewood School	TLD	2.3 mi @ 131°/SE
M-05S		Rivercrest Christian Academy	TLD	3.0 mi @ 118°/ESE
M-06S		Monte Public Works	TLD	2.6 mi @ 134°/SE
M-01C	C	Kirchenbauer Farm	TLD	11.5 mi @ 323°/NW
M-02C	C	County Roads 4 and 15	TLD	11.2 mi @ 47°/NE
M-03C	C	County Rd 19 and Jason Ave.	TLD	11.6 mi @ 130°/SE
M-04C	C	Maple Lake Water Tower	TLD	10.3 mi @ 226°/ SW
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 (s)	Collection Date or Period	Reason for not conducting REMP as required	Plans for Preventing Recurrence
WW	Gamma, H-3	M-014	1/13/2013	Sample damaged in shipment.	None Required
AP/AI	Beta, I-131	M-01	1/16/2013	Bad toggle switch.	Sampler pump replaced.
SW	Gamma	M-008	Jan. 2013	Water frozen entire month; no composite.	None Required
WW	Gamma, H-3	M-027	1/24/2013	Residence vacant, water turned off.	None Required
SW	Gamma	M-008	Feb. 2013	Water frozen entire month; no composite.	None Required
SW	Gamma	M-008	Mar. 2013	Water frozen entire month; no composite.	None Required
SW	H-3	M-008	1st Qtr. 2013	Water frozen entire quarter; no composite.	None Required
AP/AI	Beta, I-131	M-01	5/1/2013	Broken switch.	Sampler pump replaced.
WW	Gamma, H-3	M-014	5/7/2013	Sample lost in shipment.	None Required
AP/AI	Beta, I-131	M-01	5/8/2013	Vacuum leak.	Sampler pump replaced.
WW	Gamma, H-3	M-014	11/18/2013	No sample taken.	Technician coached on proper turnover.
AP/AI	Beta, I-131	M-02	11/27/2013	Filter misaligned in holder, light particulate collected.	Technician coached on verification practices.
SW	Gamma	M-008	Dec. 2013	Water frozen entire month; no composite.	None Required

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

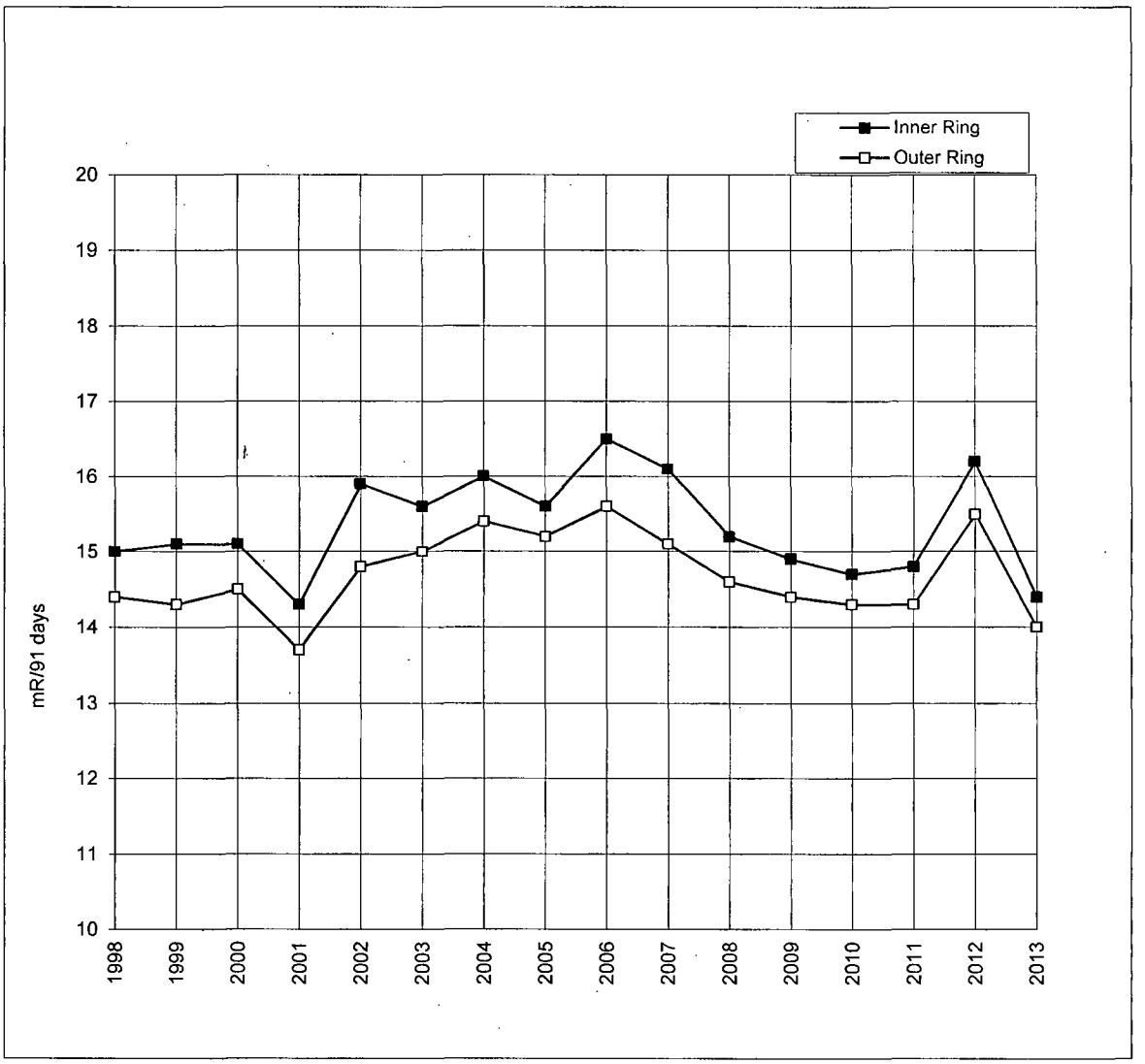

Figure 5-2. Airborne Particulates; analysis for gross beta, average mean of all indicator locations versus control location.

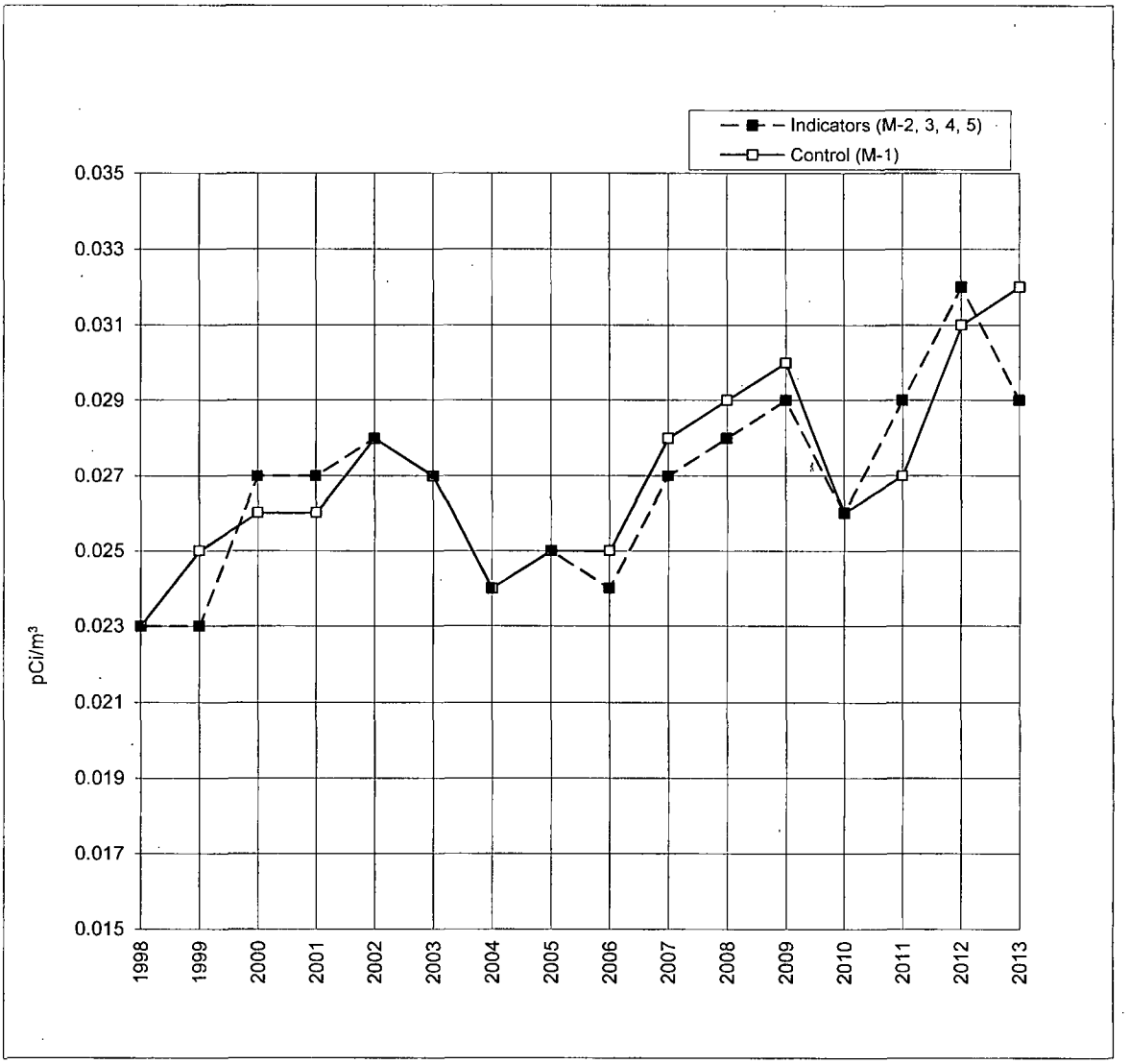

Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility: Monticello Nuclear Generating Plant — Docket No.: 50-263
Location of Facility: Wright, Minnesota — Reporting Period: January-December, 2013
(County, State)

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean: Location[d]	Location with Highest Annual Mean: Mean (F)[c] Range[c]	Control Locations Mean (F)[c] Range[c]	Number Non-Routine Results[e]
Direct Radiation							
TLD (Inner Ring, General Area at Site Boundary) mRem/91 days)	Gamma 56	3.0	14.4 (56/56) (10.9-18.6)	M-13A 1.1 mi @ 317°/NW	16.1 (4/4) (13.5-18.3)	(See Control below.)	0
TLD (Outer Ring, 4-5 mi. distant) mRem/91 days)	Gamma 64	3.0	14 (64/64) (10.4-19.1)	M-10B 4.4 mi @ 206°/SSW	15.8 (4/4) (13.6-19.1)	(See Control below.)	0
TLD (Special Interest Areas) mRem/91 days)	Gamma 24	3.0	14.0 (24/24) (10.8-17.8)	M-06S, Mont. Pub. Wks. 2.7 mi @ 136°/SE	17.1 (4/4) (16.7-17.8)	(See Control below.)	0
TLD (Control) mRem/91 days)	Gamma 16	3.0	None	M-03C, Rte. 19 & Jason, 11.6 mi @ 130°/SE	16.4 (4/4) (15.5-16.8)	15.5 (16/16) (11.8-18.8)	0
Airborne Pathway							
Airborne Particulates (pCi/m^3)	GB 256	0.002	0.029 (207/207) (0.007-0.074)	M-1 (C), Air Station 11.0 mi @ 307°/NW	0.032 (49/49) (0.011-0.070)	0.032 (49/49) (0.011-0.070)	0
	GS 20						
	Be-7	0.015	0.064 (16/16) (0.042-0.088)	M-5, Air Station 2.6 mi @ 134°/SE	0.072 (4/4) (0.047-0.088)	0.067 (4/4) (0.046-0.092)	0
	Mn-54	0.0011	< LLD	-	-	< LLD	0
	Co-58	0.0009	< LLD	-	-	< LLD	0
	Co-60	0.0008	< LLD	-	-	< LLD	0
	Zn-65	0.0015	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.0012	< LLD	-	-	< LLD	0
	Ru-103	0.0012	< LLD	-	-	< LLD	0
	Ru-106	0.0091	< LLD	-	-	< LLD	0
	Cs-134	0.0008	< LLD	-	-	< LLD	0
	Cs-137	0.0010	< LLD	-	-	< LLD	0
	Ba-La-140	0.0022	< LLD	-	-	< LLD	0
	Ce-141	0.0019	< LLD	-	-	< LLD	0
	Ce-144	0.0050	< LLD	-	-	< LLD	0
Airborne Iodine (pCi/m^3)	I-131 256	0.03	< LLD	-	-	< LLD	0

Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility: Monticello Nuclear Generating Plant — Docket No.: 50-263
Location of Facility: Wright, Minnesota (County, State) — Reporting Period: January-December, 2013

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean: Location[d]	Location with Highest Annual Mean: Mean (F)[c] Range[c]	Control Locations Mean (F)[c] Range[c]	Number Non-Routine Results[e]
Waterborne Pathway							
River Water (pCi/L)	H-3 7	500	< LLD	-	-	< LLD	0
	GS 20						
	Mn-54	10	< LLD	-	-	< LLD	0
	Fe-59	30	< LLD	-	-	< LLD	0
	Co-58	10	< LLD	-	-	< LLD	0
	Co-60	10	< LLD	-	-	< LLD	0
	Zn-65	30	< LLD	-	-	< LLD	0
	Zr-Nb-95	15	< LLD	-	-	< LLD	0
	Cs-134	10	< LLD	-	-	< LLD	0
	Cs-137	10	< LLD	-	-	< LLD	0
	Ba-La-140	15	< LLD	-	-	< LLD	0
	Ce-144	29	< LLD	-	-	< LLD	0
Drinking Water (pCi/L)	GB 12	1.0	2.6 (12/12) (1.5-3.2)	M-14, Minneapolis 37.0 mi. @ 132° /SE	2.6 (12/12) (1.5-3.2)	None	0
	I-131 12	1.0	< LLD	-	-	None	0
	H-3 4	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	51	< 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	57	< LLD	-	-	< LLD	0

Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility: Monticello Nuclear Generating Plant — Docket No.: 50-263
Location of Facility: Wright, Minnesota (County, State) — Reporting Period: January-December, 2013

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean: Location[d]	Location with Highest Annual Mean: Mean (F)[c] Range[c]	Control Locations Mean (F)[c] Range[c]	Number Non-Routine Results[e]
Waterborne Pathway							
Invertebrates (pCi/g wet)	GS 4						
	Be-7	0.84	< LLD	-	-	< LLD	0
	K-40	1.04	< LLD	-	-	< LLD	0
	Mn-54	0.067	< LLD	-	-	< LLD	0
	Fe-59	0.18	< LLD	-	-	< LLD	0
	Co-58	0.074	< LLD	-	-	< LLD	0
	Co-60	0.048	< LLD	-	-	< LLD	0
	Zn-65	0.12	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.13	< LLD	-	-	< LLD	0
	Ru-103	0.092	< LLD	-	-	< LLD	0
	Ru-106	0.56	< LLD	-	-	< LLD	0
	Cs-134	0.059	< LLD	-	-	< LLD	0
	Cs-137	0.065	< LLD	-	-	< LLD	0
	Ba-La-140	0.37	< LLD	-	-	< LLD	0
	Ce-144	0.35	< LLD	-	-	< LLD	0
Shoreline Sediments (pCi/g dry)	GS 6						
	Be-7	0.24	0.35 (2/4) (0.27-0.42)	M-09, Downstream < 1000' of discharge	0.42 (1/2)	< LLD	0
	K-40	0.10	9.96 (4/4) (8.62-10.92)	M-15, Montissippi Park 1.27 mi @ 114°/ESE	10.58 (2/2) (10.23-10.92)	9.96 (2/2) (9.71-10.21)	0
	Mn-54	0.020	< LLD	-	-	< LLD	0
	Fe-59	0.061	< LLD	-	-	< LLD	0
	Co-58	0.024	< LLD	-	-	< LLD	0
	Co-60	0.012	< LLD	-	-	< LLD	0
	Zn-65	0.053	< LLD	-	-	< LLD	0
	Nb-95	0.028	< LLD	-	-	< LLD	0
	Zr-95	0.057	< LLD	-	-	< LLD	0
	Ru-103	0.028	< LLD	-	-	< LLD	0
	Ru-106	0.13	< LLD	-	-	< LLD	0
	Cs-134	0.015	< LLD	-	-	< LLD	0
	Cs-137	0.019	0.035 (2/4) (0.022-0.049)	M-15, Montissippi Park 1.27 mi @ 114°/ESE	0.035 (2/2) (0.022-0.049)	< LLD	0
	Ba-La-140	0.11	< LLD	-	-	< LLD	0
	Ce-144	0.13	< LLD	-	-	< LLD	0

Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility: Monticello Nuclear Generating Plant
Location of Facility: Wright, Minnesota (County, State)
Docket No.: 50-263
Reporting Period: January-December, 2013

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean Location[d]	Mean (F)[c] Range[c]	Control Locations Mean (F)[c] Range[c]	Number Non-Routine Results[e]
Ingestion Pathway							
Vegetation	GS 9						
(Pasture Grass,	Mn-54	0.016	< LLD	-	-	< LLD	0
Weeds, Leaves)	Fe-59	0.026	< LLD	-	-	< LLD	0
	Co-58	0.014	< LLD	-	-	< LLD	0
(pCi/gwet)	Co-60	0.014	< LLD	-	-	< LLD	0
	Zn-65	0.031	< LLD	-	-	< LLD	0
	Nb-95	0.019	< LLD	-	-	< LLD	0
	I-131	0.034	< LLD	-	-	< LLD	0
	Cs-134	0.016	< LLD	-	-	< LLD	0
	Cs-137	0.017	< LLD	-	-	< LLD	0
Fish	GS 4						
(pCi/g wet)	K-40	0.10	3.27 (2/2) (2.91-3.64)	M-09, Downstream < 1000' of discharge	3.27 (2/2) (2.91-3.64)	3.19 (2/2) (2.99-3.38)	0
	Mn-54	0.013	< LLD	-	-	< LLD	0
	Fe-59	0.034	< LLD	-	-	< LLD	0
	Co-58	0.009	< LLD	-	-	< LLD	0
	Co-60	0.013	< LLD	-	-	< LLD	0
	Zn-65	0.017	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.012	< LLD	-	-	< LLD	0
	Cs-134	0.006	< LLD	-	-	< LLD	0
	Cs-137	0.013	< LLD	-	-	< LLD	0
	Ba-La-140	0.019	< LLD	-	-	< LLD	0
	Ce-144	0.091	< LLD	-	-	< LLD	0

[a] GB = gross beta, GS = gamma scan.
[b] LLD = nominal lower limit of detection based on a 4.66 sigma counting error for background sample.
[c] Mean and range are based on detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (F).
[d] Locations are specified: (1) by name, and/or station code and (2) by distance (miles) and direction relative to reactor site.
[e] Non-routine results are those which exceed ten times the control station value. If no control station value is available, the result is considered non-routine if it exceeds ten time the typical preoperational value for the medium or location.

6.0 REFERENCES CITED

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

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

ATI Environmental, Inc., Midwest Laboratory.

_____ 2001a through 2014a. Radiation Environmental Monitoring for Monticello Nuclear Generating Plant, Complete Analysis Data Tables, January-December, 2000 through 2013.

_____ 2001b through 2014b. Radiation Environmental Monitoring for Prairie Island Nuclear Generating Plant, Complete Analysis Data Tables, January - December, 2000 through 2013.

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

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

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

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

_____ 2009. Quality Assurance Program Manual, Rev. 3, 14 November 2012.

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

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

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

National Center for Radiological Health, 1968. Radiological Health and Data Reports, Vol. 9, Number 12, 730-746.

Northern States Power Company.

_____ 1969 through 1971. Monticello Nuclear Generating Plant, Environmental Radiation Monitoring Program, Annual Report, June 18, 1968 to December 31, 1968, 1969, 1970. Minneapolis, Minnesota.

_____ 1978 through 2008. Monticello Nuclear Generating Plant, Annual Radiation Environmental Monitoring Report to the U.S. Nuclear Regulatory Commission, January 1, to December 31, 1977 through 2007.

6.0 REFERENCES CITED (continued)

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

U.S. Environmental Protection Agency .

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

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

_____ 2009. RadNet, formerly Environmental Radiation Ambient Monitoring System, Gross Beta in Air, Gross Beta in Drinking Water (MN) 1981– 2005.

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

Xcel Energy Corporation.

_____ 2009 to 2013. Monticello Nuclear Generating Plant, Annual Radiation Environmental Monitoring Report to the U.S. Nuclear Regulatory Commission, January 1 to December 31, 2008 through 2012. Minneapolis, Minnesota.

_____ 2009 to 2013. Prairie Island Nuclear Generating Plant, Annual Radiation Environmental Monitoring Report to the U.S. Nuclear Regulatory Commission, January 1 to December 31, 2008 through 2012. Minneapolis, Minnesota.

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APPENDIX A

INTERLABORATORY COMPARISON PROGRAM RESULTS

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

January through December, 2013

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 issuingagency. Several months later, the agency reports the known values to the participant laboratories and specifies control limits. Results consistently higher or lower than the known values or outside the control limits indicate a need to check the instruments or procedures used.

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

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

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

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

Table A-5 lists REMP specific analytical results from the in-house "duplicate" program for the past twelve months. Acceptance is based on the difference of the results being less than the sum of the errors. Complete analytical data for duplicate analyses is available upon request.

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

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

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

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

Attachment A

ACCEPTANCE CRITERIA FOR "SPIKED" SAMPLES

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

Analysis	Level	One standard deviation for single determination
Gamma Emitters	5 to 100 pCi/liter or kg	5.0 pCi/liter
	> 100 pCi/liter or kg	5% of known value
Strontium-89[b]	5 to 50 pCi/liter or kg	5.0 pCi/liter
	> 50 pCi/liter or kg	10% of known value
Strontium-90[b]	2 to 30 pCi/liter or kg	5.0 pCi/liter
	> 30 pCi/liter or kg	10% of known value
Potassium-40	≥ 0.1 g/liter or kg	5% of known value
Gross alpha	≤ 20 pCi/liter	5.0 pCi/liter
	> 20 pCi/liter	25% of known value
Gross beta	≤ 100 pCi/liter	5.0 pCi/liter
	> 100 pCi/liter	5% of known value
Tritium	≤ 4,000 pCi/liter	$\pm 1\sigma$ = $169.85 \times (\text{known})^{0.0933}$
	> 4,000 pCi/liter	10% of known value
Radium-226,-228	≥ 0.1 pCi/liter	15% of known value
Plutonium	≥ 0.1 pCi/liter, gram, or sample	10% of known value
Iodine-131, Iodine-129[b]	≤ 55 pCi/liter	6 pCi/liter
	> 55 pCi/liter	10% of known value
Uranium-238, Nickel-63[b] Technetium-99[b]	≤ 35 pCi/liter	6 pCi/liter
	> 35 pCi/liter	15% of known value
Iron-55[b]	50 to 100 pCi/liter	10 pCi/liter
	> 100 pCi/liter	10% of known value
Other Analyses [b]	---	20% of known value

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

[b] Laboratory limit.

