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May 10, 2018

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

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

2017 Annual Radiological Environmental Operating Report

Pursuant to 10 CFR 50, Appendix I, Section IV.B.2, IV.B.3, IV.C and, in accordance with Monticello Nuclear Generating Plant (MNGP) Technical Specifications 5.6.1, the Northern States Power Company, a Minnesota corporation (NSPM), d/b/a Xcel Energy, is submitting the Annual Radiological Environmental Operating Report, under MNGP's "Radiological Environmental Monitoring Program," for year 2017.

Summary of Commitments

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

Christopher R. Church
Site Vice President, Monticello Nuclear Generating Plant
Northern States Power Company – Minnesota

Enclosure

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

ENCLOSURE

RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
JANUARY 1 – DECEMBER 31, 2017

92 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, 2017

Prepared under Contract by

ENVIRONMENTAL, INC
MIDWEST LABORATORY

Project No. 8010

Approved: _____

Forrest G. Shaw III
Quality Assurance Manager

PREFACE

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

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1.0 INTRODUCTION

This report summarizes and interprets results of the Radiological Environmental Monitoring Program (REMP) conducted by Environmental, Inc., Midwest Laboratory for the Monticello Nuclear Generating Plant, Monticello, Minnesota, during the period January - December, 2017. 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 included in Part II of this report.

The Monticello Nuclear Generating Plant is a boiling water reactor with a nominal generating capacity of 681 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) is described; this program is required by the U.S. Nuclear Regulatory Commission (NRC) as well as Technical Specifications and the Offsite Dose Calculation Manual (ODCM) for the Monticello Nuclear Generating Plant. Results for the year 2017 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. Both types of 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 CaSO4: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, vegetation is collected from locations M-41, M-42, and M-43 (C). The samples are analyzed for iodine-131 and other gamma emitting isotopes.

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.

Well water is monitored by quarterly collections from three off-site locations (one control and two indicators) and one on-site Plant well. To detect 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 the Annual Effluent Release Report..

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) TLD's

TLD's were found to be missing in the field at location M-2C for the first quarter of 2017 and at location M-15B for the third quarter of 2017.

(2) Air Particulates / Air Iodine:

M-01, Air particulate / air iodine sample for the week ending 3/8/17 was only a partial sample due to a GFCI failure during a thunderstorm.

M-01, Air Particulate / air iodine sample for the week ending 3/15/17. Sample was not sent for analysis due pump found off with only 6 hours of run time. Pump was replaced.

M-03, Air particulate filter sample for the week ending 6/14/17 was only a partial sample due to the hour meter for the sampler at location M-03 reading less than 50% of the hour meters for the other samplers for the same period. The lower reading is suspected to be caused by a power loss during a thunderstorm.

(3) Surface Water:

M-008, River water was frozen for the months of January 2017 and December 2017 and the weeks of 2/1/17, 2/8/17, 2/15/17 and 3/15/17.

(4) Bottom