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

Lab Code	Date	Analysis	Concentration (pCi/L) Laboratory Result [b]	ERA Result [c]	Control Limits	Acceptance
ERW-76	01/07/13	Ra-226	10.04 ± 0.55	9.91	7.42 - 11.60	Pass
ERW-76	01/07/13	Ra-228	6.11 ± 1.29	5.22	3.14 - 6.96	Pass
ERW-76	01/07/13	Uranium	5.90 ± 0.58	5.96	4.47 - 7.13	Pass
ERW-1593	04/08/13	Sr-89	43.60 ± 4.32	41.30	31.60 - 48.40	Pass
ERW-1593	04/08/13	Sr-90	23.20 ± 1.70	23.90	17.20 - 28.00	Pass
ERW-1596	04/08/13	Ba-133	74.80 ± 4.00	82.10	69.00 - 90.30	Pass
ERW-1596	04/08/13	Co-60	65.50 ± 3.42	65.90	59.30 - 75.00	Pass
ERW-1596	04/08/13	Cs-134	41.10 ± 3.47	42.80	34.20 - 47.10	Pass
ERW-1596	04/08/13	Cs-137	42.30 ± 4.03	41.70	37.00 - 48.80	Pass
ERW-1596	04/08/13	Zn-65	200.3 ± 10.1	189.0	170.0 - 222.0	Pass
ERW-1598	04/08/13	Gr. Alpha	34.30 ± 1.98	40.80	21.10 - 51.90	Pass
ERW-1598	04/08/13	Gr. Beta	18.70 ± 0.98	21.60	13.00 - 29.70	Pass
ERW-1600	04/08/13	I-131	23.00 ± 1.10	23.80	19.70 - 28.30	Pass
ERW-1600	04/08/13	I-131(G)	23.48 ± 9.44	23.80	19.70 - 28.30	Pass
ERW-1605	04/08/13	Ra-226	16.30 ± 0.70	15.40	11.50 - 17.70	Pass
ERW-1605	04/08/13	Ra-228	5.32 ± 1.30	4.36	2.54 - 5.98	Pass
ERW-1605	04/08/13	Uranium	57.30 ± 4.20	61.20	49.80 - 67.90	Pass
ERW-1606	04/08/13	H-3	4041 ± 194	4050	3450 - 4460	Pass
ERW-6009	10/07/13	Sr-89	22.00 ± 2.80	21.90	14.40 ± 28.20	Pass
ERW-6009	10/07/13	Sr-90	17.10 ± 2.55	18.10	12.80 ± 21.50	Pass
ERW-6012	10/07/13	Ba-133	48.20 ± 4.29	54.20	44.70 ± 59.90	Pass
ERW-6012	10/07/13	Co-60	100.8 ± 4.7	102.0	91.80 ± 114.00	Pass
ERW-6012	10/07/13	Cs-134	87.30 ± 4.35	86.70	71.10 ± 95.40	Pass
ERW-6012	10/07/13	Cs-137	199.6 ± 7.4	206.0	185.0 - 228.0	Pass
ERW-6012	10/07/13	Zn-65	356.2 ± 13.2	333.0	300.0 - 389.0	Pass
ERW-6015	10/07/13	Gr. Alpha	30.70 ± 11.90	42.80	22.20 ± 54.30	Pass
ERW-6015	10/07/13	Gr. Beta	25.70 ± 6.48	32.20	20.80 ± 39.90	Pass
ERW-6019	10/07/13	I-131	22.50 ± 1.01	23.60	19.60 ± 28.00	Pass
ERW-6022	10/07/13	Ra-226	12.70 ± 1.62	12.10	9.04 ± 14.00	Pass
ERW-6022 [d]	10/07/13	Ra-228	5.70 ± 0.56	4.02	2.30 ± 5.59	Fail
ERW-6022	10/07/13	Uranium	6.59 ± 0.38	6.24	4.70 ± 7.44	Pass
ERW-6024	10/07/13	H-3	18397 ± 695	17700	15500 - 19500	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.

[d] The reported result was obtained in the first cycle of counting. It can be positively biased due to extra beta counts contributed by Pb-214 and Bi-214 daughters of Rn-222. Result of second cycle of counting 4.47 pCi/L.

TABLE A-2. Thermoluminescent Dosimetry, (TLD, $CaSO_4$: Dy Cards).

Lab Code	Date	Description	mR Known Value	Lab Result ± 2 sigma	Control Limits	Acceptance
Environmental, Inc.						
2013-1	5/6/2013	40 cm.	34.26	39.92 ± 2.67	23.98 - 44.54	Pass
2013-1	5/6/2013	50 cm.	21.93	25.44 ± 3.31	15.35 - 28.51	Pass
2013-1	5/6/2013	60 cm.	15.23	15.88 ± 1.12	10.66 - 19.80	Pass
2013-1	5/6/2013	70 cm.	11.19	10.89 ± 0.66	7.83 - 14.55	Pass
2013-1	5/6/2013	80 cm.	8.57	9.21 ± 0.41	6.00 - 11.14	Pass
2013-1	5/6/2013	90 cm.	6.77	6.52 ± 0.34	4.74 - 8.80	Pass
2013-1	5/6/2013	100 cm.	5.48	5.02 ± 0.53	3.84 - 7.12	Pass
2013-1	5/6/2013	110 cm.	4.53	4.51 ± 0.34	3.17 - 5.89	Pass
2013-1	5/6/2013	120 cm.	3.81	4.28 ± 0.35	2.67 - 4.95	Pass
2013-1	5/6/2013	135 cm.	3.01	2.64 ± 0.18	2.11 - 3.91	Pass
2013-1	5/6/2013	150 cm.	2.44	2.10 ± 0.25	1.71 - 3.17	Pass
2013-1	5/6/2013	180 cm.	1.69	1.78 ± 0.33	1.18 - 2.20	Pass
Environmental, Inc.						
2013-2	11/18/2013	50 cm.	19.93	22.75 ± 3.67	13.95 - 25.91	Pass
2013-2	11/18/2013	60 cm.	13.84	15.75 ± 1.94	9.69 - 17.99	Pass
2013-2	11/18/2013	70 cm.	10.17	11.24 ± 0.88	7.12 - 13.22	Pass
2013-2	11/18/2013	75 cm.	8.86	9.18 ± 1.23	6.20 - 11.52	Pass
2013-2	11/18/2013	80 cm.	7.79	7.81 ± 1.10	5.45 - 10.13	Pass
2013-2	11/18/2013	90 cm.	6.15	5.98 ± 0.90	4.31 - 8.00	Pass
2013-2	11/18/2013	100 cm.	4.98	5.13 ± 0.73	3.49 - 6.47	Pass
2013-2	11/18/2013	110 cm.	4.12	3.87 ± 0.32	2.88 - 5.36	Pass
2013-2	11/18/2013	120 cm.	3.46	3.11 ± 0.39	2.42 - 4.50	Pass
2013-2	11/18/2013	135 cm.	2.73	2.71 ± 0.83	1.91 - 3.55	Pass
2013-2	11/18/2013	150 cm.	2.21	2.11 ± 0.63	1.55 - 2.87	Pass
2013-2	11/18/2013	180 cm.	1.54	1.81 ± 0.10	1.08 - 2.00	Pass

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

Lab Code [b]	Date	Analysis	Concentration (pCi/L)[a] Laboratory results 2s, n=1 [c]	Known Activity	Control Limits [d]	Acceptance
SPW-66	1/9/2013	Tc-99	1009 ± 5	1078	754.9 - 1402.0	Pass
SPW-1891	1/18/2013	Ra-228	35.60 ± 2.75	30.85	21.60 - 40.11	Pass
SPSO-12313S	1/23/2013	Tc-99	103.5 ± 2.2	107.8	75.46 - 140.14	Pass
SPMI-264	1/25/2013	Cs-134	110.9 ± 6.7	107.5	96.73 - 118.23	Pass
SPMI-264	1/25/2013	Cs-137	82.84 ± 7.47	77.48	67.48 - 87.48	Pass
SPMI-264	1/25/2013	Sr-90	38.19 ± 1.49	40.11	32.09 - 48.13	Pass
SPW-266	1/25/2013	Co-60	46.89 ± 4.68	44.48	34.48 - 54.48	Pass
SPW-266	1/25/2013	Cs-134	105.9 ± 8.0	107.5	96.73 - 118.23	Pass
SPW-266	1/25/2013	Cs-137	42.17 ± 5.65	39.49	29.49 - 49.49	Pass
SPW-266	1/25/2013	Sr-90	39.84 ± 1.65	40.11	32.09 - 48.13	Pass
SPAP-376	2/1/2013	Gr. Beta	44.20 ± 0.11	45.68	27.41 - 63.95	Pass
SPAP-378	2/1/2013	Cs-134	3.71 ± 0.65	3.87	2.32 - 5.42	Pass
SPAP-378	2/1/2013	Cs-137	97.47 ± 2.50	102.9	92.61 - 113.19	Pass
SPW-391	2/1/2013	H-3	63719 ± 703	65626	52501 - 78751	Pass
SPW-380	2/10/2013	Ni-63	217.0 ± 3.7	205.3	143.7 - 266.9	Pass
W-30413	3/4/2013	Gr. Alpha	19.77 ± 0.40	20.00	10.00 - 30.00	Pass
W-30413	3/4/2013	Gr. Beta	30.48 ± 0.34	30.90	20.90 - 40.90	Pass
W-30713	3/7/2013	Ra-226	18.06 ± 0.51	16.70	11.69 - 21.71	Pass
W-42713	4/27/2013	Gr. Alpha	20.67 ± 0.40	20.00	10.00 - 30.00	Pass
W-42713	4/27/2013	Gr. Beta	28.44 ± 0.32	30.90	20.90 - 40.90	Pass
WW-2870	5/7/2013	Co-60	166.1 ± 7.4	161.6	145.4 - 177.8	Pass
WW-2870	5/7/2013	Cs-137	161.2 ± 9.3	149.0	134.1 - 163.9	Pass
WW-2870	5/7/2013	H-3	6853 ± 250	6735	5388 - 8082	Pass
W-53113	5/31/2013	Ra-226	16.83 ± 0.41	16.70	11.69 - 21.71	Pass
SPAP-3332	6/19/2013	Am-241	4.60 ± 0.14	4.00	2.40 - 5.60	Pass
SPW-3334	6/19/2013	Th-230	4.36 ± 0.34	4.00	2.40 - 5.60	Pass
SPW-3458	6/24/2013	C-14	3825 ± 13	4736	2842 - 6630	Pass
SPAP-3529	6/27/2013	Cs-134	3.49 ± 1.26	3.30	1.98 - 4.62	Pass
SPAP-3529	6/27/2013	Cs-137	102.0 ± 2.9	101.1	90.99 - 111.21	Pass
SPAP-3531	6/27/2013	Gr. Beta	45.64 ± 0.11	45.42	27.25 - 63.59	Pass
SPF-3533	6/27/2013	Cs-134	1.31 ± 0.14	1.50	0.90 - 2.10	Pass
SPF-3533	6/27/2013	Cs-137	2.77 ± 0.27	2.43	1.46 - 3.40	Pass
SPW-3535	6/27/2013	Ni-63	204.3 ± 3.5	204.8	143.4 - 266.2	Pass
SPW-3537	6/27/2013	Tc-99	104.5 ± 1.7	107.8	75.46 - 140.14	Pass
SPW-3539	6/27/2013	Fe-55	97015 ± 860	90677	72542 - 108812	Pass
SPW-1893	6/28/2013	Ra-228	30.16 - 2.73	30.85	21.60 - 40.11	Pass

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

Lab Code [b]	Date	Analysis	Concentration (pCi/L)[a] Laboratory results 2s, n=1 [c]	Known Activity	Control Limits [d]	Acceptance
SPW-72913S	7/29/2013	Tc-99	126.6 ± 2.2	107.8	75.46 ± 140.14	Pass
SPW-4373	7/31/2013	Cs-134	91.71 ± 6.02	90.94	80.94 ± 100.94	Pass
SPW-4373	7/31/2013	Cs-137	83.05 ± 7.20	76.57	66.57 ± 86.57	Pass
SPW-4373	7/31/2013	Sr-90	39.28 ± 1.77	39.64	31.71 ± 47.57	Pass
SPW-4374	7/31/2013	Sr-90	42.17 ± 1.71	39.64	31.71 ± 47.57	Pass
SPMI-4376	7/31/2013	Cs-134	82.22 - 7.23	90.94	80.94 ± 100.94	Pass
SPMI-4376	7/31/2013	Cs-137	83.31 - 8.29	76.57	66.57 ± 86.57	Pass
SPMI-4376A	7/31/2013	Sr-90	35.00 ± 1.63	39.64	31.71 ± 47.57	Pass
W-73113	7/31/2013	Ra-226	17.61 ± 0.41	16.70	11.69 ± 21.71	Pass
SPS-4514	8/5/2013	Sr-90	78.63 ± 2.95	79.28	63.42 ± 95.14	Pass
W-82013	8/20/2013	Gr. Alpha	21.53 ± 0.45	20.00	10.00 ± 30.00	Pass
W-82013	8/20/2013	Gr. Beta	28.03 ± 0.32	30.90	20.90 ± 40.90	Pass
SPW-1894	8/28/2013	Ra-228	32.49 ± 3.00	30.85	21.60 ± 40.11	Pass
W-90913	9/9/2013	Gr. Alpha	19.08 ± 0.51	20.10	10.05 ± 30.15	Pass
W-90913	9/9/2013	Gr. Beta	32.12 ± 0.35	32.10	22.10 ± 42.10	Pass
WW-5623	10/3/2013	Co-60	157.0 ± 7.0	155.3	139.8 - 170.8	Pass
WW-5623	10/3/2013	Cs-137	156.0 ± 8.8	148.1	133.3 - 162.9	Pass
WW-5623	10/3/2013	H-3	6590 ± 245	6322	5058 - 7586	Pass
WW-5750	10/3/2013	Co-60	87.00 ± 7.80	77.40	77.00 ± 97.00	Pass
WW-5750	10/3/2013	Cs-137	82.30 ± 7.80	78.80	68.80 ± 88.80	Pass
WW-5750	10/3/2013	H-3	6181 ± 238	6322	5058 - 7586	Pass
W-102813	10/28/2013	Ra-226	15.69 ± 0.37	16.70	11.69 ± 21.71	Pass
SPW-1898	12/17/2013	Ra-228	28.15 ± 2.37	30.85	21.60 ± 40.11	Pass
W-122313	12/23/2013	Gr. Alpha	20.96 ± 0.47	20.10	10.05 ± 30.15	Pass
W-122313	12/23/2013	Gr. Beta	31.00 ± 0.34	32.10	22.10 ± 42.10	Pass

[a] Liquid sample results are reported in pCi/Liter, air filters(pCi/m^3), 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
				LLD	Activity[c]	Criteria (4.66 σ)
SPW-67	Water	1/9/2013	Tc-99	1.10	0.69 ± 0.68	10
SPW-190	Water	1/18/2013	Ra-228	0.74	0.66 ± 0.43	2
SPW-1901	Water	1/18/2013	Ra-228	0.74	0.66 ± 0.43	2
SPMI-263	Milk	1/25/2013	Sr-90	0.64	0.31 ± 0.34	1
SPMI-263	Milk	1/25/2013	Sr-90	0.64	0.31 ± 0.34	1
SPW-265	Water	1/25/2013	Co-60	2.86	2.10 ± 1.72	10
SPW-265	Water	1/25/2013	Cs-134	2.98	2.25 ± 1.57	10
SPW-265	Water	1/25/2013	Cs-137	2.71	0.44 ± 1.61	10
SPW-266	Water	1/25/2013	Sr-90	0.72	-0.12 ± 0.32	1
SPAP-375	Air Filter	2/1/2013	Gr. Beta	0.003	0.016 ± 0.003	0.010
SPAP-377	Air Filter	2/1/2013	Co-60	2.31	-0.34 ± 1.75	100
SPAP-377	Air Filter	2/1/2013	Cs-134	2.72	1.22 ± 1.62	100
SPAP-377	Air Filter	2/1/2013	Cs-137	1.50	-0.52 ± 1.80	100
SPW-391	Water	2/1/2013	H-3	92.04	-29.44 ± 69.24	200
SPW-379	Water	2/10/2013	Ni-63	2.11	0.91 ± 1.30	20
W-30413	Water	3/4/2013	Gr. Alpha	0.35	0.08 ± 0.26	1
W-30413	Water	3/4/2013	Gr. Beta	0.73	0.10 ± 0.51	3.2
W-30713	Water	3/7/2013	Ra-226	0.031	0.032 ± 0.024	1
W-42713	Water	4/27/2013	Gr. Alpha	0.45	-0.14 ± 0.30	1
W-42713	Water	4/27/2013	Gr. Beta	0.72	-0.23 ± 0.50	3.2
W-53113	Water	5/31/2013	Ra-226	0.03	0.01 ± 0.02	1
SPW-3335	Water	6/19/2013	Th-230	0.01	0.01 ± 0.01	1
SPW-3459	Water	6/24/2013	C-14	10.89	10.44 ± 6.82	200
SPAP-3528	Air Filter	6/27/2013	Cs-134	2.10	-0.98 ± 1.11	100
SPAP-3528	Air Filter	6/27/2013	Cs-137	2.71	-0.24 ± 1.36	100
SPAP-3530	Air Filter	6/27/2013	Gr. Beta	0.004	0.018 ± 0.003	0.010
SPF-3532	Fish	6/27/2013	Cs-134	8.38	-1.39 ± 5.69	100
SPF-3532	Fish	6/27/2013	Cs-137	8.37	-1.88 ± 6.41	100
SPW-3534	Water	6/27/2013	Ni-63	2.47	-1.04 ± 1.48	20
SPW-3536	Water	6/27/2013	Tc-99	1.15	-1.11 ± 0.68	10
SPW-3538	water	6/27/2013	Fe-55	170.27	-17.50 ± 102.70	1000
SPW-1903	Water	6/28/2013	Ra-228	0.85	-0.02 ± 0.39	2

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

Lab Code	Sample Type	Date	Analysis[b]	Concentration (pCi/L)[a]		
				Laboratory results (4.66σ)		Acceptance
				LLD	Activity[c]	Criteria (4.66 σ)
SPW-72913B	Water	7/29/2013	Tc-99	1.44	-0.33 ± 0.87	10
SPW-4372	Water	7/31/2013	Co-60	1.41	-1.42 ± 3.00	10
SPW-4372	Water	7/31/2013	Cs-134	3.68	-2.66 ± 3.46	10
SPW-4372	Water	7/31/2013	Cs-137	3.53	0.29 ± 3.31	10
SPMI-4375	Milk	7/31/2013	Co-60	3.92	2.65 ± 2.26	10
SPMI-4375	Milk	7/31/2013	Cs-134	4.67	0.68 ± 2.54	10
SPMI-4375	Milk	7/31/2013	Cs-137	4.79	1.30 ± 2.68	10
SPMI-4375	Milk	7/31/2013	Sr-90	0.57	0.32 ± 0.30	1
W-73113	Water	7/31/2013	Ra-226	0.02	0.04 ± 0.02	1
SPS-4515	Powder	8/5/2013	Sr-90	0.09	-0.01 ± 0.04	1
W-82013	Water	8/20/2013	Gr. Alpha	0.42	-0.15 ± 0.28	1
W-82013	Water	8/20/2013	Gr. Beta	0.74	-0.24 ± 0.51	3.2
SPW-1904	Water	8/28/2013	Ra-228	0.96	0.85 ± 0.56	2
CHW-90913	Water	9/9/2013	Gr. Alpha	0.25	0.20 ± 0.29	1
CHW-90913	Water	9/9/2013	Gr. Beta	0.49	-0.18 ± 0.53	3.2
CHW-102013	Water	10/20/2013	Gr. Alpha	0.29	0.24 ± 0.33	1
CHW-102013	Water	10/20/2013	Gr. Beta	0.54	-0.32 ± 0.54	3.2
W-102813	Water	10/28/2013	Ra-226	0.02	0.02 ± 0.01	1
SPW-1908	Water	12/17/2013	Ra-228	0.69	0.55 ± 0.39	2
CHW-122313	Water	12/23/2013	Gr. Alpha	0.25	-0.09 ± 0.26	1
CHW-122313	Water	12/23/2013	Gr. Beta	0.48	0.05 ± 0.53	3.2
CHW-122713	Water	12/27/2013	Gr. Alpha	0.28	0.04 ± 0.31	1
CHW-122713	Water	12/27/2013	Gr. Beta	0.49	-0.33 ± 0.53	3.2

[a] Liquid sample results are reported in pCi/Liter, air filters(pCi/m^3), 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

			Concentration (pCi/L)[a]			
Lab Code	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
CF-41, 42	1/2/2013	Gr. Beta	8.45 ± 0.37	7.90 ± 0.35	8.17 ± 0.26	Pass
CF-41, 42	1/2/2013	Sr-90	0.030 ± 0.015	0.029 ± 0.014	0.030 ± 0.010	Pass
SWT-8243, 8244	1/2/2013	Gr. Beta	1.07 ± 0.54	0.98 ± 0.51	1.03 ± 0.37	Pass
AP-8454, 8455	1/2/2013	Be-7	0.053 ± 0.010	0.042 ± 0.010	0.048 ± 0.007	Pass
AP-8517, 8518	1/3/2013	Be-7	0.051 ± 0.015	0.049 ± 0.017	0.050 ± 0.011	Pass
MI-62, 63	1/8/2013	K-40	1317.70 ± 91.70	1351.90 ± 72.50	1334.80 ± 58.45	Pass
WW-151, 152	1/8/2013	H-3	222.70 ± 81.00	289.70 ± 84.10	256.20 ± 58.38	Pass
SG-107, 108	1/11/2013	Ra-226	55.20 ± 5.53	58.60 ± 5.94	56.90 ± 4.06	Pass
SG-107, 108	1/11/2013	Ra-228	71.60 ± 1.10	74.30 ± 1.70	72.95 ± 1.01	Pass
SG-130, 131	1/14/2013	Ra-226	3.91 ± 0.20	3.45 ± 0.27	3.68 ± 0.17	Pass
SG-130, 131	1/14/2013	Ra-228	2.40 ± 0.33	2.70 ± 0.39	2.55 ± 0.26	Pass
WW-277, 278	1/17/2013	H-3	159.71 ± 77.91	196.57 ± 79.72	178.14 ± 55.73	Pass
WW-256, 257	1/22/2013	H-3	502.70 ± 93.40	483.30 ± 92.60	493.00 ± 65.76	Pass
DW-40010, 40011	1/24/2013	Ra-226	2.55 ± 0.18	2.86 ± 0.20	2.71 ± 0.13	Pass
DW-40010, 40011	1/24/2013	Ra-228	1.78 ± 0.62	2.22 ± 0.62	2.00 ± 0.44	Pass
SWT-361, 362	1/29/2013	Gr. Beta	0.90 ± 0.40	1.01 ± 0.38	0.96 ± 0.28	Pass
DW-484, 485	1/29/2013	Gr. Beta	14.85 ± 1.93	14.81 ± 2.06	14.83 ± 1.41	Pass
S-945, 946	1/29/2013	Cs-137	14.50 ± 0.18	14.45 ± 0.19	14.48 ± 0.13	Pass
S-945, 946	1/29/2013	K-40	7.90 ± 0.74	8.00 ± 0.73	7.95 ± 0.52	Pass
S-340, 341	1/31/2013	Cs-137	0.16 ± 0.05	0.15 ± 0.06	0.15 ± 0.04	Pass
S-340, 341	1/31/2013	K-40	17.35 ± 1.34	19.75 ± 1.25	18.55 ± 0.92	Pass
AP-463, 464	1/31/2013	Be-7	0.27 ± 0.10	0.26 ± 0.10	0.26 ± 0.07	Pass
MI-631, 632	2/13/2013	K-40	1350.50 ± 105.20	1413.70 ± 85.94	1382.10 ± 67.92	Pass
WW-769, 770	2/25/2013	Gr. Beta	1.20 ± 0.33	1.35 ± 0.34	1.28 ± 0.24	Pass
DW-736, 737	2/26/2013	Gr. Beta	1.09 ± 0.54	1.57 ± 0.58	1.33 ± 0.40	Pass
SWU-790, 791	2/26/2013	Gr. Beta	2.68 ± 0.96	2.08 ± 0.95	2.38 ± 0.67	Pass
W-925, 926	2/27/2013	H-3	2265.00 ± 153.00	2329.00 ± 154.00	2297.00 ± 108.54	Pass
AP-1034, 1035	3/7/2013	Be-7	0.17 ± 0.08	0.16 ± 0.09	0.17 ± 0.06	Pass
MI-1076, 1077	3/13/2013	K-40	1347.70 ± 99.32	1396.10 ± 108.00	1371.90 ± 73.36	Pass
CH-1118, 1119	3/14/2013	I-131(G)	109.41 ± 5.69	103.88 ± 7.76	106.65 ± 4.81	Pass
WW-1221, 1222	3/14/2013	H-3	452.11 ± 97.43	403.29 ± 95.46	427.70 ± 68.20	Pass
P-1368, 1369	3/15/2013	H-3	735.24 ± 113.99	666.04 ± 111.41	700.64 ± 79.70	Pass
DW-40017, 40018	3/19/2013	Gr. Alpha	1.43 ± 0.94	1.61 ± 1.00	1.52 ± 0.69	Pass
MI-1473, 1474	4/1/2013	K-40	1618.00 ± 107.00	1767.00 ± 129.00	1692.50 ± 83.80	Pass
AP-2014, 2015	4/1/2013	Be-7	0.055 ± 0.008	0.057 ± 0.006	0.056 ± 0.005	Pass
DW-40023, 40024	4/1/2013	Ra-226	2.29 ± 0.18	2.54 ± 0.20	2.42 ± 0.13	Pass
DW-40023, 40024	4/1/2013	Ra-228	2.99 ± 0.69	2.96 ± 0.67	2.98 ± 0.48	Pass
SWU-736, 737	4/2/2013	Gr. Beta	4.80 ± 0.95	4.43 ± 0.86	4.62 ± 0.64	Pass
AP-2035, 2036	4/2/2013	Be-7	0.070 ± 0.013	0.065 ± 0.013	0.068 ± 0.009	Pass
BS-1680, 1681	4/8/2013	K-40	1995.30 ± 265.70	1992.00 ± 289.40	1993.65 ± 196.44	Pass
SW-1638, 1639	4/9/2013	H-3	1350.77 ± 130.08	1320.45 ± 129.25	1335.61 ± 91.69	Pass

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

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
WW-2394, 2395	4/9/2013	H-3	348.08 ± 88.40	302.43 ± 86.41	325.25 ± 61.81	Pass
DW-40035, 40036	4/12/2013	Ra-226	1.36 ± 0.15	1.29 ± 0.13	1.33 ± 0.10	Pass
DW-40035, 40036	4/12/2013	Ra-228	1.22 ± 0.49	1.38 ± 0.53	1.30 ± 0.36	Pass
MI-1825, 1826	4/15/2013	K-40	1290.20 ± 113.80	1378.60 ± 91.99	1334.40 ± 73.17	Pass
MI-1825, 1826	4/15/2013	Sr-90	0.68 ± 0.32	0.46 ± 0.31	0.57 ± 0.22	Pass
DW-40049, 40050	4/15/2013	Gr. Alpha	1.88 ± 0.69	2.51 ± 0.71	2.20 ± 0.50	Pass
WW-1909, 1910	4/16/2013	H-3	2145.68 ± 156.65	2108.32 ± 155.80	2127.00 ± 110.47	Pass
DW-40064, 40065	4/23/2013	Gr. Alpha	1.95 ± 0.79	1.80 ± 0.81	1.88 ± 0.57	Pass
DW-40066, 40067	4/23/2013	Ra-226	1.98 ± 0.17	1.66 ± 0.16	1.82 ± 0.12	Pass
DW-40066, 40067	4/23/2013	Ra-228	2.30 ± 0.59	2.32 ± 0.59	2.31 ± 0.42	Pass
F-2225, 2226	5/1/2013	K-40	2.81 ± 0.37	2.67 ± 0.39	2.74 ± 0.27	Pass
BS-2267, 2268	5/1/2013	K-40	13.46 ± 0.64	13.59 ± 0.62	13.52 ± 0.45	Pass
SG-2235, 2236	5/2/2013	Ac-228	18.30 ± 0.60	18.50 ± 0.60	18.40 ± 0.42	Pass
SG-2235, 2236	5/2/2013	Gr. Alpha	54.00 ± 3.70	51.90 ± 3.40	52.95 ± 2.51	Pass
SG-2235, 2236	5/2/2013	Pb-214	11.30 ± 0.30	11.20 ± 0.20	11.25 ± 0.18	Pass
AP-2288, 2289	5/2/2013	Be-7	0.19 ± 0.10	0.19 ± 0.08	0.19 ± 0.07	Pass
WW-3091, 3092	5/2/2013	H-3	1107.91 ± 153.49	1263.37 ± 157.43	1185.64 ± 109.94	Pass
SW-2373, 2374	5/8/2013	H-3	324.80 ± 86.81	364.61 ± 88.53	344.71 ± 62.00	Pass
W-2352, 2353	5/9/2013	Ra-226	0.91 ± 0.20	1.29 ± 0.22	1.10 ± 0.15	Pass
W-2352, 2353	5/9/2013	Ra-228	1.28 ± 0.87	1.03 ± 0.94	1.16 ± 0.64	Pass
CF-2499, 2500	5/13/2013	K-40	11.52 ± 0.45	12.55 ± 0.61	12.04 ± 0.38	Pass
F-3987, 3988	5/20/2013	K-40	3.07 ± 0.48	3.05 ± 0.43	3.06 ± 0.32	Pass
BS-4113, 4114	5/20/2013	K-40	8.06 ± 0.44	7.99 ± 0.44	8.02 ± 0.31	Pass
SO-2902, 2903	5/22/2013	Th-228	0.57 ± 0.07	0.51 ± 0.06	0.54 ± 0.05	Pass
SO-2902, 2903	5/22/2013	Th-230	0.39 ± 0.06	0.40 ± 0.05	0.40 ± 0.04	Pass
SO-2902, 2903	5/22/2013	Th-232	0.55 ± 0.07	0.62 ± 0.06	0.59 ± 0.05	Pass
WW-2776, 2777	5/23/2013	H-3	261.76 ± 100.85	283.17 ± 101.68	272.46 ± 71.61	Pass
WW-2818, 2819	5/23/2013	H-3	999.35 ± 126.15	880.63 ± 122.43	939.99 ± 87.90	Pass
S-7271, 7272	5/27/2013	Cs-137	2.82 ± 0.10	2.91 ± 0.09	2.86 ± 0.07	Pass
S-7271, 7272	5/27/2013	K-40	21.52 ± 0.97	21.13 ± 1.02	21.32 ± 0.70	Pass
P-2923, 2924	5/29/2013	H-3	441.31 ± 92.75	374.30 ± 89.94	407.80 ± 64.60	Pass
WW-3133, 3134	6/1/2013	H-3	278.42 ± 86.54	209.45 ± 83.44	243.93 ± 60.11	Pass
WW-3049, 3050	6/5/2013	H-3	156.08 ± 79.16	244.66 ± 83.86	200.37 ± 57.66	Pass
DW-40079, 40080	6/5/2013	Ra-226	6.67 ± 0.30	7.03 ± 0.35	6.85 ± 0.23	Pass
DW-40079, 40080	6/5/2013	Ra-228	5.55 ± 0.75	6.11 ± 0.77	5.83 ± 0.54	Pass
DW-40089, 40090	6/5/2013	Gr. Alpha	6.82 ± 0.90	5.64 ± 1.02	6.23 ± 0.68	Pass
DW-40091, 40092	6/5/2013	Ra-226	3.44 ± 0.19	3.66 ± 0.19	3.55 ± 0.13	Pass
DW-40091, 40092	6/5/2013	Ra-228	3.70 ± 0.68	4.69 ± 0.73	4.20 ± 0.50	Pass
DW-40103, 40104	6/5/2013	Ra-226	0.98 ± 0.22	0.62 ± 0.15	0.80 ± 0.13	Pass
MI-3154, 3155	6/12/2013	K-40	1513.00 ± 128.10	1456.70 ± 110.30	1484.85 ± 84.52	Pass
P-3385, 3386	6/14/2013	H-3	236.88 ± 87.87	242.87 ± 88.14	239.88 ± 62.23	Pass
F-3776, 3777	6/16/2013	Cs-137	0.039 ± 0.015	0.048 ± 0.019	0.044 ± 0.012	Pass
F-3776, 3777	6/16/2013	Gr. Beta	4.52 ± 0.09	4.63 ± 0.09	4.57 ± 0.06	Pass
F-3776, 3777	6/16/2013	K-40	3.40 ± 0.41	3.52 ± 0.39	3.46 ± 0.29	Pass

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

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
S-3238, 3239	6/17/2013	Be-7	1139.80 ± 215.00	1102.00 ± 194.70	1120.90 ± 145.03	Pass
S-3238, 3239	6/17/2013	Cs-134	26.23 ± 13.23	39.91 ± 11.73	33.07 ± 8.84	Pass
S-3238, 3239	6/17/2013	Cs-137	72.75 ± 25.99	85.91 ± 22.58	79.33 ± 17.21	Pass
S-3238, 3239	6/17/2013	K-40	21847.00 ± 656.50	22158.00 ± 622.80	22002.50 ± 452.46	Pass
SO-3343, 3344	6/17/2013	Cs-137	0.087 ± 0.022	0.084 ± 0.017	0.086 ± 0.014	Pass
SO-3343, 3344	6/17/2013	K-40	8.90 ± 0.53	9.47 ± 0.49	9.19 ± 0.36	Pass
DW-40118, 40119	6/26/2013	Gr. Alpha	3.56 ± 1.07	4.51 ± 0.96	4.04 ± 0.72	Pass
DW-40118, 40119	6/26/2013	Ra-226	2.52 ± 0.22	2.48 ± 0.19	2.50 ± 0.15	Pass
DW-40118, 40119	6/26/2013	Ra-228	2.75 ± 0.71	2.86 ± 0.75	2.81 ± 0.52	Pass
WW-3583, 3584	6/27/2013	H-3	6732.57 ± 246.74	6807.94 ± 247.98	6770.26 ± 174.91	Pass
AP-4092, 4093	6/28/2013	Be-7	0.078 ± 0.015	0.083 ± 0.017	0.080 ± 0.011	Pass
E-3608, 3609	7/1/2013	K-40	1.28 ± 0.13	1.29 ± 0.11	1.28 ± 0.09	Pass
MI-3629, 3630	7/1/2013	K-40	1840.70 ± 130.10	1804.90 ± 143.00	1822.80 ± 96.66	Pass
AP-4050, 4051	7/1/2013	Be-7	0.094 ± 0.009	0.093 ± 0.009	0.093 ± 0.006	Pass
DW-40134, 40135	7/1/2013	Ra-226	1.75 ± 0.15	1.56 ± 0.15	1.66 ± 0.11	Pass
DW-40134, 40135	7/1/2013	Ra-228	2.07 ± 0.60	1.61 ± 0.57	1.84 ± 0.41	Pass
AP-4071, 4072	7/3/2013	Be-7	0.066 ± 0.009	0.069 ± 0.011	0.067 ± 0.007	Pass
DW-40144, 40145	7/9/2013	Gr. Alpha	3.66 ± 0.85	2.85 ± 0.79	3.26 ± 0.58	Pass
DW-40146, 40147	7/9/2013	Ra-226	0.70 ± 0.11	0.72 ± 0.11	0.71 ± 0.08	Pass
DW-40146, 40147	7/9/2013	Ra-228	1.00 ± 0.58	0.70 ± 0.52	0.85 ± 0.39	Pass
VE-3818, 3819	7/9/2013	Be-7	0.41 ± 0.11	0.46 ± 0.18	0.43 ± 0.11	Pass
VE-3818, 3819	7/9/2013	K-40	4.67 ± 0.30	4.52 ± 0.43	4.60 ± 0.26	Pass
XW-4646, 4647	7/15/2013	H-3	465.00 ± 111.00	525.00 ± 114.00	495.00 ± 79.56	Pass
WW-4134, 4135	7/16/2013	H-3	315.86 ± 123.54	264.98 ± 121.78	290.42 ± 86.73	Pass
AP-4155, 4156	7/18/2013	Be-7	0.20 ± 0.11	0.16 ± 0.09	0.18 ± 0.07	Pass
MI-4218, 4219	7/22/2013	K-40	1426.80 ± 117.50	1335.70 ± 110.60	1381.25 ± 80.68	Pass
MI-4218, 4219	7/22/2013	Sr-90	0.62 ± 0.32	0.67 ± 0.32	0.65 ± 0.23	Pass
WW-4239, 4240	7/23/2013	H-3	223.71 ± 92.64	221.74 ± 92.56	222.73 ± 65.48	Pass
WW-4394, 4395	7/30/2013	Gr. Alpha	2.63 ± 1.49	2.57 ± 1.11	2.60 ± 0.93	Pass
WW-4394, 4395	7/30/2013	Gr. Beta	3.72 ± 1.17	2.63 ± 1.29	3.18 ± 0.87	Pass
WW-4394, 4395	7/30/2013	H-3	271.50 ± 91.30	297.60 ± 91.50	284.55 ± 64.63	Pass
SWU-4478, 4479	7/30/2013	Gr. Beta	2.07 ± 0.54	2.24 ± 0.55	2.16 ± 0.39	Pass
DW-40159, 40160	7/31/2013	Ra-226	3.39 ± 0.63	2.39 ± 0.45	2.89 ± 0.39	Pass
DW-40159, 40160	7/31/2013	Ra-228	3.29 ± 0.73	2.94 ± 0.68	3.12 ± 0.50	Pass
VE-4436, 4437	8/1/2013	Be-7	0.98 ± 0.21	0.89 ± 0.17	0.94 ± 0.14	Pass
VE-4436, 4437	8/1/2013	K-40	3.95 ± 0.39	3.75 ± 0.31	3.85 ± 0.25	Pass
G-4457, 4458	8/1/2013	Be-7	0.78 ± 0.19	0.67 ± 0.16	0.72 ± 0.12	Pass
G-4457, 4458	8/1/2013	Gr. Beta	6.15 ± 0.14	6.10 ± 0.14	6.13 ± 0.10	Pass
G-4457, 4458	8/1/2013	K-40	4.25 ± 0.36	4.60 ± 0.41	4.42 ± 0.27	Pass
VE-4520, 4521	8/1/2013	K-40	2.20 ± 0.16	2.09 ± 0.17	2.15 ± 0.12	Pass
WW-4772, 4773	8/6/2013	H-3	143.80 ± 86.70	157.80 ± 87.30	150.80 ± 61.52	Pass

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

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
VE-4709, 4710	8/8/2013	Gr. Beta	31.40 ± 1.00	30.70 ± 1.00	31.05 ± 0.71	Pass
VE-4709, 4710	8/8/2013	H-3	1504.00 ± 132.00	1468.00 ± 131.00	1486.00 ± 92.99	Pass
VE-4709, 4710	8/8/2013	U-233/4	0.009 ± 0.002	0.005 ± 0.002	0.007 ± 0.001	Pass
VE-4709, 4710	8/8/2013	U-238	0.005 ± 0.002	0.004 ± 0.001	0.005 ± 0.001	Pass
WW-4562, 4563	8/8/2013	H-3	208.82 ± 105.55	213.13 ± 105.73	210.97 ± 74.70	Pass
SG-4651, 4652	8/13/2013	Gr. Alpha	29.00 ± 3.10	28.80 ± 3.20	28.90 ± 2.23	Pass
SG-4651, 4652	8/13/2013	Gr. Beta	34.10 ± 1.80	34.00 ± 1.80	34.05 ± 1.27	Pass
SG-4651, 4652	8/13/2013	Ra-226	9.00 ± 0.20	8.70 ± 0.20	8.85 ± 0.14	Pass
VE-4835, 4836	8/13/2013	K-40	3.01 ± 0.24	3.08 ± 0.28	3.04 ± 0.19	Pass
WW-4877, 4878	8/14/2013	H-3	217.35 ± 87.57	276.63 ± 90.20	246.99 ± 62.86	Pass
LW-4856, 4857	8/15/2013	Gr. Beta	0.96 ± 0.40	0.94 ± 0.38	0.95 ± 0.28	Pass
W-4982, 4983	8/16/2013	H-3	757.43 ± 112.40	767.56 ± 112.76	762.50 ± 79.60	Pass
VE-4919, 4920	8/19/2013	K-40	4891.90 ± 407.90	4907.40 ± 350.40	4899.65 ± 268.87	Pass
VE-4919, 4920	8/19/2013	Be-7	470.50 ± 159.60	325.10 ± 104.10	397.80 ± 95.27	Pass
DW-40184, 40185	8/19/2013	Ra-228	2.35 ± 0.72	2.53 ± 0.70	2.44 ± 0.50	Pass
DW-40184, 40185	8/19/2013	Ra-228	1.44 ± 0.35	2.30 ± 0.56	1.87 ± 0.33	Pass
AP-5003, 5004	8/22/2013	Be-7	0.23 ± 0.10	0.21 ± 0.10	0.22 ± 0.07	Pass
LW-5229, 5230	8/29/2013	Gr. Beta	1.09 ± 0.86	2.28 ± 0.96	1.69 ± 0.64	Pass
SS-5333, 5334	9/3/2013	Cs-137	89.20 ± 41.60	97.80 ± 34.60	93.50 ± 27.05	Pass
SS-5333, 5334	9/3/2013	K-40	11893.00 ± 681.30	12353.00 ± 778.90	12123.00 ± 517.41	Pass
VE-5313, 5314	9/3/2013	K-40	1.84 ± 0.20	1.85 ± 0.20	1.85 ± 0.14	Pass
VE-5313, 5314	9/3/2013	Gr. Beta	2.38 ± 0.04	2.43 ± 0.04	2.41 ± 0.03	Pass
WW-5617, 5618	9/5/2013	H-3	1987.00 ± 147.00	2094.00 ± 150.00	2040.50 ± 105.01	Pass
AP-5355, 5356	9/5/2013	Be-7	0.22 ± 0.12	0.27 ± 0.14	0.25 ± 0.09	Pass
XW-5694, 5695	9/8/2013	C-14	0.94 ± 0.09	0.78 ± 0.10	0.86 ± 0.07	Pass
VE-5409, 5410	9/9/2013	K-40	3.60 ± 0.26	3.33 ± 0.29	3.46 ± 0.19	Pass
AP-5430, 5431	9/12/2013	Be-7	0.26 ± 0.10	0.26 ± 0.10	0.26 ± 0.07	Pass
MI-5401, 5402	9/12/2013	K-40	1404.60 ± 114.10	1356.10 ± 128.60	1380.35 ± 85.96	Pass
WW-5451, 5452	9/12/2013	H-3	196.66 ± 84.44	200.78 ± 84.64	198.72 ± 59.78	Pass
MI-5484, 5485	9/16/2013	K-40	1398.50 ± 88.93	1364.60 ± 113.30	1381.55 ± 72.02	Pass
WW-5568, 5569	9/17/2013	H-3	274.69 ± 87.95	203.72 ± 84.71	239.20 ± 61.05	Pass
BS-5764, 5765	9/20/2013	Cs-137	0.40 ± 0.03	0.37 ± 0.02	0.39 ± 0.02	Pass
BS-5764, 5765	9/20/2013	K-40	17.97 ± 0.59	17.54 ± 0.55	17.76 ± 0.40	Pass
VE-5638, 5639	9/23/2013	K-40	4.15 ± 0.33	4.46 ± 0.38	4.31 ± 0.25	Pass
WW-5596, 5597	9/23/2013	Gr. Beta	5.97 ± 1.39	5.95 ± 1.45	5.96 ± 1.01	Pass
G-5680, 5681	9/25/2013	Be-7	0.36 ± 0.13	0.35 ± 0.09	0.35 ± 0.08	Pass
G-5680, 5681	9/25/2013	Gr. Beta	3.81 ± 0.11	3.77 ± 0.11	3.79 ± 0.08	Pass
G-5680, 5681	9/25/2013	K-40	3.23 ± 0.32	2.99 ± 0.24	3.11 ± 0.20	Pass
S-5659, 5660	9/26/2013	Ac-228	1.19 ± 0.21	1.06 ± 0.21	1.13 ± 0.15	Pass
S-5659, 5660	9/26/2013	Cs-137	0.13 ± 0.04	0.14 ± 0.05	0.14 ± 0.03	Pass
S-5659, 5660	9/26/2013	K-40	16.08 ± 1.39	16.65 ± 1.46	16.37 ± 1.01	Pass
S-5659, 5660	9/26/2013	Pb-214	0.97 ± 0.15	1.10 ± 0.16	1.04 ± 0.11	Pass
AP-6345, 6346	9/30/2013	Be-7	0.077 ± 0.010	0.081 ± 0.008	0.079 ± 0.006	Pass
AP-6366, 6367	9/30/2013	Be-7	0.078 ± 0.012	0.083 ± 0.014	0.081 ± 0.009	Pass

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

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
DW-5701, 5702	9/30/2013	Gr. Beta	14.48 ± 2.04	13.32 ± 1.84	13.90 ± 1.37	Pass
SG-5722, 5723	9/30/2013	Ra-226	12.41 ± 0.47	11.98 ± 0.59	12.20 ± 0.38	Pass
SG-5722, 5723	9/30/2013	Ra-228	7.84 ± 0.71	8.13 ± 0.97	7.99 ± 0.60	Pass
G-5806, 5807	10/1/2013	Be-7	3.26 ± 0.30	3.11 ± 0.13	3.19 ± 0.16	Pass
G-5806, 5807	10/1/2013	K-40	6.65 ± 0.21	6.68 ± 0.50	6.67 ± 0.27	Pass
SG-5827, 5828	10/1/2013	Ac-228	4.08 ± 0.33	3.92 ± 0.40	4.00 ± 0.26	Pass
SG-5827, 5828	10/1/2013	K-40	2.55 ± 0.65	2.37 ± 0.63	2.46 ± 0.45	Pass
SG-5827, 5828	10/1/2013	Pb-214	3.82 ± 0.17	3.93 ± 0.20	3.88 ± 0.13	Pass
VE-5848, 5849	10/1/2013	K-40	1.62 ± 0.16	1.57 ± 0.14	1.60 ± 0.11	Pass
AP-6408, 6409	10/3/2013	Be-7	0.072 ± 0.015	0.063 ± 0.012	0.068 ± 0.010	Pass
f-5954, 5955	10/3/2013	K-40	2.74 ± 0.36	3.02 ± 0.34	2.88 ± 0.25	Pass
P-6035, 6036	10/7/2013	H-3	198.41 ± 85.00	288.60 ± 89.15	243.51 ± 61.59	Pass
SG-6115, 6116	10/8/2013	Ac-228	5.22 ± 0.50	4.87 ± 0.48	5.05 ± 0.35	Pass
SG-6115, 6116	10/8/2013	K-40	5.61 ± 1.08	6.61 ± 1.04	6.11 ± 0.75	Pass
SG-6115, 6116	10/8/2013	Pb-214	4.29 ± 0.24	4.24 ± 0.20	4.27 ± 0.16	Pass
VE-6136, 6137	10/8/2013	Be-7	0.55 ± 0.18	0.60 ± 0.15	0.58 ± 0.12	Pass
VE-6136, 6137	10/8/2013	K-40	2.78 ± 0.35	2.61 ± 0.33	2.69 ± 0.24	Pass
WW-6198, 6199	10/8/2013	H-3	12973.70 ± 332.60	12757.80 ± 330.00	12865.75 ± 234.27	Pass
VE-6240, 6241	10/9/2013	K-40	14.29 ± 0.29	14.95 ± 0.54	14.62 ± 0.31	Pass
W-5996, 5997	10/9/2013	Gr. Alpha	3.87 ± 1.18	4.07 ± 1.08	3.97 ± 0.80	Pass
W-5996, 5997	10/9/2013	Gr. Beta	9.82 ± 0.85	8.53 ± 0.82	9.18 ± 0.59	Pass
W-5996, 5997	10/9/2013	Ra-228	3.42 ± 1.02	3.39 ± 1.01	3.41 ± 0.72	Pass
DW-40224, 40225	10/11/2013	Ra-226	0.62 ± 0.10	0.76 ± 0.10	0.69 ± 0.07	Pass
DW-40224, 40225	10/11/2013	Ra-228	0.87 ± 0.55	1.00 ± 0.54	0.94 ± 0.39	Pass
WW-6219, 6220	10/11/2013	H-3	455.41 ± 111.54	354.66 ± 107.84	405.03 ± 77.57	Pass
CF-6261, 6262	10/14/2013	Be-7	1.97 ± 0.24	2.06 ± 0.22	2.01 ± 0.16	Pass
CF-6261, 6262	10/14/2013	K-40	11.55 ± 0.56	12.06 ± 0.61	11.80 ± 0.41	Pass
MI-6303, 6304	10/14/2013	K-40	1507.30 ± 110.80	1482.40 ± 110.00	1494.85 ± 78.07	Pass
VE-6534, 6535	10/17/2013	K-40	15.96 ± 0.17	16.16 ± 0.36	16.06 ± 0.20	Pass
S-6471, 6472	10/18/2013	Ac-228	0.94 ± 0.19	0.78 ± 0.18	0.86 ± 0.13	Pass
S-6471, 6472	10/18/2013	K-40	12.82 ± 1.05	12.90 ± 1.17	12.86 ± 0.79	Pass
S-6471, 6472	10/18/2013	Pb-214	0.88 ± 0.11	0.72 ± 0.12	0.80 ± 0.08	Pass
VE-6597, 6598	10/22/2013	K-40	2.46 ± 0.22	2.58 ± 0.20	2.52 ± 0.15	Pass
WW-6576, 6577	10/22/2013	H-3	745.60 ± 110.70	663.30 ± 107.60	704.45 ± 77.19	Pass
LW-6681, 6682	10/29/2013	Gr. Beta	2.00 ± 0.92	2.17 ± 0.98	2.09 ± 0.67	Pass
SWU-6765, 6766	10/29/2013	Gr. Beta	3.07 ± 0.61	2.90 ± 0.65	2.99 ± 0.45	Pass
WW-6849, 6850	10/29/2013	H-3	863.00 ± 113.80	826.60 ± 112.50	844.80 ± 80.01	Pass
MI-6786, 6787	10/30/2013	K-40	1370.60 ± 109.60	1449.20 ± 105.50	1409.90 ± 76.06	Pass
SO-6744, 6745	10/30/2013	Ac-228	0.46 ± 0.11	0.51 ± 0.11	0.48 ± 0.08	Pass
SO-6744, 6745	10/30/2013	Bi-214	0.48 ± 0.10	0.30 ± 0.10	0.39 ± 0.07	Pass
SO-6744, 6745	10/30/2013	Cs-137	0.21 ± 0.04	0.24 ± 0.04	0.23 ± 0.03	Pass
SO-6744, 6745	10/30/2013	Gr. Beta	27.40 ± 1.14	27.44 ± 1.11	27.42 ± 0.80	Pass
SO-6744, 6745	10/30/2013	K-40	14.93 ± 0.88	15.20 ± 0.90	15.07 ± 0.63	Pass
SO-6744, 6745	10/30/2013	Pb-212	0.43 ± 0.04	0.40 ± 0.05	0.42 ± 0.03	Pass
SO-6744, 6745	10/30/2013	Ra-226	1.47 ± 0.35	1.31 ± 0.36	1.39 ± 0.25	Pass
SO-6744, 6745	10/30/2013	Tl-208	0.16 ± 0.04	0.16 ± 0.04	0.16 ± 0.03	Pass

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

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
DW-40238, 40239	10/31/2013	Ra-228	0.94 ± 0.41	1.60 ± 0.55	1.27 ± 0.34	Pass
WW-7018, 7019	11/1/2013	H-3	593.09 ± 104.72	648.69 ± 106.89	620.89 ± 74.82	Pass
CF-6870, 6871	11/4/2013	K-40	12.67 ± 0.49	13.30 ± 0.47	12.98 ± 0.34	Pass
XW-6828, 6829	11/4/2013	K-40	97.99 ± 55.33	160.21 ± 74.99	129.10 ± 46.60	Pass
BS-6891, 6892	11/5/2013	Cs-137	0.018 ± 0.010	0.018 ± 0.009	0.018 ± 0.007	Pass
BS-6891, 6892	11/5/2013	Gr. Beta	12.41 ± 1.74	9.97 ± 1.57	11.19 ± 1.17	Pass
BS-6891, 6892	11/5/2013	K-40	6.49 ± 0.33	6.28 ± 0.40	6.39 ± 0.26	Pass
WW-6912, 6913	11/5/2013	Gr. Alpha	2.87 ± 1.30	4.46 ± 1.47	3.67 ± 0.98	Pass
WW-6912, 6913	11/5/2013	Gr. Beta	3.18 ± 0.87	3.18 ± 0.87	3.18 ± 0.62	Pass
WW-6912, 6913	11/5/2013	H-3	349.01 ± 101.42	430.14 ± 98.06	389.58 ± 70.54	Pass
SO-6954, 6955	11/6/2013	Cs-137	0.14 ± 0.03	0.12 ± 0.02	0.13 ± 0.02	Pass
SO-6954, 6955	11/6/2013	K-40	15.16 ± 0.72	14.11 ± 0.64	14.64 ± 0.48	Pass
S-6976, 6977	11/13/2013	K-40	22.36 ± 0.69	22.62 ± 0.72	22.49 ± 0.50	Pass
DW-40246, 40247	11/15/2013	Gr. Alpha	15.00 ± 3.41	20.31 ± 4.00	17.65 ± 2.63	Pass
CF-7102, 7103	11/18/2013	Be-7	17.79 ± 0.51	18.09 ± 0.80	17.94 ± 0.48	Pass
DW-40250, 40251	11/18/2013	Ra-226	27.77 ± 2.84	26.15 ± 2.67	26.96 ± 1.95	Pass
DW-40250, 40251	11/18/2013	Ra-228	7.91 ± 0.94	6.32 ± 0.84	7.12 ± 0.63	Pass
WW-7164, 7165	11/19/2013	H-3	266.90 ± 91.10	268.90 ± 91.20	267.90 ± 64.45	Pass
SS-7334, 7335	11/20/2013	K-40	15.51 ± 0.72	14.14 ± 0.80	14.83 ± 0.54	Pass
WW-7558, 7559	11/22/2013	H-3	229.86 ± 83.89	191.77 ± 82.05	210.82 ± 58.67	Pass
LW-7292, 7293	11/26/2013	Gr. Beta	1.92 ± 0.75	2.38 ± 0.77	2.15 ± 0.54	Pass
W-7229, 7230	12/1/2013	Ra-226	0.87 ± 0.23	0.88 ± 0.25	0.88 ± 0.17	Pass
W-7229, 7230	12/1/2013	Ra-228	3.00 ± 0.98	3.27 ± 1.16	3.14 ± 0.76	Pass
SG-7313, 7314	12/2/2013	Ac-228	6.33 ± 0.23	6.69 ± 0.30	6.51 ± 0.19	Pass
SG-7313, 7314	12/2/2013	K-40	5.47 ± 0.61	6.24 ± 0.74	5.86 ± 0.48	Pass
SG-7313, 7314	12/2/2013	Pb-214	5.60 ± 0.14	5.37 ± 0.16	5.49 ± 0.11	Pass
W-7432, 7433	12/4/2013	Gr. Beta	5.35 ± 1.20	3.89 ± 1.23	4.62 ± 0.86	Pass
WW-7516, 7517	12/10/2013	H-3	369.30 ± 95.64	269.22 ± 91.35	319.26 ± 66.13	Pass
SG-7579, 7580	12/20/2013	Ra-226	3.72 ± 0.11	3.85 ± 0.30	3.79 ± 0.16	Pass
SG-7579, 7580	12/20/2013	Ra-228	2.38 ± 0.18	2.77 ± 0.44	2.58 ± 0.24	Pass
LW-7684, 7685	12/23/2013	Gr. Beta	0.84 ± 0.51	1.96 ± 0.61	1.40 ± 0.40	Pass
DW-40261, 40262	12/27/2013	Ra-226	0.54 ± 0.10	0.67 ± 0.10	0.61 ± 0.07	Pass
DW-40261, 40262	12/27/2013	Ra-228	1.09 ± 0.51	1.12 ± 0.43	1.11 ± 0.33	Pass
SWU-7663, 7664	12/30/2013	Gr. Beta	2.85 ± 0.71	3.88 ± 0.77	3.37 ± 0.52	Pass

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

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

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

			Concentration [a]			
Lab Code [b]	Date	Analysis	Laboratory result	Known Activity	Control Limits [c]	Acceptance
MAAP-738	02/01/13	Am-241	0.10 ± 0.02	0.10	0.07 - 0.14	Pass
MAAP-738	02/01/13	Co-57	2.58 ± 0.06	2.36	1.65 - 3.07	Pass
MAAP-738	02/01/13	Co-60	0.01 ± 0.03	0.00	NA [c]	Pass
MAAP-738	02/01/13	Cs-134	1.82 ± 0.13	1.78	1.25 - 2.31	Pass
MAAP-738	02/01/13	Cs-137	2.93 ± 0.10	2.60	1.82 - 3.38	Pass
MAAP-738	02/01/13	Mn-54	4.87 ± 0.13	4.26	2.98 - 5.54	Pass
MAAP-738	02/01/13	Pu-238	0.12 ± 0.02	0.13	0.09 - 0.17	Pass
MAAP-738	02/01/13	Pu-239/40	0.11 ± 0.02	0.12	0.09 - 0.16	Pass
MAAP-738	02/01/13	Sr-90	1.39 ± 0.14	1.49	1.04 - 1.94	Pass
MAAP-738	02/01/13	U-233/4	0.03 ± 0.01	0.03	0.02 - 0.04	Pass
MAAP-738	02/01/13	U-238	0.23 ± 0.03	0.23	0.16 - 0.30	Pass
MAAP-738	02/01/13	Zn-65	3.84 ± 0.20	3.13	2.19 - 4.07	Pass
MAAP-738 [e]	02/01/13	Gr. Alpha	0.14 ± 0.03	1.20	0.36 - 2.04	Fail
MAAP-738	02/01/13	Gr. Beta	0.93 ± 0.06	0.85	0.43 - 1.28	Pass
MAW-806	02/01/13	Am-241	0.71 ± 0.08	0.69	0.48 - 0.90	Pass
MAW-806	02/01/13	Co-57	31.20 ± 0.40	30.90	21.60 - 40.20	Pass
MAW-806	02/01/13	Co-60	19.70 ± 0.30	16.56	13.69 - 25.43	Pass
MAW-806	02/01/13	Cs-134	23.20 ± 0.50	24.40	17.10 - 31.70	Pass
MAW-806	02/01/13	Cs-137	0.03 ± 0.12	0.00	NA [c]	Pass
MAW-806	02/01/13	Fe-55	34.00 ± 3.30	44.00	30.80 - 57.20	Pass
MAW-806	02/01/13	H-3	511.60 ± 12.50	507.00	355.00 - 659.00	Pass
MAW-806	02/01/13	K-40	2.20 ± 0.90	0.00	NA [c]	Pass
MAW-806	02/01/13	Mn-54	27.60 ± 0.50	27.40	19.20 - 35.60	Pass
MAW-806	02/01/13	Ni-63	34.30 ± 2.80	33.40	23.40 - 43.40	Pass
MAW-806	02/01/13	Pu-238	0.83 ± 0.10	0.88	0.62 - 1.15	Pass
MAW-806	02/01/13	Pu-239/40	0.02 ± 0.02	0.01	NA [d]	Pass
MAW-806	02/01/13	Sr-90	9.30 ± 0.80	10.50	7.40 - 13.70	Pass
MAW-806	02/01/13	Tc-99	10.25 ± 0.40	13.10	9.20 - 17.00	Pass
MAW-806	02/01/13	U-233/4	0.31 ± 0.05	0.32	0.22 - 0.41	Pass
MAW-806	02/01/13	U-238	1.91 ± 0.13	1.95	1.37 - 2.54	Pass
MAW-806	02/01/13	Zn-65	31.60 ± 0.80	30.40	21.30 - 39.50	Pass
MAW-811	02/01/13	Gr. Alpha	1.87 ± 0.09	2.31	0.69 - 3.93	Pass
MAW-811	02/01/13	Gr. Beta	13.04 ± 0.13	13.00	6.50 - 19.50	Pass
MAW-811	02/01/13	I-129	4.60 ± 0.19	6.06	4.24 - 7.88	Pass

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

			Concentration [a]			
Lab Code [b]	Date	Analysis	Laboratory result	Known Activity	Control Limits [c]	Acceptance
MASO-739	02/01/13	Am-241	106.90 ± 11.40	113.00	79.00 - 147.00	Pass
MASO-739	02/01/13	Co-57	0.60 ± 0.50	0.00	NA [c]	Pass
MASO-739	02/01/13	Co-60	739.20 ± 28.50	691.00	484.00 - 898.00	Pass
MASO-739	02/01/13	Cs-134	863.30 ± 34.10	887.00	621.00 - 1153.00	Pass
MASO-739	02/01/13	Cs-137	661.80 ± 25.70	587.00	411.00 - 763.00	Pass
MASO-739	02/01/13	K-40	745.80 ± 33.30	625.30	437.70 - 812.90	Pass
MASO-739	02/01/13	Mn-54	1.10 ± 1.00	0.00	NA [c]	Pass
MASO-739	02/01/13	Zn-65	1109.60 ± 44.10	995.00	697.00 - 1294.00	Pass
MASO-744	02/01/13	Ni-63	682.60 ± 16.80	670.00	469.00 - 871.00	Pass
MASO-744	02/01/13	Pu-238	0.20 ± 0.90	0.52	NA [d]	Pass
MASO-744	02/01/13	Pu-239/40	88.30 ± 9.00	79.50	55.70 - 103.40	Pass
MASO-744 [f]	02/01/13	Sr-90	408.40 ± 14.00	628.00	440.00 - 816.00	Fail
MASO-744	02/01/13	Tc-99	380.50 ± 16.80	444.00	311.00 - 577.00	Pass
MASO-744	02/01/13	U-233/4	53.20 ± 4.80	62.50	43.80 - 81.30	Pass
MASO-744	02/01/13	U-238	242.10 ± 10.20	281.00	197.00 - 365.00	Pass
MAVE-747	02/01/13	Co-57	10.37 ± 0.17	8.68	6.08 - 11.28	Pass
MAVE-747	02/01/13	Co-60	6.48 ± 0.17	5.85	4.10 - 7.61	Pass
MAVE-747	02/01/13	Cs-134	0.02 ± 0.04	0.00	NA [c]	Pass
MAVE-747	02/01/13	Cs-137	7.79 ± 0.21	6.87	4.81 - 8.93	Pass
MAVE-747	02/01/13	Mn-54	0.00 ± 0.05	0.00	NA [c]	Pass
MAVE-747	02/01/13	Zn-65	7.29 ± 0.33	6.25	4.38 - 8.13	Pass
MASO-5043	08/01/13	Am-241	1.40 ± 1.70	0.00	NA [c]	Pass
MASO-5043 [g]	08/01/13	Co-57	699.60 ± 3.90	0.00	NA [c]	Fail
MASO-5043	08/01/13	Cs-134	1191.70 ± 23.00	1172.00	820.00 - 1524.00	Pass
MASO-5043	08/01/13	Cs-137	1072.00 ± 5.10	977.00	684.00 - 1270.00	Pass
MASO-5043	08/01/13	K-40	760.00 ± 16.20	633.00	443.00 - 823.00	Pass
MASO-5043	08/01/13	Mn-54	753.80 ± 4.90	674.00	472.00 - 876.00	Pass
MASO-5043	08/01/13	Ni-63	560.00 ± 23.70	571.00	400.00 - 742.00	Pass
MASO-5043	08/01/13	Pu-238	68.40 ± 7.50	61.50	43.10 - 80.00	Pass
MASO-5043	08/01/13	Pu-239/40	0.40 ± 0.80	0.36	NA [d]	Pass
MASO-5043	08/01/13	Sr-90	383.90 ± 14.50	460.00	322.00 - 598.00	Pass
MASO-5043	08/01/13	Tc-99	-1.00 ± 10.50	0.00	NA [c]	Pass
MASO-5043	08/01/13	U-233/4	23.80 ± 3.30	30.00	21.00 - 39.00	Pass
MASO-5043	08/01/13	U-238	26.80 ± 3.50	34.00	23.80 - 44.20	Pass
MASO-5043	08/01/13	Zn-65	-351.50 ± 5.50	0.00	NA [c]	Pass

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

			Concentration [a]			
Lab Code [b]	Date	Analysis	Laboratory result	Known Activity	Control Limits [c]	Acceptance
MAW-5052	08/01/13	I-129	2.75 ± 0.20	3.79	2.65 - 4.93	Pass
MAW-5094	08/01/13	Am-241	0.00 ± 0.01	0.00	NA [c]	Pass
MAW-5094	08/01/13	Co-57	0.01 ± 0.09	0.00	NA [c]	Pass
MAW-5094	08/01/13	Co-60	23.20 ± 0.32	23.58	16.51 - 30.65	Pass
MAW-5094	08/01/13	Cs-134	27.60 ± 0.58	30.40	21.00 - 39.00	Pass
MAW-5094	08/01/13	Cs-137	32.31 ± 0.52	31.60	22.10 - 41.10	Pass
MAW-5094	08/01/13	Fe-55	39.20 ± 3.50	53.30	37.30 - 69.30	Pass
MAW-5094	08/01/13	Gr. Alpha	0.54 ± 0.05	0.70	0.21 - 1.19	Pass
MAW-5094	08/01/13	Gr. Beta	5.85 ± 0.09	5.94	2.97 - 8.91	Pass
MAW-5094	08/01/13	H-3	1.20 ± 3.00	0.00	NA [c]	Pass
MAW-5094	08/01/13	K-40	2.22 ± 0.90	0.00	NA [c]	Pass
MAW-5094	08/01/13	Mn-54	0.01 ± 0.11	0.00	NA [c]	Pass
MAW-5094	08/01/13	Ni-63	21.80 ± 3.30	26.40	18.50 - 34.30	Pass
MAW-5094	08/01/13	Pu-238	1.30 ± 0.11	1.22	0.85 - 1.58	Pass
MAW-5094	08/01/13	Pu-239/40	0.98 ± 0.09	1.00	0.70 - 1.30	Pass
MAW-5094	08/01/13	Sr-90	6.40 ± 0.60	7.22	5.05 - 9.39	Pass
MAW-5094	08/01/13	Tc-99	13.10 ± 0.70	16.20	11.30 - 21.10	Pass
MAW-5094	08/01/13	U-233/4	0.08 ± 0.02	0.07	NA [d]	Pass
MAW-5094	08/01/13	U-238	0.03 ± 0.01	0.03	NA [d]	Pass
MAW-5094	08/01/13	Zn-65	35.30 ± 0.90	34.60	24.20 - 45.00	Pass
MAVE-5046	08/01/13	Co-57	0.01 ± 0.03	0.00	NA [c]	Pass
MAVE-5046	08/01/13	Co-60	0.00 ± 0.04	0.00	NA [c]	Pass
MAVE-5046	08/01/13	Cs-134	5.71 ± 0.23	5.20	3.64 - 6.76	Pass
MAVE-5046	08/01/13	Cs-137	7.64 ± 0.20	6.60	4.62 - 8.58	Pass
MAVE-5046	08/01/13	Mn-54	9.08 ± 0.24	7.88	5.52 - 10.24	Pass
MAVE-5046	08/01/13	Zn-65	2.92 ± 0.25	2.63	1.84 - 3.42	Pass

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

			Concentration [a]			
Lab Code [b]	Date	Analysis	Laboratory result	Known Activity	Control Limits [c]	Acceptance
MAAP-5046	08/01/13	Am-241	0.01 ± 0.02	0.00	NA [c]	Pass
MAAP-5046	08/01/13	Co-57	3.48 ± 0.14	3.40	1.90 - 3.50	Pass
MAAP-5046	08/01/13	Co-60	2.44 ± 0.08	3.40	1.60 - 3.00	Pass
MAAP-5046	08/01/13	Cs-134	0.01 ± 0.03	0.00	NA [c]	Pass
MAAP-5046	08/01/13	Cs-137	3.09 ± 0.13	2.70	1.90 - 3.50	Pass
MAAP-5046	08/01/13	Gr. Alpha	0.28 ± 0.04	0.90	0.27 - 1.53	Pass
MAAP-5046	08/01/13	Gr. Beta	1.90 ± 0.08	1.63	0.82 - 2.45	Pass
MAAP-5046	08/01/13	Mn-54	3.95 ± 0.12	3.50	2.50 - 4.60	Pass
MAAP-5046	08/01/13	Pu-238	0.14 ± 0.028	0.12	0.087 - 0.16	Pass
MAAP-5046	08/01/13	Pu-239/40	0.10 ± 0.022	0.092	0.064 - 0.12	Pass
MAAP-5046	08/01/13	Sr-90	1.69 ± 4.10	1.81	1.27 - 2.35	Pass
MAAP-5046 [h]	08/01/13	U-233/4	0.04 ± 0.01	0.03	0.02 - 0.04	Fail
MAAP-5046	08/01/13	U-238	0.19 ± 0.027	0.21	0.14 - 0.27	Pass
MAAP-5046	08/01/13	Zn-65	3.27 ± 0.18	2.70	2.50 - 4.60	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] Provided in the series for "sensitivity evaluation". MAPEP does not provide control limits.

[e] The filter was recounted overnight, no significant alpha activity could be detected.

[f] The sample was reanalyzed using additional fuming nitric separations. Result of reanalysis: 574.4 ± 35.2 Bq/kg.

[g] Interference from Eu-152 resulted in misidentification of Co-57.

[h] Result of repeat analysis: 0.031 ± 0.013 pCi/filter.

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

Lab Code [b]	Date	Analysis	Concentration (pCi/L) [b] Laboratory Result [c]	ERA Result [d]	Control Limits	Acceptance
ERAP-1174	03/18/13	Am-241	65.2 ± 4.4	66.8	41.2 - 90.4	Pass
ERAP-1174	03/18/13	Co-60	226.5 ± 4.1	214.0	166.0 - 267.0	Pass
ERAP-1174	03/18/13	Cs-134	1101.2 ± 23.6	1110.0	706.0 - 1380.0	Pass
ERAP-1174	03/18/13	Cs-137	1065.6 ± 21.4	940.0	706.0 - 1230.0	Pass
ERAP-1174	03/18/13	Fe-55	178.8 ± 88.0	225.0	69.8 - 440.0	Pass
ERAP-1174	03/18/13	Mn-54	< 3.1	0.0	0.0 - 50.0	Pass
ERAP-1174	03/18/13	Pu-238	50.0 ± 3.0	51.1	34.3 - 65.9	Pass
ERAP-1174	03/18/13	Pu-239/40	65.7 ± 2.6	65.2	47.2 - 85.2	Pass
ERAP-1174	03/18/13	U-233/4	54.0 ± 2.5	59.4	36.8 - 89.6	Pass
ERAP-1174	03/18/13	U-238	55.6 ± 2.6	58.9	38.1 - 81.4	Pass
ERAP-1174	03/18/13	Uranium	112.0 ± 5.6	121.0	67.0 - 184.0	Pass
ERAP-1174	03/18/13	Zn-65	236.6 ± 13.8	199.0	142.0 - 275.0	Pass
ERAP-1175	03/18/13	Gr. Alpha	52.3 ± 2.8	42.3	14.2 - 65.7	Pass
ERAP-1175	03/18/13	Gr. Beta	36.2 ± 2.0	25.1	15.9 - 36.6	Pass
ERSO-1176	03/18/13	Am-241	293.1 ± 97.4	229.0	134.0 - 297.0	Pass
ERSO-1176	03/18/13	Pu-238	909.0 ± 180.0	788.0	474.0 - 1090.0	Pass
ERSO-1176	03/18/13	Pu-239/40	432.0 ± 120.0	366.0	239.0 - 506.0	Pass
ERSO-1176	03/18/13	Sr-90	8050.8 ± 376.0	8530.0	3250.0 - 13500.0	Pass
ERSO-1176	03/18/13	U-233/4	1662.6 ± 150.0	1920.0	1170.0 - 2460.0	Pass
ERSO-1176	03/18/13	U-238	1682.8 ± 160.0	1900.0	1180.0 - 2410.0	Pass
ERSO-1176	03/18/13	Uranium	3404.0 ± 330.5	3920.0	2130.0 - 5170.0	Pass
ERSO-1176	03/18/13	Ac-228	1335.0 ± 132.0	1240.0	795.0 - 1720.0	Pass
ERSO-1176	03/18/13	Bi-212	1420.0 ± 311.0	1240.0	330.0 - 1820.0	Pass
ERSO-1176	03/18/13	Bi-214	2626.0 ± 60.0	3660.0	2200.0 - 5270.0	Pass
ERSO-1176	03/18/13	Co-60	7951.0 ± 45.4	7920.0	5360.0 - 10900.0	Pass
ERSO-1176	03/18/13	Cs-134	5785.0 ± 51.0	6370.0	4160.0 - 7650.0	Pass
ERSO-1176	03/18/13	Cs-137	6106.0 ± 47.9	6120.0	4690.0 - 7870.0	Pass
ERSO-1176	03/18/13	K-40	11756.0 ± 284.3	10300.0	7520.0 - 13800.0	Pass
ERSO-1176	03/18/13	Mn-54	< 28.0	0.0	0.0 - 1000.0	Pass
ERSO-1176	03/18/13	Pb-212	1096.0 ± 29.1	1240.0	812.0 - 1730.0	Pass
ERSO-1176	03/18/13	Pb-214	2875.0 ± 60.0	3660.0	2140.0 - 5460.0	Pass
ERSO-1176	03/18/13	Th-234	2404.0 ± 218.3	1900.0	601.0 - 3570.0	Pass
ERSO-1176	03/18/13	Zn-65	1542.0 ± 56.4	1400.0	1110.0 - 1860.0	Pass

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

Lab Code [b]	Date	Analysis	Concentration (pCi/L) [b] Laboratory Result [c]	ERA Result [d]	Control Limits	Acceptance
ERVE-1180	03/18/13	Am-241	569.8 ± 81.7	553.0	338.0 - 735.0	Pass
ERVE-1180	03/18/13	Cm-244	1260.9 ± 107.3	1340.0	657.0 - 2090.0	Pass
ERVE-1180	03/18/13	Co-60	2130.5 ± 48.0	1920.0	1320.0 - 2680.0	Pass
ERVE-1180	03/18/13	Cs-134	1296.5 ± 68.0	1240.0	797.0 - 1610.0	Pass
ERVE-1180	03/18/13	Cs-137	600.1 ± 34.3	544.0	394.0 - 757.0	Pass
ERVE-1180	03/18/13	K-40	34078.0 ± 787.0	31900.0	23000.0 - 44800.0	Pass
ERVE-1180	03/18/13	Mn-54	< 28.7	0.0	0.0 - 300.0	Pass
ERVE-1180	03/18/13	Pu-238	2476.5 ± 259.4	1980.0	1180.0 - 2710.0	Pass
ERVE-1180	03/18/13	Pu-239/40	2659.3 ± 273.2	2260.0	1390.0 - 3110.0	Pass
ERVE-1180	03/18/13	Sr-90	3809.7 ± 420.5	3840.0	2190.0 - 5090.0	Pass
ERVE-1180	03/18/13	U-233/4	2460.6 ± 205.0	2460.0	1620.0 - 3160.0	Pass
ERVE-1180	03/18/13	U-238	2319.1 ± 189.6	2440.0	1630.0 - 3100.0	Pass
ERVE-1180	03/18/13	Uranium	4866.3 ± 375.6	5010.0	3390.0 - 6230.0	Pass
ERVE-1180	03/18/13	Zn-65	1052.5 ± 82.1	878.0	633.0 - 1230.0	Pass
ERW-1184	03/18/13	Am-241	114.5 ± 8.1	118.0	79.5 - 158.0	Pass
ERW-1184	03/18/13	Co-60	2221.8 ± 17.0	2270.0	1970.0 - 2660.0	Pass
ERW-1184	03/18/13	Cs-134	1309.4 ± 58.4	1400.0	1030.0 - 1610.0	Pass
ERW-1184	03/18/13	Cs-137	1865.9 ± 22.0	1880.0	1600.0 - 2250.0	Pass
ERW-1184	03/18/13	Fe-55	503.1 ± 105.0	712.0	424.0 - 966.0	Pass
ERW-1184	03/18/13	Mn-54	< 9.4	0.0	0.0 - 100.0	Pass
ERW-1184	03/18/13	Pu-238	98.4 ± 5.6	98.8	73.1 - 123.0	Pass
ERW-1184	03/18/13	Pu-239/40	184.5 ± 7.7	185.0	144.0 - 233.0	Pass
ERW-1184	03/18/13	Sr-90	125.7 ± 6.0	137.0	89.2 - 181.0	Pass
ERW-1184	03/18/13	U-233/4	44.9 ± 3.4	48.8	36.7 - 62.9	Pass
ERW-1184	03/18/13	U-238	46.5 ± 3.5	48.4	36.9 - 59.4	Pass
ERW-1184	03/18/13	Uranium	93.3 ± 7.1	99.5	73.1 - 129.0	Pass
ERW-1184	03/18/13	Zn-65	412.8 ± 32.0	384.0	320.0 - 484.0	Pass
ERW-1186	03/18/13	Gr. Alpha	109.1 ± 5.7	130.0	46.2 - 201.0	Pass
ERW-1186	03/18/13	Gr. Beta	74.5 ± 6.4	78.9	45.2 - 117.0	Pass
ERW-1188	03/18/13	H-3	12279.0 ± 319.0	12300.0	8240.0 - 17500.0	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.

APPENDIX B. DATA REPORTING CONVENTIONS

Data Reporting Conventions

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

2.0. Single Measurements

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

where: x = value of the measurement;

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

In cases where the activity is less than the lower limit of detection L, it is reported as: < L, where L = the lower limit of detection based on 4.66σ uncertainty for a background sample.

3.0. Duplicate analyses

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

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

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

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

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

4.0. Computation of Averages and Standard Deviations

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

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

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

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

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

4.5 In rounding off, the following rules are followed:

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

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

APPENDIX C

Table C-1. Maximum permissible concentrations of radioactivity in air and water above natural background in unrestricted areas[a].

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

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

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

[c] A natural radionuclide.

APPENDIX D

Sampling Location Maps

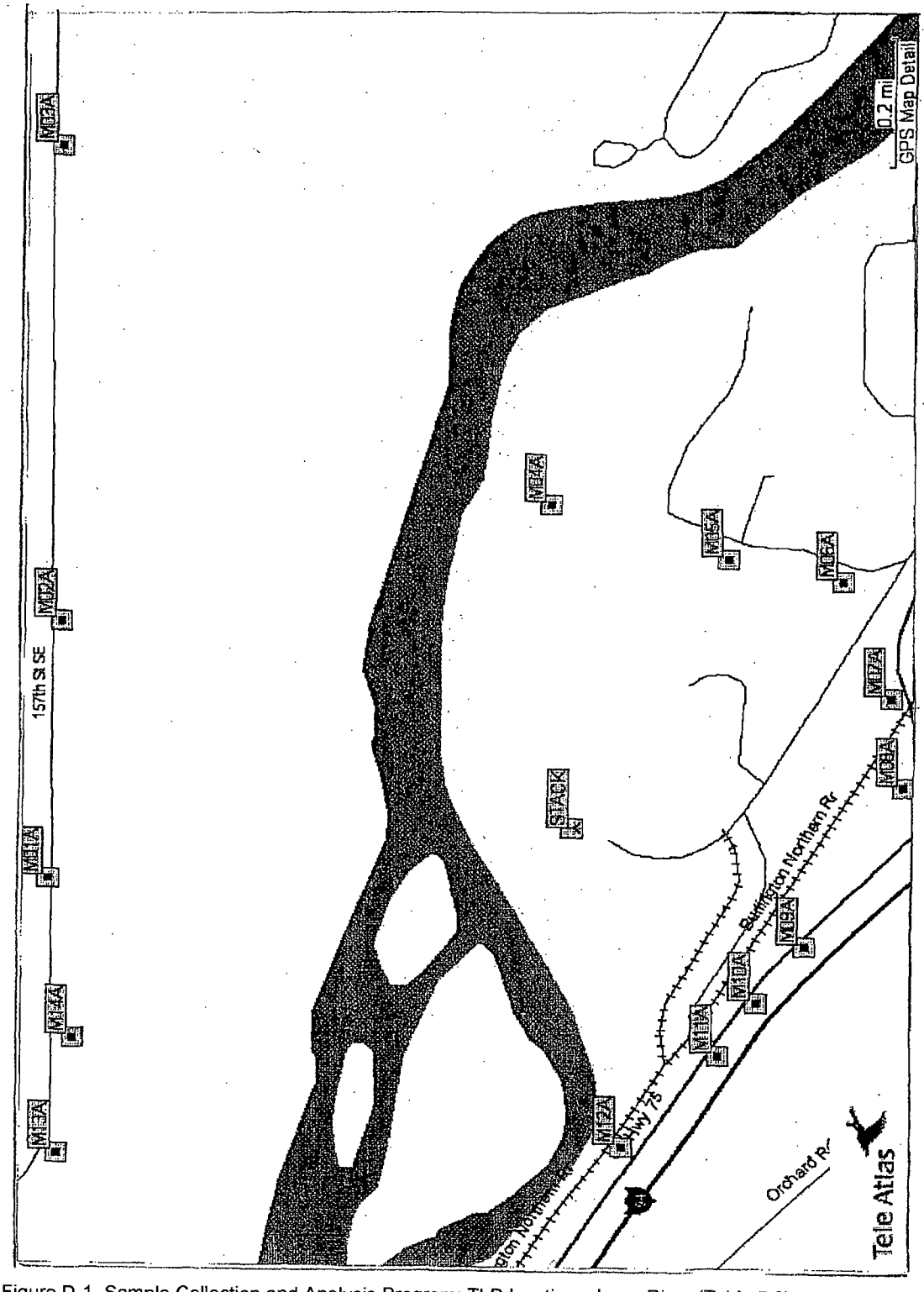

Figure D-1, Sample Collection and Analysis Program: TLD locations, Inner Ring. (Table 5.2)

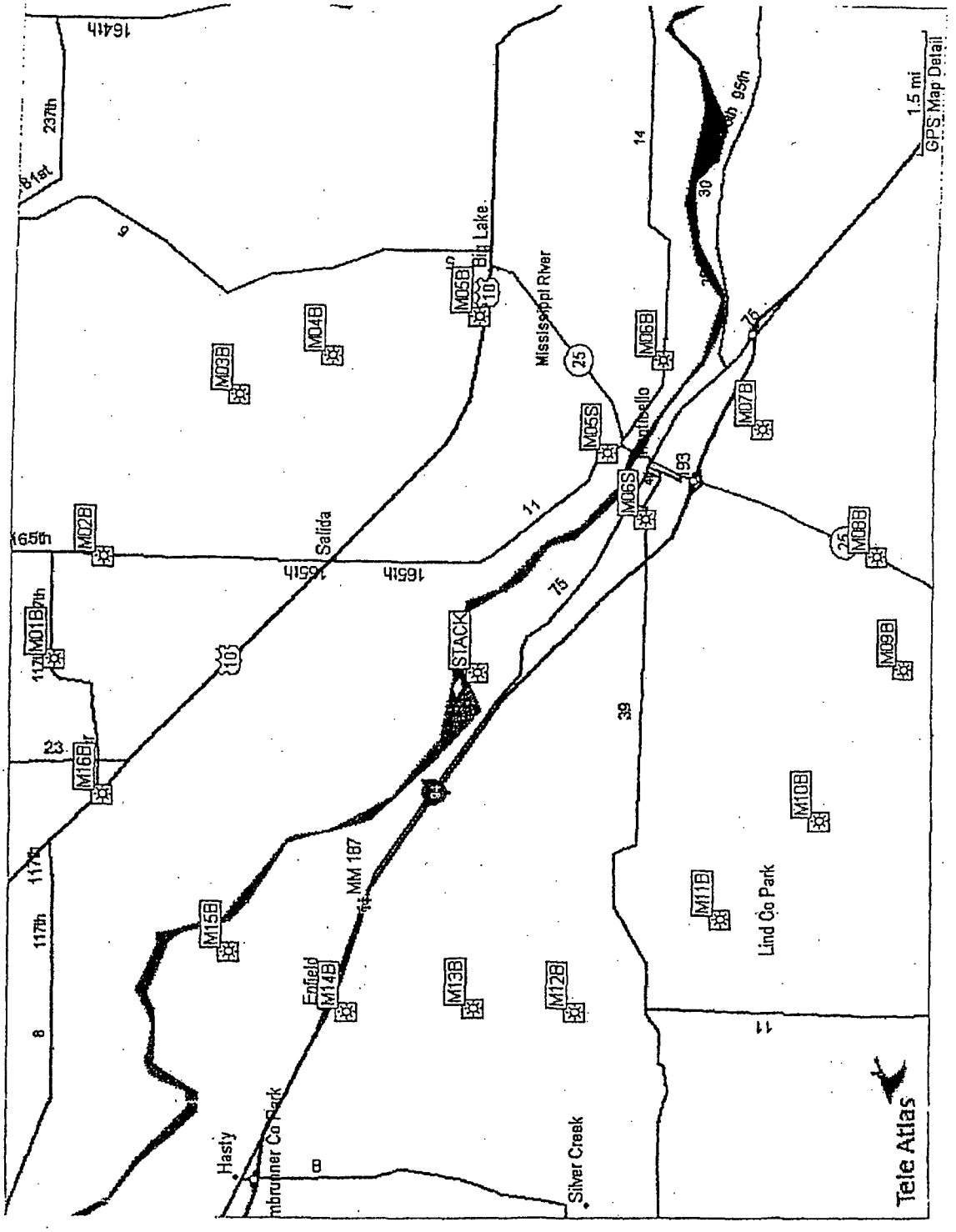

Figure D-2, Sample Collection and Analysis Program: TLD locations, Outer Ring. (Table 5.2)

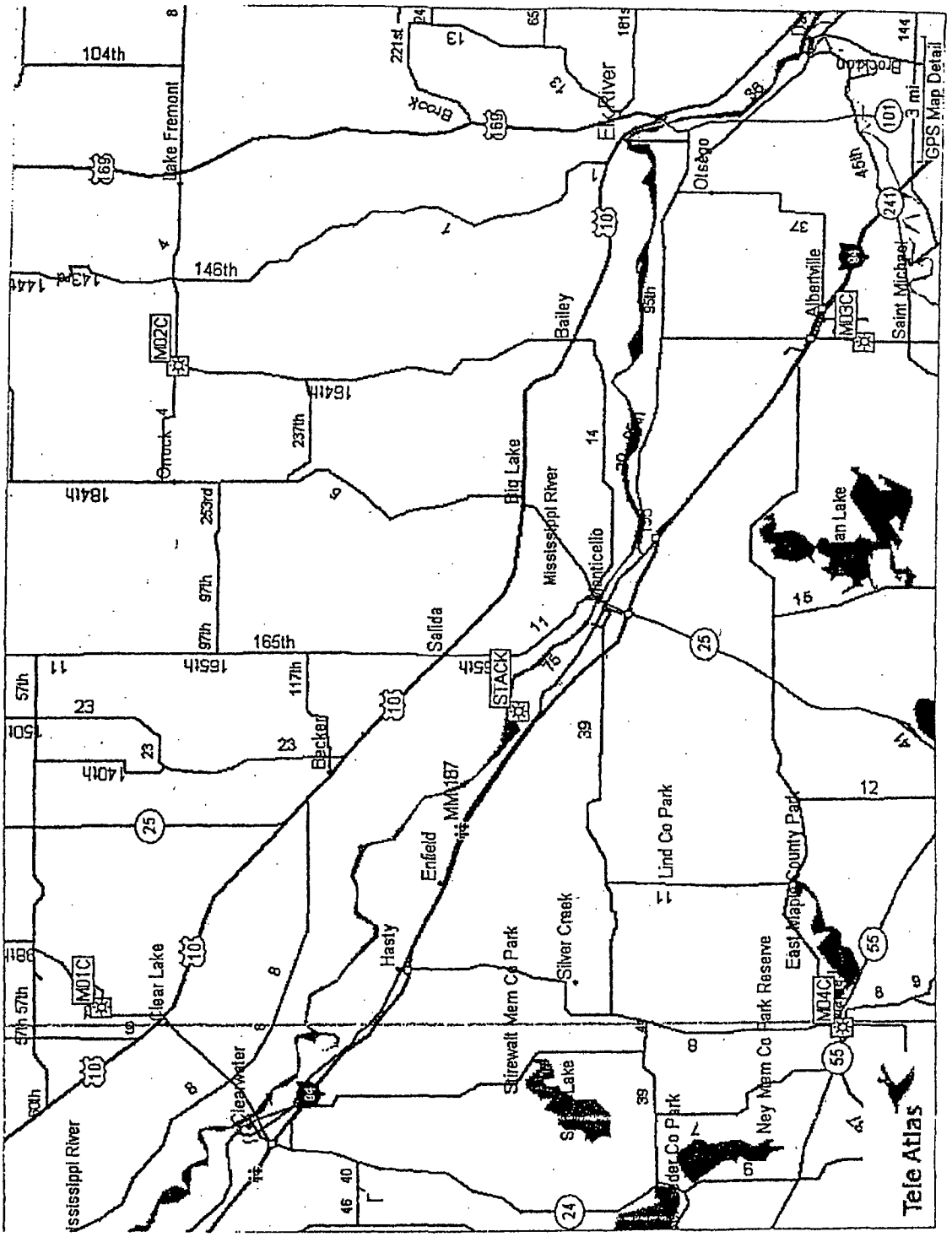

Figure D-3, Sample Collection and Analysis Program: TLD locations, Controls. (Table 5.2)

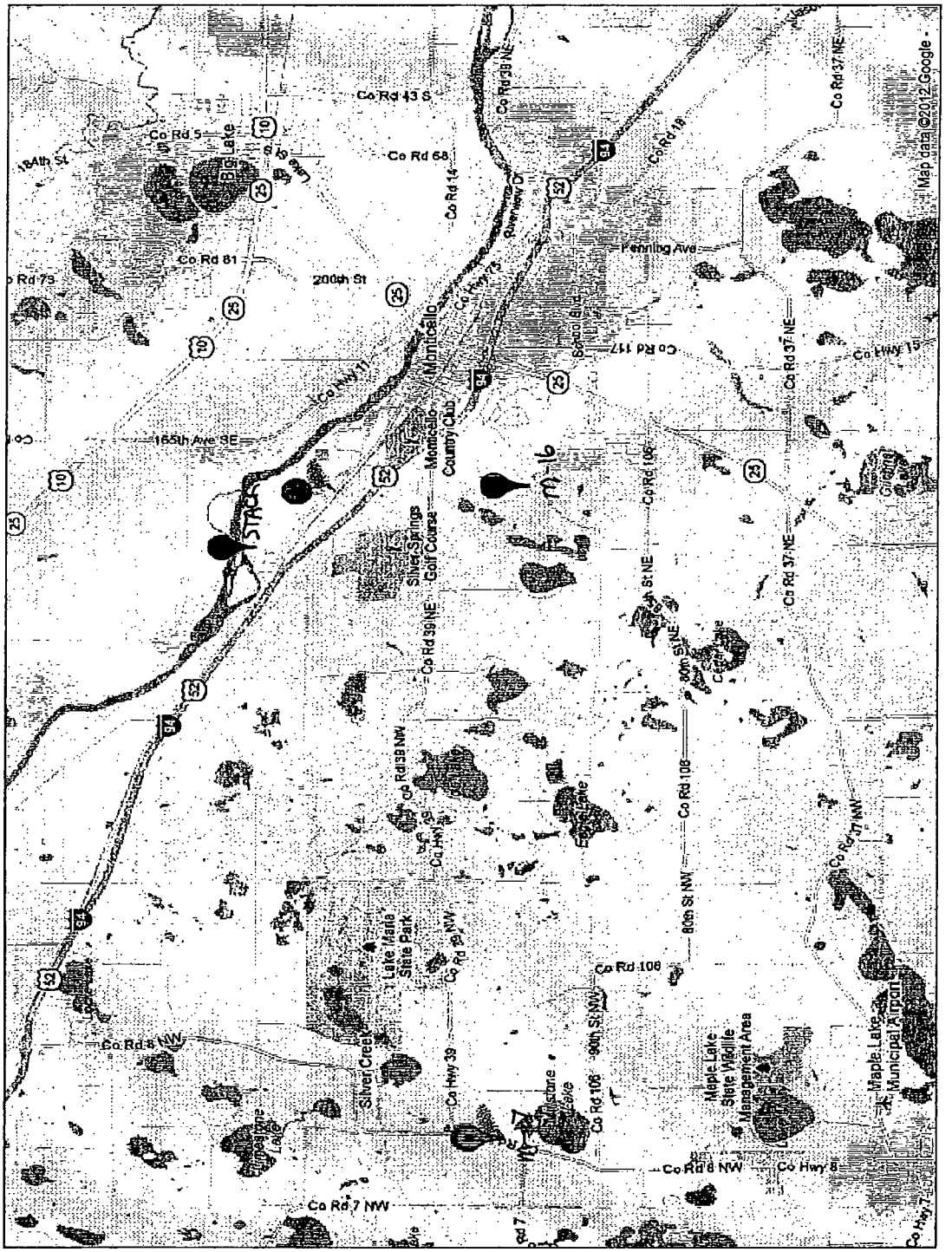

Figure D-4, Sample Collection and Analysis Program: Radiological Environmental Monitoring Program, Milk Sampling locations. (Table 5.2)

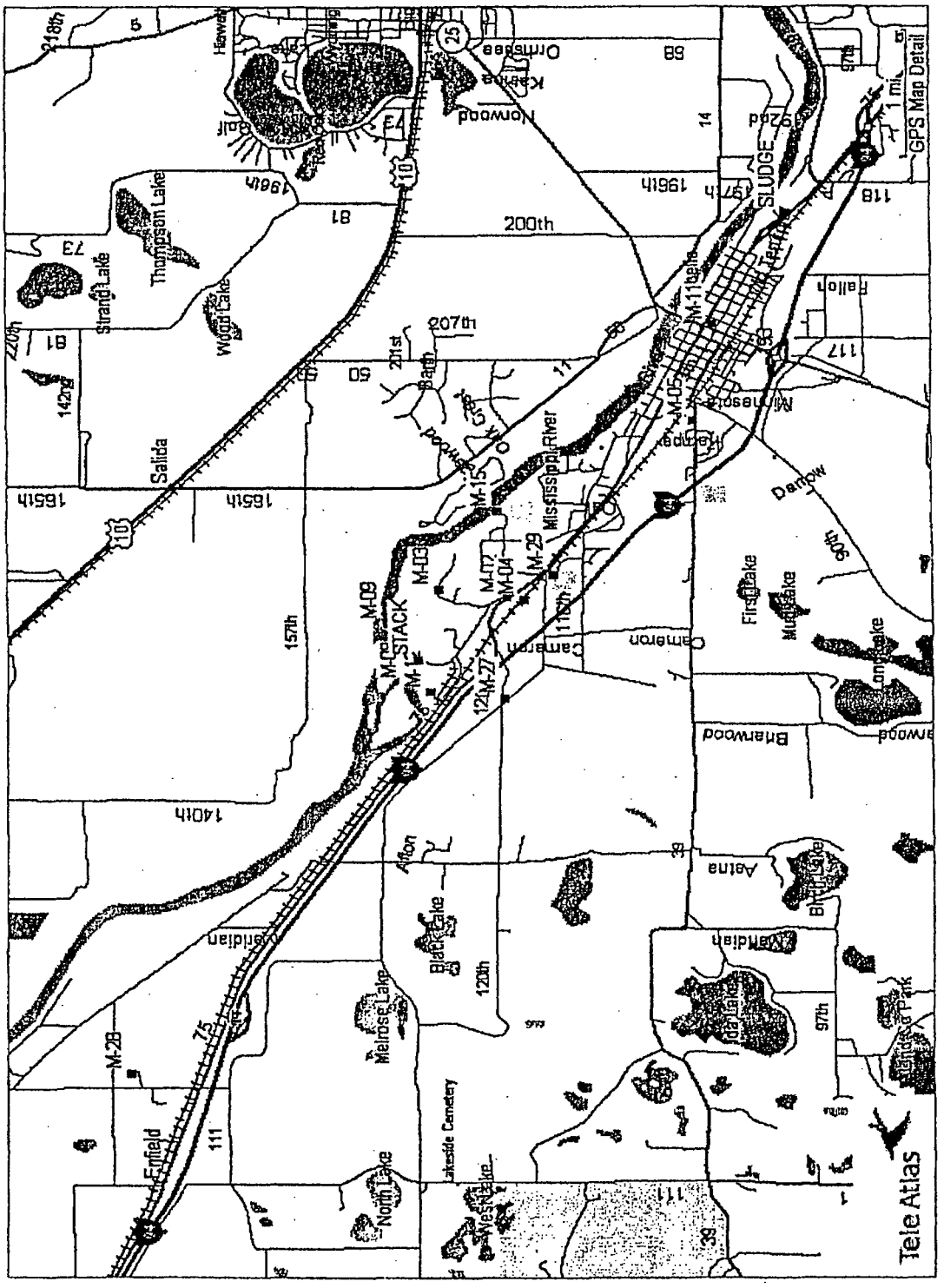

Figure D-5, Sample Collection and Analysis Program: Radiological Environmental Monitoring Program, Sludge, Ground Water and Shoreline sampling locations. (Table 5.2)

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 2013. 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, 2013") 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 2013 are summarized and discussed.

Program findings for 2013 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 samples collected from the sanitary sewer and the sewer lift station. The 2013 sample results (excluding MW-9A and MW-13A) all measured below the required limit of 500 pCi/L. Measurements for 2013 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 Tables E-4 and E-5.

3.4 Program Modifications

There were no additional on-site monitoring wells added to the ground water program in 2013.

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, 2013 sample results all measured below an LLD level of 500 pCi/L, and were similar to averages measured in 2012.

The tritium activity at location MW-9A was higher than previous measurements from 2010 to 2012. A spike in activity seemed to occur from July through September, 2013, but declined significantly in October, and dropped throughout the rest of the year. Activity ranged from a high of 15,124 to less than 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.

One sample collected from MW-9A was tested for hard to detect isotopes. Results for gross alpha, iron-55, nickel-63 and strontium-89 and strontium-90 all measured below detection limits.

The tritium activity measured in samples collected from monitoring well MW-13A was highest in October and November, 2013, suggesting migration from MW-9A. Activity ranged from a high of 729 to less than 500 pCi/L.

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	Monticello Nuclear Generating Plant	Docket No.	50-263
Location of Facility	Wright, Minnesota	Reporting Period	January-December, 2013
	(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-3 114	500	1182 (11/114) (566-15124)	MW-9A, Onsite, 0.1 mi @ 310°/NW	5457 (9/12) (879-15124)	none	3
	GS 62						
	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	50	< LLD	-	-	none	0
Stormwater Runoff (pCi/L)	H-3 4	500	< LLD	-	-	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

[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 time the typical preoperational value for the medium or location.

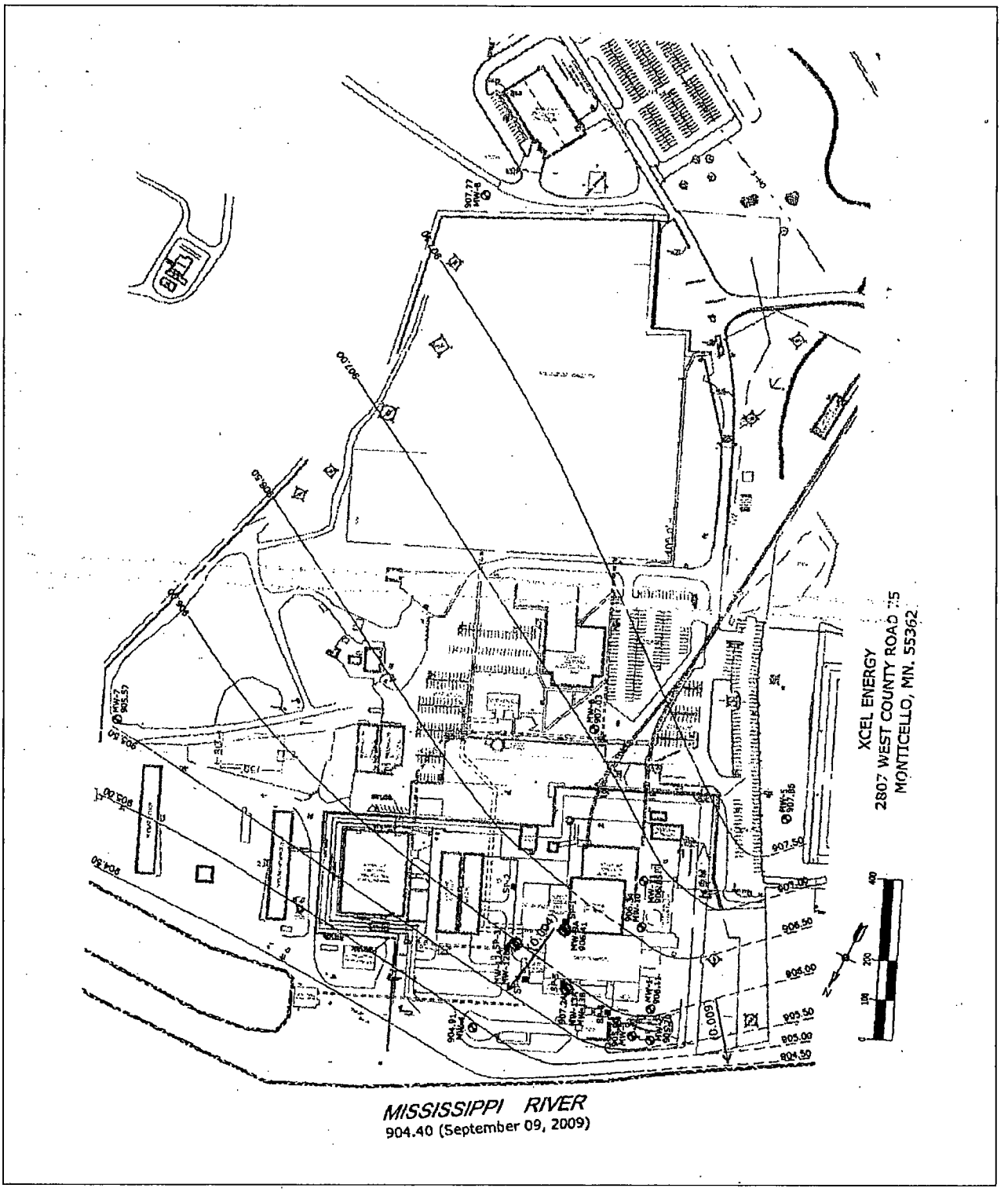

Figure E-1. Sample collection and analysis program: Ground water, On-site monitoring well locations.

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
		Monitoring Well #1 (M-33)										
MWW- 699	02/21/13	< 143	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 45
MWW- 2775	05/23/13	< 148	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 17
MWW- 5160	08/22/13	< 150	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 25
MWW- 7160	11/19/13	< 156	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 26
		Monitoring Well #2 (M-34)										
MWW- 700	02/21/13	263 ± 84	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 46
MWW- 2776	05/23/13	262 ± 101	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 23
MWW- 5161	08/22/13	165 ± 80	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 20
MWW- 7161	11/19/13	211 ± 86	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 39
		Monitoring Well #3 (M-35)										
MWW- 701	02/21/13	219 ± 82	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 43
MWW- 2778	05/23/13	322 ± 103	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 22
MWW- 5162	08/22/13	< 150	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 20
MWW- 7162	11/19/13	224 ± 86	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 30
		Monitoring Well #4 (M-36)										
	ND [a]											
MWW- 2779	05/23/13	270 ± 101	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 19
MWW- 5561	09/17/13	< 151	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 31
MWW- 7163	11/20/13	< 156	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 28
		Monitoring Well #5 (M-37)										
MWW- 5163	08/20/13	< 150	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 21
		Monitoring Well #6 (M-38)										
MWW- 5164	08/22/13	< 150	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 25
		Monitoring Well #7 (M-39)										
MWW- 5165	08/22/13	< 150	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 21
		Monitoring Well #8 (M-40)										
MWW- 5166	08/22/13	< 150	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 25

[a] ND = No Data; Sample not collected.

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
						Monitoring Well #9A (M-44)						
MWW- 475	01/30/13	< 136	-	-	-	-	-	-	-	-	-	-
MWW- 702	02/19/13	371 ± 88	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 17
MWW- 1330	03/26/13	4717 ± 206	-	-	-	-	-	-	-	-	-	-
MWW- 2175	04/26/13	< 142	-	-	-	-	-	-	-	-	-	-
MWW- 2818	05/23/13	999 ± 126	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 43
MWW- 3451	06/18/13	879 ± 133	-	-	-	-	-	-	-	-	-	-
MWW- 4213	07/16/13	12868 ± 337	-	-	-	-	-	-	-	-	-	-
MWW- 5008	08/20/13	15124 ± 352	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 18
MWW- 5790	09/27/13	10378 ± 297	-	-	-	-	-	-	-	-	-	-
MWW- 6817	10/31/13	1785 ± 147	-	-	-	-	-	-	-	-	-	-
MWW- 7177	11/19/13	1147 ± 123	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 15
MWW- 7594	12/17/13	1214 ± 137	-	-	-	-	-	-	-	-	-	-
						Monitoring Well #9B (M-51)						
MWW- 703	02/19/13	< 143	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 33
MWW- 2820	05/23/13	< 148	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 27
MWW- 5168	08/20/13	< 150	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 18
MWW- 7178	11/19/13	< 156	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 16
						Monitoring Well #10 (M-45)						
MWW- 476	01/29/13 ND [a]	343 ± 88	-	-	-	-	-	-	-	-	-	-
MWW- 1331	03/27/13	356 ± 93	-	-	-	-	-	-	-	-	-	-
MWW- 2176	04/26/13	346 ± 91	-	-	-	-	-	-	-	-	-	-
MWW- 2780	05/23/13	390 ± 106	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 22
MWW- 3452	06/18/13	215 ± 112	-	-	-	-	-	-	-	-	-	-
MWW- 4132	07/15/13	< 185	-	-	-	-	-	-	-	-	-	-
MWW- 5169	08/23/13	305 ± 89	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 17
MWW- 5562	09/17/13	318 ± 90	-	-	-	-	-	-	-	-	-	-
MWW- 6818	10/31/13	359 ± 105	-	-	-	-	-	-	-	-	-	-
MWW- 7164	11/19/13	364 ± 93	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 25
MWW- 7588	12/18/13	301 ± 87	-	-	-	-	-	-	-	-	-	-
						Monitoring Well #11 (M-46)						
MWW- 704	02/21/13	< 146	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 16
MWW- 2781	05/23/13	< 188	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 18
MWW- 5563	09/17/13	< 151	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 33
MWW- 7166	11/19/13	< 156	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 19
						Monitoring Well #12A (M-47)						
MWW- 914	02/20/13	< 144	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 24
MWW- 2782	05/23/13	< 188	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 25
MWW- 5170	08/23/13	< 150	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 31
MWW- 7167	11/21/13	< 156	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 23

[a] ND = No Data; Sample not collected.

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
						Monitoring Well #12B (M-48)						
MWW- 915	02/20/13	< 144	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 27
MWW- 2783	05/23/13	< 188	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 29
MWW- 5171	08/23/13	< 150	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 34
MWW- 7168	11/21/13	< 156	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 24
						Monitoring Well #13A (M-49)						
MWW- 477	01/29/13	< 149	-	-	-	-	-	-	-	-	-	-
MWW- 705	02/21/13	182 ± 78	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 18
MWW- 1332	03/27/13	249 ± 89	-	-	-	-	-	-	-	-	-	-
MWW- 2177	04/26/13	277 ± 88	-	-	-	-	-	-	-	-	-	-
MWW- 2784	05/23/13	340 ± 104	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 19
	ND [a]											
MWW- 4133	07/16/13	< 185	-	-	-	-	-	-	-	-	-	-
MWW- 5172	08/22/13	234 ± 86	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 17
MWW- 5564	09/18/13	432 ± 95	-	-	-	-	-	-	-	-	-	-
MWW- 6819	10/31/13	566 ± 112	-	-	-	-	-	-	-	-	-	-
MWW- 7169	11/20/13	729 ± 108	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 21
						Monitoring Well #13B (M-50)						
MWW- 478	01/29/13	331 ± 88	-	-	-	-	-	-	-	-	-	-
MWW- 706	02/21/13	292 ± 84	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 24
MWW- 1333	03/27/13	185 ± 86	-	-	-	-	-	-	-	-	-	-
MWW- 2178	04/26/13	299 ± 89	-	-	-	-	-	-	-	-	-	-
MWW- 2785	05/23/13	357 ± 104	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 15
	ND [a]											
MWW- 4134	07/16/13	316 ± 124	-	-	-	-	-	-	-	-	-	-
MWW- 5173	08/23/13	173 ± 83	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 21
MWW- 5565	09/18/13	170 ± 83	-	-	-	-	-	-	-	-	-	-
MWW- 6820	10/31/13	197 ± 103	-	-	-	-	-	-	-	-	-	-
MWW- 7170	11/20/13	240 ± 87	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 22
						Monitoring Well #14 (M-52)						
MWW- 479	01/29/13	< 149	-	-	-	-	-	-	-	-	-	-
MWW- 707	02/21/13	238 ± 81	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 18
MWW- 1334	03/27/13	< 147	-	-	-	-	-	-	-	-	-	-
MWW- 2179	04/25/13	< 142	-	-	-	-	-	-	-	-	-	-
MWW- 2786	05/23/13	< 148	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 24
MWW- 3453	06/18/13	< 198	-	-	-	-	-	-	-	-	-	-
MWW- 4136	07/15/13	< 185	-	-	-	-	-	-	-	-	-	-
MWW- 5174	08/20/13	< 150	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 20
MWW- 5566	09/16/13	< 151	-	-	-	-	-	-	-	-	-	-
MWW- 6821	10/29/13	< 184	-	-	-	-	-	-	-	-	-	-
MWW- 7179	11/18/13	< 156	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 24
MWW- 7589	12/17/13	< 145	-	-	-	-	-	-	-	-	-	-

[a] ND = No Data; Sample not collected.

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
		Monitoring Well #15A (M-53)										
MWW- 480	01/29/13	< 149	-	-	-	-	-	-	-	-	-	-
MWW- 916	02/20/13	< 146	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 23
MWW- 1335	03/27/13	< 147	-	-	-	-	-	-	-	-	-	-
MWW- 2180	04/25/13	< 144	-	-	-	-	-	-	-	-	-	-
MWW- 2787	05/23/13	< 148	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 28
MWW- 3454	06/18/13	< 198	-	-	-	-	-	-	-	-	-	-
MWW- 4137	07/15/13	< 185	-	-	-	-	-	-	-	-	-	-
MWW- 5175	08/23/13	< 150	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 29
MWW- 5567	09/17/13	< 151	-	-	-	-	-	-	-	-	-	-
MWW- 6822	10/31/13	< 184	-	-	-	-	-	-	-	-	-	-
MWW- 7171	11/21/13	188 ± 84	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 19
MWW- 7590	12/18/13	< 146	-	-	-	-	-	-	-	-	-	-
		Monitoring Well #15B (M-54)										
MWW- 481	01/29/13	402 ± 91	-	-	-	-	-	-	-	-	-	-
MWW- 917	02/20/13	335 ± 91	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 23
MWW- 1336	03/27/13	199 ± 87	-	-	-	-	-	-	-	-	-	-
MWW- 2181	04/25/13	291 ± 89	-	-	-	-	-	-	-	-	-	-
MWW- 2788	05/23/13	240 ± 100	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 22
MWW- 3455	06/18/13	< 198	-	-	-	-	-	-	-	-	-	-
MWW- 4138	07/15/13	< 185	-	-	-	-	-	-	-	-	-	-
MWW- 5176	08/23/13	195 ± 81	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 17
MWW- 5568	09/17/13	275 ± 88	-	-	-	-	-	-	-	-	-	-
MWW- 6823	10/31/13	< 182	-	-	-	-	-	-	-	-	-	-
MWW- 7172	11/21/13	242 ± 87	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 50
MWW- 7591	12/18/13	185 ± 81	-	-	-	-	-	-	-	-	-	-
		Storm Water Run-off (SD-006)										
MXW- 3450	06/12/13	< 198	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 43
MXW- 5560	09/09/13	< 151	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 26
MXW- 6460	10/03/13	< 147	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 10
		Storm Water Run-off (Sewer Lift Station)										
MXW- 7355	12/03/13	< 151	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 17

Table E-5. Ground water, analyses for hard to detect isotopes.

Lab Code	Collection Date	Location	Concentration (pCi/L)				
			Gross Alpha	^{89}Sr	^{90}Sr	^{55}Fe	^{63}Ni
MWW- 5008	08/20/13	MW-9A	< 1.2	< 0.6	< 0.5	< 768	< 98

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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, 2013

Prepared under contract by

ENVIRONMENTAL, INC.
MIDWEST LABORATORY

PROJECT NO. 8010

Reviewed and
Approved

05-13-2014

Bronia Grob, M.S.
Laboratory Manager

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1.0 INTRODUCTION

The following constitutes the final 2013 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
WW	Gamma, H-3	M-014	1/13/2013	Sample damaged in shipment.	None required.
AP/AI	Beta, I-131	M-01	1/16/2013	Pump found off.	Sampler restarted.
SW	Gamma	M-008	Jan. 2013	Water frozen entire month; no composite.	None required.
WW	Gamma, H-3	M-027	1/23/2013	Residence vacant, water turned off.	None required.
SW	Gamma	M-008	Feb. 2013	Water frozen entire month; no composite.	None required.
SW	Gamma	M-008	Mar. 2013	Water frozen entire month; no composite.	None required.
SW	H-3	M-008	1st Qtr '13	Water frozen entire quarter; no composite.	None required.
AP/AI	Beta, I-131	M-01	5/1/2013	Pump found off.	Sampler pump replaced.
WW	Gamma, H-3	M-014	5/7/2013	Sample damaged in shipment.	None required.
AP/AI	Beta, I-131	M-01	5/8/2013	Pump failure.	Sampler pump replaced.
AP/AI	Beta, I-131	M-02	11/27/2013	Filter misaligned in holder; light particulate collected.	Technician coached on verification practices.
WW	Gamma, H-3	M-014	11/27/2013	No sample taken.	Technician coached on proper turnover.
SW	Gamma	M-008	Dec. 2013	Water frozen entire month; no composite.	None required.

3.0 DATA TABLES

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

Location	mRem/91 days 1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Cumulative Average	Previous Annual Average
			Indicators (Inner Ring, General Area of Site Boundary)			
M-01A	12.1 ± 1.2	15.5 ± 1.3	13.8 ± 1.0	16.0 ± 1.4	14.4	14.0
M-02A	15.3 ± 1.1	15.6 ± 1.2	17.1 ± 0.8	14.8 ± 0.9	15.7	16.2
M-03A	15.0 ± 1.4	14.2 ± 1.7	16.1 ± 1.5	13.0 ± 1.1	14.6	15.9
M-04A	12.9 ± 1.1	17.0 ± 1.0	12.5 ± 0.9	16.8 ± 0.9	14.8	15.7
M-05A	11.1 ± 1.0	14.0 ± 0.8	13.3 ± 1.1	13.0 ± 0.9	12.9	16.1
M-06A	12.5 ± 1.0	15.4 ± 0.9	14.8 ± 0.9	15.2 ± 0.7	14.5	16.8
M-07A	13.5 ± 1.0	13.4 ± 0.9	13.1 ± 0.6	15.7 ± 0.8	13.9	16.6
M-08A	12.8 ± 0.9	15.3 ± 0.8	15.1 ± 0.8	15.2 ± 1.3	14.6	17.4
M-09A	13.8 ± 1.2	13.1 ± 1.0	15.1 ± 0.8	13.3 ± 0.7	13.8	16.6
M-10A	14.0 ± 1.1	14.4 ± 0.8	15.8 ± 0.9	14.0 ± 0.9	14.6	16.8
M-11A	10.9 ± 0.9	15.4 ± 0.8	13.6 ± 0.6	14.3 ± 1.0	13.6	17.8
M-12A	12.3 ± 1.0	13.4 ± 0.8	14.6 ± 0.6	12.6 ± 0.6	13.2	17.1
M-13A	13.5 ± 1.1	18.3 ± 1.1	15.3 ± 0.9	17.3 ± 1.0	16.1	14.5
M-14A	15.0 ± 0.8	13.0 ± 0.8	18.6 ± 0.7	13.6 ± 0.7	15.1	16.2
Mean ± s.d.	13.2 ± 1.4	14.9 ± 1.5	14.9 ± 1.7	14.6 ± 1.5	14.4	16.3
			Indicators (Outer Ring, 4-5 Miles Distant)			
M-01B	12.7 ± 0.9	14.9 ± 1.4	15.7 ± 1.0	14.0 ± 1.4	14.3	15.7
M-02B	12.7 ± 1.0	16.3 ± 0.8	15.1 ± 0.8	15.7 ± 0.7	15.0	15.3
M-03B	10.4 ± 0.9	12.8 ± 1.0	13.0 ± 0.8	12.1 ± 1.0	12.1	12.8
M-04B	12.8 ± 0.8	13.6 ± 0.9	15.4 ± 0.6	12.5 ± 0.7	13.6	14.5
M-05B	13.6 ± 0.7	13.3 ± 1.0	15.0 ± 0.5	14.2 ± 0.9	14.0	15.7
M-06B	12.7 ± 0.8	15.7 ± 1.0	15.9 ± 1.1	14.5 ± 1.0	14.7	15.8
M-07B	11.1 ± 1.0	14.0 ± 1.2	14.0 ± 1.0	13.4 ± 1.0	13.1	16.9
M-08B	13.4 ± 0.7	16.8 ± 1.2	14.8 ± 0.8	16.0 ± 0.9	15.3	15.0
M-09B	11.8 ± 0.8	15.6 ± 0.9	15.8 ± 0.6	14.8 ± 0.9	14.5	17.2
M-10B	14.9 ± 1.2	15.4 ± 1.1	19.1 ± 1.7	13.6 ± 1.0	15.8	16.9
M-11B	11.7 ± 1.1	14.9 ± 1.1	16.6 ± 1.3	14.6 ± 1.0	14.5	16.7
M-12B	12.9 ± 1.4	13.6 ± 0.8	16.1 ± 0.9	14.9 ± 0.8	14.4	16.2
M-13B	12.3 ± 1.0	13.8 ± 1.1	13.7 ± 1.0	13.0 ± 0.9	13.2	14.8
M-14B	11.7 ± 0.9	14.9 ± 0.8	14.6 ± 1.3	13.9 ± 0.8	13.8	16.5
M-15B	11.4 ± 0.9	13.8 ± 1.1	15.3 ± 1.0	13.0 ± 0.9	13.4	15.2
M-16B	11.9 ± 0.8	14.1 ± 1.4	14.3 ± 0.6	12.1 ± 1.0	13.1	13.4
Mean ± s.d.	12.4 ± 1.1	14.6 ± 1.1	15.3 ± 1.4	13.9 ± 1.2	14.0	15.5

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

Location	mRem/91 days 1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Cumulative Average	Previous Annual Average
			Control			
M-01C	13.9 ± 1.4	18.3 ± 1.2	14.5 ± 1.0	18.8 ± 1.1	16.4	16.0
M-02C	11.8 ± 1.3	13.8 ± 1.0	16.2 ± 1.2	14.0 ± 0.9	14.0	17.0
M-03C	15.5 ± 0.8	16.6 ± 0.9	16.8 ± 0.6	16.7 ± 0.6	16.4	18.2
M-04C	12.8 ± 0.7	15.7 ± 0.8	16.3 ± 0.6	15.6 ± 0.8	15.1	16.6
Mean ± s.d.	13.5 ± 1.6	16.1 ± 1.9	16.0 ± 1.0	16.3 ± 2.0	15.5	16.9
			Indicators (Special Interest Areas)			
M-01S	10.9 ± 1.1	11.4 ± 0.8	13.3 ± 1.2	10.8 ± 0.6	11.6	13.8
M-02S	14.2 ± 0.9	11.4 ± 0.9	17.4 ± 0.9	10.9 ± 0.9	13.5	12.9
M-03S	11.8 ± 1.1	15.5 ± 1.1	16.5 ± 0.6	14.8 ± 0.9	14.7	15.4
M-04S	11.9 ± 1.0	13.4 ± 1.0	15.0 ± 1.2	13.4 ± 0.8	13.4	15.7
M-05S	12.6 ± 0.8	13.8 ± 1.1	15.1 ± 0.7	13.6 ± 0.8	13.8	14.4
M-06S	17.1 ± 1.4	16.7 ± 1.0	17.8 ± 0.9	16.8 ± 0.8	17.1	17.6
Mean ± s.d.	13.1 ± 2.3	13.7 ± 2.1	15.9 ± 1.7	13.4 ± 2.3	14.0	15.0
			Special TLDs			
M-I-01	89.7 ± 2.6	17.3 ± 1.1	106.0 ± 3.2	43.3 ± 1.9	64.1	100.5
M-I-02	53.8 ± 2.1	16.9 ± 0.8	63.3 ± 1.7	38.4 ± 1.3	43.1	83.5
M-I-03	42.3 ± 2.1	17.3 ± 1.0	52.5 ± 3.1	33.0 ± 1.4	36.3	57.2
M-I-04	29.5 ± 1.8	18.2 ± 1.3	33.7 ± 2.2	42.4 ± 2.6	31.0	40.4
M-I-05	43.0 ± 1.7	34.5 ± 1.4	95.3 ± 6.5	99.0 ± 1.9	68.0	53.0
M-I-06	23.1 ± 1.6	20.9 ± 0.8	27.4 ± 1.7	28.0 ± 2.1	24.9	31.6
M-I-07	30.2 ± 1.2	22.6 ± 1.2	34.0 ± 1.4	35.0 ± 2.1	30.5	36.5
M-I-08	30.3 ± 2.3	18.4 ± 1.3	33.5 ± 2.2	32.1 ± 2.9	28.6	33.7
M-I-09	56.1 ± 1.7	44.5 ± 1.8	138.4 ± 3.9	216.7 ± 3.7	113.9	63.5
M-I-10	32.0 ± 1.2	20.5 ± 1.2	45.1 ± 1.7	39.5 ± 1.9	34.3	54.0
M-I-11	14.4 ± 1.3	13.8 ± 0.9	15.3 ± 1.1	13.8 ± 0.7	14.3	17.2
M-I-12	14.0 ± 0.7	15.8 ± 1.0	16.7 ± 0.7	16.3 ± 0.8	15.7	17.0
M-I-13	16.1 ± 2.0	13.7 ± 1.3	18.9 ± 1.8	14.3 ± 1.3	15.8	18.2
Mean ± s.d.	36.5 ± 21.1	21.1 ± 8.8	52.3 ± 38.4	50.1 ± 54.4	40.0	46.6

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

Location: M-1 (C)

Units: pCi/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	Date Collected	Volume (m^3)	Gross Beta
Required LLD		0.010	Required LLD		0.010
01-09-13	353	0.063 ± 0.004	07-10-13	380	0.028 ± 0.003
01-16-13		ND[b]	07-17-13	385	0.029 ± 0.003
01-23-13	322	0.043 ± 0.004	07-24-13	380	0.021 ± 0.003
01-30-13	295	0.061 ± 0.005	07-31-13	353	0.016 ± 0.003
02-06-13	294	0.070 ± 0.005	08-06-13	304	0.023 ± 0.003
02-13-13	323	0.032 ± 0.004	08-14-13	405	0.020 ± 0.003
02-20-13	323	0.039 ± 0.004	08-21-13	315	0.052 ± 0.005
02-27-13	324	0.038 ± 0.004	08-28-13	323	0.041 ± 0.004
03-06-13	322	0.028 ± 0.004	09-04-13	320	0.022 ± 0.003
03-13-13	321	0.032 ± 0.004	09-11-13	322	0.043 ± 0.004
03-20-13	325	0.034 ± 0.004	09-18-13	355	0.022 ± 0.003
03-27-13	322	0.024 ± 0.003	09-25-13	293	0.027 ± 0.004
04-03-13	324	0.029 ± 0.003	10-02-13	295	0.036 ± 0.004
1st Quarter Mean ± s.d.		0.041 ± 0.015	3rd Quarter Mean ± s.d.		0.029 ± 0.011
04-10-13	329	0.029 ± 0.003	10-09-13	293	0.021 ± 0.003
04-17-13	319	0.011 ± 0.003	10-16-13	296	0.029 ± 0.004
04-24-13	324	0.026 ± 0.003	10-23-13	290	0.015 ± 0.004
05-01-13	55	ND[b]	10-30-13	294	0.015 ± 0.003
05-08-13	129	ND[b]	11-06-13	356	0.032 ± 0.004
05-15-13	343	0.024 ± 0.003	11-13-13	353	0.028 ± 0.003
05-22-13	348	0.015 ± 0.003	11-21-13	337	0.047 ± 0.004
05-29-13	352	0.017 ± 0.003	11-27-13	302	0.030 ± 0.004
			12-03-13	254	0.070 ± 0.006
06-05-13	354	0.018 ± 0.003			
06-12-13	352	0.023 ± 0.003	12-10-13	293	0.053 ± 0.005
06-19-13	361	0.016 ± 0.003	12-18-13	335	0.052 ± 0.004
06-26-13	345	0.022 ± 0.003	12-26-13	337	0.052 ± 0.004
07-03-13	353	0.017 ± 0.003	01-02-14	293	0.056 ± 0.005
2nd Quarter Mean ± s.d.		0.020 ± 0.005	4th Quarter Mean ± s.d.		0.038 ± 0.017
			Cumulative Average		0.032
			Previous Annual Average		0.031

[a] Iodine-131 concentrations are < 0.03 pCi/m^3 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/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	Date Collected	Volume (m^3)	Gross Beta
Required LLD		0.010			0.010
01-09-13	339	0.063 ± 0.005	07-10-13	381	0.027 ± 0.003
01-16-13	327	0.038 ± 0.004	07-17-13	384	0.024 ± 0.003
01-23-13	329	0.044 ± 0.004	07-24-13	381	0.018 ± 0.003
01-30-13	351	0.048 ± 0.004	07-31-13	353	0.015 ± 0.003
02-06-13	352	0.074 ± 0.005	08-06-13	332	0.019 ± 0.003
02-13-13	353	0.031 ± 0.003	08-14-13	403	0.016 ± 0.003
02-20-13	353	0.033 ± 0.003	08-21-13	347	0.043 ± 0.004
02-27-13	353	0.034 ± 0.003	08-28-13	354	0.036 ± 0.004
03-06-13	343	0.023 ± 0.003	09-04-13	353	0.022 ± 0.003
03-14-13	401	0.026 ± 0.003	09-11-13	351	0.040 ± 0.004
03-20-13	304	0.034 ± 0.004	09-18-13	355	0.018 ± 0.003
03-27-13	352	0.017 ± 0.003	09-25-13	351	0.025 ± 0.004
04-03-13	325	0.025 ± 0.003	10-02-13	353	0.031 ± 0.004
1st Quarter Mean ± s.d.		0.038 ± 0.016	3rd Quarter Mean ± s.d.		0.026 ± 0.009
04-10-13	329	0.025 ± 0.003	10-09-13	352	0.018 ± 0.003
04-17-13	349	0.007 ± 0.002	10-16-13	332	0.023 ± 0.003
04-24-13	356	0.019 ± 0.003	10-23-13	321	0.014 ± 0.003
05-01-13	413	0.023 ± 0.003	10-30-13	325	0.016 ± 0.003
05-08-13	414	0.011 ± 0.002	11-06-13	356	0.029 ± 0.003
05-15-13	405	0.022 ± 0.003	11-13-13	352	0.029 ± 0.003
05-22-13	284	0.016 ± 0.003	11-21-13	404	0.035 ± 0.003
05-29-13	382	0.016 ± 0.003	11-27-13	302	ND[b]
			12-03-13	305	0.059 ± 0.005
06-05-13	385	0.014 ± 0.003			
06-12-13	387	0.019 ± 0.003	12-10-13	352	0.044 ± 0.004
06-19-13	405	0.014 ± 0.003	12-18-13	370	0.047 ± 0.004
06-26-13	355	0.020 ± 0.003	12-26-13	373	0.043 ± 0.004
07-03-13	411	0.015 ± 0.003	01-02-14	332	0.048 ± 0.004
2nd Quarter Mean ± s.d.		0.017 ± 0.005	4th Quarter Mean ± s.d.		0.034 ± 0.015
			Cumulative Average		0.028
			Previous Annual Average		0.031

[a] Iodine-131 concentrations are < 0.03 pCi/m^3 unless otherwise noted.

[b] ND = No data; see Table 2.0, Listing of Missed Samples.

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

Location: M-3

Units: pCi/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	Date Collected	Volume (m^3)	Gross Beta
Required LLD		0.010			0.010
01-09-13	326	0.074 ± 0.005	07-10-13	353	0.033 ± 0.004
01-16-13	326	0.042 ± 0.004	07-17-13	384	0.026 ± 0.003
01-23-13	329	0.043 ± 0.004	07-24-13	322	0.020 ± 0.003
01-30-13	351	0.045 ± 0.004	07-31-13	353	0.014 ± 0.003
02-06-13	352	0.048 ± 0.004	08-06-13	334	0.019 ± 0.003
02-13-13	353	0.029 ± 0.003	08-14-13	403	0.018 ± 0.003
02-20-13	353	0.034 ± 0.003	08-21-13	348	0.045 ± 0.004
02-27-13	353	0.031 ± 0.003	08-28-13	354	0.032 ± 0.004
03-06-13	352	0.021 ± 0.003	09-04-13	353	0.019 ± 0.003
03-13-13	350	0.025 ± 0.003	09-11-13	381	0.038 ± 0.004
03-20-13	354	0.032 ± 0.003	09-18-13	355	0.019 ± 0.003
03-27-13	351	0.020 ± 0.003	09-25-13	352	0.022 ± 0.003
04-03-13	354	0.025 ± 0.003	10-02-13	383	0.028 ± 0.003
1st Quarter Mean ± s.d.		0.036 ± 0.015	3rd Quarter Mean ± s.d.		0.026 ± 0.009
04-10-13	359	0.025 ± 0.003	10-09-13	352	0.017 ± 0.003
04-17-13	378	0.007 ± 0.002	10-16-13	360	0.023 ± 0.003
04-24-13	357	0.023 ± 0.003	10-23-13	348	0.015 ± 0.003
05-01-13	383	0.020 ± 0.003	10-30-13	352	0.013 ± 0.003
05-08-13	385	0.011 ± 0.002	11-06-13	356	0.031 ± 0.003
05-15-13	375	0.021 ± 0.003	11-13-13	352	0.028 ± 0.003
05-22-13	354	0.014 ± 0.003	11-21-13	439	0.031 ± 0.003
05-29-13	350	0.014 ± 0.003	11-27-13	302	0.024 ± 0.003
			12-03-13	305	0.056 ± 0.005
06-05-13	356	0.014 ± 0.003			
06-12-13	357	0.019 ± 0.003	12-10-13	352	0.041 ± 0.004
06-19-13	376	0.014 ± 0.003	12-18-13	401	0.039 ± 0.003
06-26-13	444	0.017 ± 0.002	12-26-13	370	0.046 ± 0.004
07-03-13	353	0.021 ± 0.003	01-02-14	352	0.044 ± 0.004
2nd Quarter Mean ± s.d.		0.017 ± 0.005	4th Quarter Mean ± s.d.		0.031 ± 0.013
			Cumulative Average		0.027
			Previous Annual Average		0.031

[a] Iodine-131 concentrations are < 0.03 pCi/m^3 unless otherwise noted.

Table 5. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131[a].
Location: M-4
Units: pCi/m^3
Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	Date Collected	Volume (m^3)	Gross Beta
Required LLD		0.010			0.010
01-09-13	353	0.065 ± 0.005	07-10-13	369	0.034 ± 0.003
01-16-13	327	0.039 ± 0.004	07-17-13	408	0.029 ± 0.003
01-23-13	356	0.040 ± 0.004	07-24-13	438	0.021 ± 0.003
01-30-13	321	0.049 ± 0.004	07-31-13	383	0.017 ± 0.003
02-06-13	353	0.051 ± 0.004	08-06-13	308	0.022 ± 0.003
02-13-13	353	0.029 ± 0.003	08-14-13	403	0.019 ± 0.003
02-20-13	353	0.040 ± 0.004	08-21-13	348	0.040 ± 0.004
02-27-13	382	0.034 ± 0.003	08-28-13	354	0.034 ± 0.004
03-06-13	381	0.024 ± 0.003	09-04-13	353	0.018 ± 0.003
03-13-13	379	0.024 ± 0.003	09-11-13	351	0.036 ± 0.004
03-20-13	354	0.043 ± 0.004	09-18-13	355	0.017 ± 0.003
03-27-13	320	0.027 ± 0.003	09-25-13	322	0.023 ± 0.004
04-03-13	383	0.026 ± 0.003	10-02-13	383	0.028 ± 0.003
1st Quarter Mean ± s.d.		0.038 ± 0.012	3rd Quarter Mean ± s.d.		0.026 ± 0.008
04-10-13	389	0.030 ± 0.003	10-09-13	323	0.020 ± 0.003
04-17-13	406	0.010 ± 0.002	10-16-13	329	0.022 ± 0.003
04-24-13	354	0.025 ± 0.003	10-23-13	319	0.014 ± 0.003
05-01-13	445	0.022 ± 0.003	10-30-13	323	0.012 ± 0.003
05-08-13	473	0.012 ± 0.002	11-06-13	356	0.031 ± 0.003
05-15-13	435	0.020 ± 0.003	11-13-13	352	0.027 ± 0.003
05-22-13	440	0.012 ± 0.002	11-21-13	371	0.033 ± 0.003
05-29-13	469	0.015 ± 0.002	11-27-13	302	0.024 ± 0.003
			12-03-13	331	0.047 ± 0.004
06-05-13	472	0.014 ± 0.002			
06-12-13	478	0.017 ± 0.002	12-10-13	323	0.049 ± 0.004
06-19-13	462	0.013 ± 0.002	12-18-13	402	0.038 ± 0.003
06-26-13	385	0.024 ± 0.003	12-26-13	370	0.043 ± 0.004
07-03-13	470	0.011 ± 0.002	01-02-14	323	0.050 ± 0.004
2nd Quarter Mean ± s.d.		0.017 ± 0.006	4th Quarter Mean ± s.d.		0.032 ± 0.013
			Cumulative Average		0.028
			Previous Annual Average		0.033

[a] Iodine-131 concentrations are < 0.03 pCi/m^3 unless otherwise noted.

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

Location: M-5

Units: pCi/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	Date Collected	Volume (m^3)	Gross Beta
Required LLD		0.010			0.010
01-09-13	324	0.074 ± 0.005	07-10-13	323	0.034 ± 0.004
01-16-13	295	0.046 ± 0.004	07-17-13	325	0.028 ± 0.004
01-23-13	352	0.040 ± 0.004	07-24-13	318	0.024 ± 0.003
01-30-13	295	0.053 ± 0.005	07-31-13	357	0.014 ± 0.003
02-06-13	294	0.065 ± 0.005	08-06-13	308	0.022 ± 0.003
02-13-13	323	0.035 ± 0.004	08-14-13	403	0.018 ± 0.003
02-20-13	323	0.037 ± 0.004	08-21-13	348	0.041 ± 0.004
02-27-13	324	0.036 ± 0.004	08-28-13	354	0.034 ± 0.004
03-06-13	322	0.024 ± 0.003	09-04-13	353	0.019 ± 0.003
03-13-13	306	0.027 ± 0.004	09-11-13	352	0.040 ± 0.004
03-20-13	295	0.044 ± 0.004	09-18-13	355	0.018 ± 0.003
03-27-13	322	0.026 ± 0.003	09-25-13	322	0.025 ± 0.004
04-03-13	295	0.031 ± 0.004	10-02-13	324	0.034 ± 0.004
1st Quarter Mean ± s.d.		0.041 ± 0.015	3rd Quarter Mean ± s.d.		0.027 ± 0.009
04-10-13	329	0.030 ± 0.003	10-09-13	322	0.019 ± 0.003
04-17-13	290	0.010 ± 0.003	10-16-13	329	0.023 ± 0.003
04-24-13	324	0.023 ± 0.003	10-23-13	318	0.016 ± 0.003
05-01-13	327	0.026 ± 0.003	10-30-13	324	0.018 ± 0.003
05-08-13	354	0.013 ± 0.003	11-06-13	356	0.031 ± 0.003
05-15-13	319	0.025 ± 0.004	11-13-13	352	0.028 ± 0.003
05-22-13	324	0.015 ± 0.003	11-21-13	337	0.050 ± 0.004
05-29-13	322	0.019 ± 0.003	11-27-13	302	0.026 ± 0.004
			12-03-13	302	0.058 ± 0.005
06-05-13	355	0.016 ± 0.003			
06-12-13	328	0.019 ± 0.003	12-10-13	325	0.055 ± 0.005
06-19-13	318	0.017 ± 0.003	12-18-13	368	0.047 ± 0.004
06-26-13	355	0.022 ± 0.003	12-26-13	370	0.047 ± 0.004
07-03-13	323	0.018 ± 0.003	01-02-14	323	0.050 ± 0.004
2nd Quarter Mean ± s.d.		0.019 ± 0.006	4th Quarter Mean ± s.d.		0.036 ± 0.015
			Cumulative Average		0.031
			Previous Annual Average		0.032

[a] Iodine-131 concentrations are < 0.03 pCi/m^3 unless otherwise noted.

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

January

Location	Average	Minima	Maxima
Control	0.056	0.043	0.063
M-1	0.056	0.043	0.063
Indicators	0.050	0.038	0.074
M-2	0.048	0.038	0.063
M-3	0.051	0.042	0.074
M-4	0.048	0.039	0.065
M-5	0.053	0.040	0.074

February

Location	Average	Minima	Maxima
Control	0.045	0.032	0.070
M-1	0.045	0.032	0.070
Indicators	0.040	0.029	0.074
M-2	0.043	0.031	0.074
M-3	0.036	0.029	0.048
M-4	0.039	0.029	0.051
M-5	0.043	0.035	0.065

March

Location	Average	Minima	Maxima
Control	0.029	0.024	0.034
M-1	0.029	0.024	0.034
Indicators	0.027	0.017	0.044
M-2	0.025	0.017	0.034
M-3	0.024	0.020	0.032
M-4	0.029	0.024	0.043
M-5	0.030	0.024	0.044

April

Location	Average	Minima	Maxima
Control	0.022	0.011	0.029
M-1	0.022	0.011	0.029
Indicators	0.020	0.007	0.030
M-2	0.018	0.007	0.025
M-3	0.019	0.007	0.025
M-4	0.022	0.010	0.030
M-5	0.022	0.010	0.030

May

Location	Average	Minima	Maxima
Control	0.019	0.015	0.024
M-1	0.019	0.015	0.024
Indicators	0.016	0.011	0.025
M-2	0.016	0.011	0.022
M-3	0.015	0.011	0.021
M-4	0.015	0.012	0.020
M-5	0.018	0.013	0.025

June

Location	Average	Minima	Maxima
Control	0.019	0.016	0.023
M-1	0.019	0.016	0.023
Indicators	0.017	0.011	0.024
M-2	0.016	0.014	0.020
M-3	0.017	0.014	0.021
M-4	0.016	0.011	0.024
M-5	0.018	0.016	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	0.023	0.016	0.029
M-1	0.023	0.016	0.029
Indicators	0.024	0.014	0.034
M-2	0.021	0.015	0.027
M-3	0.023	0.014	0.033
M-4	0.025	0.017	0.034
M-5	0.025	0.014	0.029

August

Location	Average	Minima	Maxima
Control	0.034	0.020	0.052
M-1	0.034	0.020	0.052
Indicators	0.029	0.016	0.045
M-2	0.028	0.016	0.043
M-3	0.029	0.018	0.045
M-4	0.029	0.019	0.040
M-5	0.029	0.018	0.041

September

Location	Average	Minima	Maxima
Control	0.030	0.022	0.043
M-1	0.030	0.022	0.043
Indicators	0.026	0.017	0.040
M-2	0.027	0.018	0.040
M-3	0.025	0.019	0.038
M-4	0.024	0.017	0.036
M-5	0.027	0.018	0.040

October

Location	Average	Minima	Maxima
Control	0.020	0.015	0.029
M-1	0.020	0.015	0.029
Indicators	0.018	0.012	0.023
M-2	0.018	0.014	0.023
M-3	0.017	0.013	0.023
M-4	0.017	0.012	0.022
M-5	0.019	0.016	0.023

November

Location	Average	Minima	Maxima
Control	0.041	0.028	0.070
M-1	0.041	0.028	0.070
Indicators	0.034	0.024	0.058
M-2	0.031	0.029	0.035
M-3	0.034	0.024	0.056
M-4	0.032	0.024	0.047
M-5	0.039	0.026	0.058

December

Location	Average	Minima	Maxima
Control	0.053	0.052	0.056
M-1	0.053	0.052	0.056
Indicators	0.046	0.038	0.059
M-2	0.048	0.043	0.059
M-3	0.042	0.039	0.046
M-4	0.045	0.038	0.050
M-5	0.050	0.047	0.055

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)					
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Cumulative Average	Previous Average
			M-1 (C)			
Lab Code	MAP- 2050	MAP- 4068	MAP- 6372	MAP- 7860		
Volume(m^3)	3848	3963	4429	4032		
Be-7	0.092 ± 0.010	0.078 ± 0.014	0.065 ± 0.012	0.046 ± 0.011	0.067	0.064
Mn-54	< 0.0003	< 0.0007	< 0.0009	< 0.0005	<0.0009	<0.0007
Co-58	< 0.0004	< 0.0006	< 0.0006	< 0.0003	<0.0006	<0.0007
Co-60	< 0.0003	< 0.0007	< 0.0007	< 0.0003	<0.0007	<0.0009
Zn-65	< 0.0004	< 0.0011	< 0.0015	< 0.0005	<0.0015	<0.0009
Zr-Nb-95	< 0.0007	< 0.0012	< 0.0008	< 0.0006	<0.0012	<0.0011
Ru-103	< 0.0006	< 0.0007	< 0.0007	< 0.0010	<0.0007	<0.0010
Ru-106	< 0.0042	< 0.0091	< 0.0075	< 0.0026	<0.0091	<0.0056
Cs-134	< 0.0005	< 0.0005	< 0.0008	< 0.0007	<0.0008	<0.0006
Cs-137	< 0.0004	< 0.0010	< 0.0007	< 0.0005	<0.0010	<0.0008
Ba-La-140	< 0.0013	< 0.0019	< 0.0022	< 0.0019	<0.0022	<0.0011
Ce-141	< 0.0012	< 0.0015	< 0.0016	< 0.0014	<0.0016	<0.0014
Ce-144	< 0.0025	< 0.0044	< 0.0050	< 0.0037	<0.0050	<0.0037
			M-2			
Lab Code	MAP- 2051	MAP- 4069	MAP- 6373	MAP- 7861		
Volume(m^3)	4479	4874	4697	4475		
Be-7	0.064 ± 0.011	0.080 ± 0.012	0.078 ± 0.013	0.046 ± 0.012	0.062	0.064
Mn-54	< 0.0008	< 0.0005	< 0.0007	< 0.0008	<0.0008	<0.0006
Co-58	< 0.0007	< 0.0006	< 0.0004	< 0.0005	<0.0007	<0.0006
Co-60	< 0.0005	< 0.0004	< 0.0008	< 0.0006	<0.0008	<0.0005
Zn-65	< 0.0009	< 0.0004	< 0.0004	< 0.0013	<0.0009	<0.0008
Zr-Nb-95	< 0.0011	< 0.0006	< 0.0009	< 0.0008	<0.0011	<0.0007
Ru-103	< 0.0008	< 0.0007	< 0.0006	< 0.0009	<0.0008	<0.0009
Ru-106	< 0.0052	< 0.0059	< 0.0061	< 0.0070	<0.0061	<0.0056
Cs-134	< 0.0006	< 0.0007	< 0.0007	< 0.0008	<0.0007	<0.0007
Cs-137	< 0.0006	< 0.0006	< 0.0005	< 0.0007	<0.0006	<0.0006
Ba-La-140	< 0.0019	< 0.0009	< 0.0020	< 0.0015	<0.0020	<0.0012
Ce-141	< 0.0010	< 0.0012	< 0.0014	< 0.0010	<0.0014	<0.0012
Ce-144	< 0.0032	< 0.0040	< 0.0041	< 0.0032	<0.0041	<0.0040

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-3			
Lab Code	MAP- 2052	MAP- 4070	MAP- 6374	MAP- 7862		
Volume(m^3)	4503	4826	4673	4641		
Be-7	0.068 ± 0.016	0.067 ± 0.010	0.066 ± 0.011	0.042 ± 0.010	0.059	0.065
Mn-54	< 0.0007	< 0.0003	< 0.0005	< 0.0004	<0.0007	<0.0007
Co-58	< 0.0006	< 0.0005	< 0.0005	< 0.0004	<0.0006	<0.0006
Co-60	< 0.0003	< 0.0003	< 0.0005	< 0.0005	<0.0005	<0.0007
Zn-65	< 0.0006	< 0.0013	< 0.0010	< 0.0007	<0.0013	<0.0010
Zr-Nb-95	< 0.0006	< 0.0008	< 0.0011	< 0.0007	<0.0011	<0.0008
Ru-103	< 0.0007	< 0.0006	< 0.0008	< 0.0006	<0.0008	<0.0009
Ru-106	< 0.0024	< 0.0037	< 0.0057	< 0.0027	<0.0057	<0.0057
Cs-134	< 0.0004	< 0.0003	< 0.0007	< 0.0006	0.0013	0.0013
Cs-137	< 0.0005	< 0.0005	< 0.0006	< 0.0007	0.0014	0.0014
Ba-La-140	< 0.0019	< 0.0009	< 0.0011	< 0.0018	<0.0019	<0.0018
Ce-141	< 0.0018	< 0.0008	< 0.0014	< 0.0010	<0.0018	<0.0013
Ce-144	< 0.0038	< 0.0027	< 0.0034	< 0.0031	<0.0038	<0.0036
			M-4			
Lab Code	MAP- 2053	MAP- 4071	MAP- 6375	MAP- 7863		
Volume(m^3)	4613	5679	4776	4423		
Be-7	0.069 ± 0.015	0.066 ± 0.009	0.074 ± 0.012	0.045 ± 0.010	0.063	0.068
Mn-54	< 0.0007	< 0.0004	< 0.0005	< 0.0005	<0.0007	<0.0007
Co-58	< 0.0005	< 0.0004	< 0.0005	< 0.0005	<0.0005	<0.0005
Co-60	< 0.0004	< 0.0004	< 0.0003	< 0.0008	<0.0004	<0.0006
Zn-65	< 0.0006	< 0.0006	< 0.0006	< 0.0006	<0.0006	<0.0010
Zr-Nb-95	< 0.0007	< 0.0005	< 0.0006	< 0.0007	<0.0007	<0.0010
Ru-103	< 0.0006	< 0.0007	< 0.0006	< 0.0004	<0.0007	<0.0011
Ru-106	< 0.0038	< 0.0035	< 0.0066	< 0.0060	<0.0066	<0.0067
Cs-134	< 0.0004	< 0.0004	< 0.0006	< 0.0006	<0.0006	<0.0008
Cs-137	< 0.0003	< 0.0005	< 0.0003	< 0.0003	<0.0005	<0.0008
Ba-La-140	< 0.0019	< 0.0008	< 0.0014	< 0.0012	<0.0019	<0.0022
Ce-141	< 0.0012	< 0.0010	< 0.0009	< 0.0011	<0.0012	<0.0012
Ce-144	< 0.0034	< 0.0026	< 0.0033	< 0.0026	<0.0034	<0.0045

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- 2054	MAP- 4073	MAP- 6376	MAP- 7864		
Volume(m^3)	4071	4268	4441	4330		
Be-7	0.088 ± 0.013	0.074 ± 0.017	0.081 ± 0.012	0.047 ± 0.012	0.072	0.068
Mn-54	< 0.0008	< 0.0011	< 0.0006	< 0.0007	<0.0011	<0.0009
Co-58	< 0.0003	< 0.0007	< 0.0009	< 0.0006	<0.0009	<0.0007
Co-60	< 0.0005	< 0.0007	< 0.0003	< 0.0007	<0.0007	<0.0007
Zn-65	< 0.0009	< 0.0012	< 0.0005	< 0.0014	<0.0012	<0.0015
Zr-Nb-95	< 0.0010	< 0.0008	< 0.0008	< 0.0013	<0.0010	<0.0013
Ru-103	< 0.0012	< 0.0007	< 0.0008	< 0.0009	<0.0012	<0.0009
Ru-106	< 0.0054	< 0.0044	< 0.0056	< 0.0066	<0.0056	<0.0068
Cs-134	< 0.0006	< 0.0006	< 0.0006	< 0.0008	<0.0006	<0.0007
Cs-137	< 0.0004	< 0.0006	< 0.0003	< 0.0007	<0.0006	<0.0007
Ba-La-140	< 0.0013	< 0.0018	< 0.0015	< 0.0011	<0.0018	<0.0013
Ce-141	< 0.0010	< 0.0019	< 0.0013	< 0.0016	<0.0019	<0.0013
Ce-144	< 0.0038	< 0.0048	< 0.0027	< 0.0033	<0.0048	<0.0038

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	07-24-13	08-14-13	09-27-13		
Lab Code	MVE- 4234	MVE- 4830	MVE- 5758		
Mn-54	< 0.008	< 0.010	< 0.007	< 0.010	< 0.009
Fe-59	< 0.018	< 0.026	< 0.014	< 0.026	< 0.027
Co-58	< 0.011	< 0.007	< 0.008	< 0.011	< 0.008
Co-60	< 0.009	< 0.011	< 0.006	< 0.011	< 0.011
Zn-65	< 0.020	< 0.026	< 0.018	< 0.026	< 0.025
Nb-95	< 0.017	< 0.019	< 0.009	< 0.019	< 0.014
I-131	< 0.025	< 0.022	< 0.034	< 0.034	< 0.044
Cs-134	< 0.009	< 0.011	< 0.008	< 0.011	< 0.010
Cs-137	< 0.017	< 0.016	< 0.011	< 0.017	< 0.010
Location:	M-42 (Biology Station Road)				
Date Collected	07-24-13	08-14-13	09-27-13		
Lab Code	MVE- 4235	MVE- 4831	MVE- 5759		
Mn-54	< 0.014	< 0.009	< 0.009	< 0.014	< 0.011
Fe-59	< 0.019	< 0.022	< 0.022	< 0.022	< 0.023
Co-58	< 0.012	< 0.013	< 0.009	< 0.013	< 0.010
Co-60	< 0.014	< 0.012	< 0.009	< 0.014	< 0.010
Zn-65	< 0.031	< 0.022	< 0.012	< 0.031	< 0.022
Nb-95	< 0.014	< 0.017	< 0.011	< 0.017	< 0.011
I-131	< 0.034	< 0.030	< 0.028	< 0.034	< 0.034
Cs-134	< 0.016	< 0.011	< 0.009	< 0.016	< 0.009
Cs-137	< 0.017	< 0.017	< 0.010	< 0.017	< 0.014
Location:	M-43 (Imholte Farm, Control)				
Date Collected	07-24-13	08-14-13	09-27-13		
Lab Code	MVE- 4236	MVE- 4832	MVE- 5760		
Mn-54	< 0.009	< 0.016	< 0.009	< 0.016	< 0.010
Fe-59	< 0.017	< 0.018	< 0.016	< 0.018	< 0.031
Co-58	< 0.011	< 0.014	< 0.008	< 0.014	< 0.008
Co-60	< 0.010	< 0.011	< 0.007	< 0.011	< 0.012
Zn-65	< 0.022	< 0.021	< 0.012	< 0.022	< 0.030
Nb-95	< 0.010	< 0.015	< 0.015	< 0.015	< 0.011
I-131	< 0.021	< 0.026	< 0.031	< 0.031	< 0.031
Cs-134	< 0.010	< 0.016	< 0.010	< 0.016	< 0.009
Cs-137	< 0.012	< 0.016	< 0.009	< 0.016	< 0.013

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	May
Lab Code	NS[a]	NS[a]	NS[a]	MSW-2519	MSW-3271
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	-	-	-	< 14	< 21
Period Collected	June	July	August	September	October
Lab Code	MSW-3889	MSW-4907	MSW-5153	MSW-6174	MSW-6961
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	< 14	< 20	< 23	< 26	< 23
Period Collected	November [b]	December		Cumulative	Previous Annual
Lab Code	MSW-7532	NS[a]		Average	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	< 10	-		< 26	< 24

[a] "NS" = No sample; see Table 2.0, Listing of Missed Samples.
[b] Composite of three samples for month; water frozen on 11-27-13.

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	February	March	April	May
Lab Code	MSW-583	MSW-1234	MSW-1577	MSW-2520	MSW-3272
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	< 21	< 28	< 17	< 24	< 17
Period Collected	June	July	August	September	October
Lab Code	MSW-3890	MSW-4908	MSW-5154	MSW-6175	MSW-6962
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	< 13	< 22	< 20	< 29	< 23
Period Collected	November	December		Cumulative	Previous Annual
Lab Code	MSW-7533	MSW-7694		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	< 16	< 25		< 29	< 31

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 Lab Code	January MDW-483	February [a] MDW-1053	March MDW-1573	April MDW-2295	May MDW-2865
Gross beta	2.7 ± 0.8	2.7 ± 0.8	2.3 ± 0.9 [b]	2.7 ± 0.7	3.0 ± 1.0
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	< 23	< 19	< 14	< 25	< 51

Period Collected Lab Code	June MDW-3894	July MDW-4537	August MDW-5329	September MDW-5703	October MDW-6918
Gross beta	2.5 ± 1.0	2.9 ± 1.0	1.5 ± 0.6	2.1 ± 0.8	2.0 ± 0.6
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	< 28	< 15	< 35	< 27	< 47

Period Collected Lab Code	November [c] MDW-7354	December MDW-7695	Cumulative Average	Previous Average
Gross beta	3.2 ± 0.8	2.6 ± 1.0	2.6	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	< 31	< 29	< 51	< 36

[a] Composite of three samples for month; 01-21-13 sample lost in transit; container torn.
[b] Gross beta reanalyzed; previous result = 0.9±0.5 pCi/L.
[c] Composite of three samples for month; sample not obtained on 11-18-13.

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	
River Water Upstream, M-8 (C)			
1st Quarter	ND[a]		
2nd Quarter	MSW - 3895	< 500	< 153
3rd Quarter	MSW - 6180	< 500	< 155
4th Quarter	MSW - 7696	< 500	< 150
Cumulative Average		< 500	< 153
Previous Annual Average		< 500	< 147
River Water Downstream, M-9			
1st Quarter	MSW - 1578	< 500	< 182
2nd Quarter	MSW - 3896	< 500	< 153
3rd Quarter	MSW - 6181	< 500	< 155
4th Quarter	MSW - 7697	< 500	< 149
Cumulative Average		< 500	< 160
Previous Annual Average		< 500	< 147
Drinking Water Minneapolis, M-14			
1st Quarter	MDW - 1580	< 500	< 182
2nd Quarter	MDW - 3897	< 500	< 153
3rd Quarter	MDW - 6182	< 500	< 155
4th Quarter	MDW - 7698	< 500	< 149
Cumulative Average		< 500	< 160
Previous Annual Average		< 500	< 147

[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
						Monticello (M-11)						
1/23/2013	MWW-252	< 139	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 22
5/1/2013	MWW-2291	< 139	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 24
7/24/2013	MWW-4320	< 179	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 29
10/16/2013	MWW-6456	< 147	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 18
Cumulative Averages		< 500	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 29
						Plant Well No. 1 (M-12)						
1/23/2013	MWW-253	< 139	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 24
5/2/2013	MWW-2292	< 139	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 27
7/24/2013	MWW-4321	< 179	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 20
10/16/2013	MWW-6457	< 147	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 33
Cumulative Averages		< 500	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 33
						Wise (M-27)						
1/23/2013							NS[a]					
5/2/2013	MWW-2293	< 139	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 16
7/24/2013	MWW-4322	< 179	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 21
10/16/2013	MWW-6458	< 147	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 22
Cumulative Averages		< 500	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 22
						Imholte (M-43) Control						
1/23/2013	MWW-254	< 139	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 21
5/1/2013	MWW-2294	< 139	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 24
7/24/2013	MWW-4323	< 179	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 33
10/16/2013	MWW-6459	< 147	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 57
Cumulative Averages		< 500	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 57

[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
		Upstream 1000' M-8 (C)		
Date Collected	05-28-13	09-11-13		
Lab Code	MF- 2773	MF- 5475		
Sample Type		Carp		
K-40	2.99 ± 0.40	3.38 ± 0.38	3.19	3.36
Mn-54	< 0.013	< 0.010	< 0.013	< 0.018
Fe-59	< 0.034	< 0.037	< 0.037	< 0.055
Co-58	< 0.008	< 0.010	< 0.010	< 0.023
Co-60	< 0.013	< 0.009	< 0.013	< 0.022
Zn-65	< 0.011	< 0.030	< 0.030	< 0.037
Nb-95	< 0.010	< 0.030	< 0.030	< 0.027
Zr-95	< 0.026	< 0.036	< 0.036	< 0.035
Cs-134	< 0.006	< 0.015	< 0.015	< 0.018
Cs-137	< 0.012	< 0.015	< 0.015	< 0.020
Ba-La-140	< 0.019	< 0.089	< 0.089	< 0.067
Ce-144	< 0.091	< 0.060	< 0.091	< 0.107
		Downstream 1000' M-9		
Date Collected	05-28-13	09-11-13		
Lab Code	MF- 2774	MF- 5476		
Sample Type		Catfish		
K-40	2.91 ± 0.37	3.64 ± 0.47	3.27	3.34
Mn-54	< 0.012	< 0.016	< 0.016	< 0.017
Fe-59	< 0.026	< 0.078	< 0.078	< 0.052
Co-58	< 0.009	< 0.013	< 0.013	< 0.023
Co-60	< 0.013	< 0.019	< 0.019	< 0.013
Zn-65	< 0.017	< 0.026	< 0.026	< 0.030
Nb-95	< 0.012	< 0.042	< 0.042	< 0.021
Zr-95	< 0.019	< 0.033	< 0.033	< 0.039
Cs-134	< 0.005	< 0.018	< 0.018	< 0.014
Cs-137	< 0.013	< 0.021	< 0.021	< 0.017
Ba-La-140	< 0.018	< 0.168	< 0.168	< 0.043
Ce-144	< 0.078	< 0.090	< 0.090	< 0.100

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

Sample Description and Concentration (pCi/g wet)			Cumulative Average	Previous Average
	Upstream 1000' M-8 (C)[a]			
Date Collected	08-05-13	10-10-13		
Lab Code	MBO- 4493	MBO- 6147		
Be-7	< 0.40	< 0.84	< 0.84	< 0.58
K-40	< 0.75	2.30 ± 0.97	2.30	< 1.08
Mn-54	< 0.037	< 0.067	< 0.067	< 0.048
Fe-59	< 0.14	< 0.13	< 0.14	< 0.12
Co-58	< 0.053	< 0.073	< 0.073	< 0.068
Co-60	< 0.017	< 0.043	< 0.043	< 0.052
Zn-65	< 0.067	< 0.12	< 0.125	< 0.10
Zr-Nb-95	< 0.089	< 0.13	< 0.133	< 0.12
Ru-103	< 0.064	< 0.092	< 0.092	< 0.091
Ru-106	< 0.35	< 0.56	< 0.56	< 0.34
Cs-134	< 0.027	< 0.059	< 0.059	< 0.045
Cs-137	< 0.040	< 0.057	< 0.057	< 0.042
Ba-La-140	< 0.31	< 0.23	< 0.31	< 0.39
Ce-144	< 0.17	< 0.35	< 0.35	< 0.30
	Downstream 1000' M-9			
Date Collected	08-05-13	10-10-13		
Lab Code	MBO- 4494	MBO- 6148		
Be-7	< 0.35	< 0.65	< 0.65	< 0.48
K-40	< 0.68	< 1.04	< 1.04	< 0.97
Mn-54	< 0.030	< 0.057	< 0.057	< 0.051
Fe-59	< 0.10	< 0.18	< 0.18	< 0.17
Co-58	< 0.050	< 0.074	< 0.074	< 0.072
Co-60	< 0.029	< 0.048	< 0.048	< 0.022
Zn-65	< 0.063	< 0.092	< 0.092	< 0.094
Zr-Nb-95	< 0.073	< 0.093	< 0.093	< 0.086
Ru-103	< 0.054	< 0.070	< 0.070	< 0.053
Ru-106	< 0.24	< 0.48	< 0.48	< 0.39
Cs-134	< 0.028	< 0.052	< 0.052	< 0.046
Cs-137	< 0.025	< 0.065	< 0.065	< 0.055
Ba-La-140	< 0.37	< 0.31	< 0.37	< 0.25
Ce-144	< 0.12	< 0.21	< 0.21	< 0.25

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
	Upstream 1000' M-8 (C)			
Date Collected	08-05-13	10-10-13		
Lab Code	MSS- 4495	MSS- 6149		
Be-7	< 0.23	< 0.15	< 0.23	< 0.18
K-40	10.21 ± 0.49	9.71 ± 0.49	9.96	10.02
Mn-54	< 0.013	< 0.014	< 0.014	< 0.013
Fe-59	< 0.022	< 0.043	< 0.043	< 0.031
Co-58	< 0.017	< 0.015	< 0.017	< 0.016
Co-60	< 0.007	< 0.012	< 0.012	< 0.015
Zn-65	< 0.040	< 0.029	< 0.040	< 0.025
Nb-95	< 0.018	< 0.019	< 0.019	< 0.028
Zr-95	< 0.026	< 0.040	< 0.040	< 0.023
Ru-103	< 0.021	< 0.015	< 0.021	< 0.013
Ru-106	< 0.12	< 0.12	< 0.12	< 0.06
Cs-134	< 0.011	< 0.011	< 0.011	< 0.010
Cs-137	< 0.016	< 0.014	< 0.016	< 0.014
Ba-La-140	< 0.078	< 0.068	< 0.078	< 0.044
Ce-144	< 0.071	< 0.088	< 0.088	< 0.10
	Downstream 1000' M-9			
Date Collected	08-05-13	10-10-13		
Lab Code	MSS- 4496	MSS- 6150		
Be-7	< 0.13	0.42 ± 0.25	0.42	0.33
K-40	8.62 ± 0.51	10.05 ± 0.55	9.33	8.85
Mn-54	< 0.020	< 0.017	< 0.020	< 0.017
Fe-59	< 0.024	< 0.061	< 0.061	< 0.042
Co-58	< 0.017	< 0.024	< 0.024	< 0.019
Co-60	< 0.007	< 0.010	< 0.010	< 0.013
Zn-65	< 0.032	< 0.053	< 0.053	< 0.030
Nb-95	< 0.016	< 0.026	< 0.026	< 0.032
Zr-95	< 0.057	< 0.036	< 0.057	< 0.014
Ru-103	< 0.028	< 0.015	< 0.028	< 0.017
Ru-106	< 0.098	< 0.12	< 0.120	< 0.06
Cs-134	< 0.015	< 0.015	< 0.015	< 0.011
Cs-137	< 0.018	< 0.019	< 0.019	< 0.013
Ba-La-140	< 0.059	< 0.053	< 0.059	< 0.043
Ce-144	< 0.10	< 0.11	< 0.11	< 0.081

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

Sample Description and Concentration (pCi/g dry)			Cumulative Average	Cumulative Average
		Montissippi Park M-15		
Date Collected	08-05-13	10-10-13		
Lab Code	MSS- 4497	MSS- 6151		
Be-7	< 0.24	0.27 ± 0.16	0.27	1.09
K-40	10.92 ± 0.56	10.23 ± 0.51	10.58	10.82
Mn-54	< 0.012	< 0.017	<0.017	<0.020
Fe-59	< 0.040	< 0.041	<0.041	<0.030
Co-58	< 0.018	< 0.022	<0.022	<0.026
Co-60	< 0.007	< 0.012	<0.012	<0.016
Zn-65	< 0.035	< 0.036	<0.036	<0.035
Nb-95	< 0.025	< 0.028	<0.028	<0.026
Zr-95	< 0.019	< 0.029	<0.029	<0.020
Ru-103	< 0.024	< 0.023	<0.024	<0.027
Ru-106	< 0.083	< 0.13	< 0.126	< 0.14
Cs-134	< 0.014	< 0.011	<0.014	<0.014
Cs-137	0.049 ± 0.025	0.022 ± 0.013	0.035	0.081
Ba-La-140	< 0.11	< 0.084	< 0.11	<0.059
Ce-144	< 0.070	< 0.13	<0.13	< 0.12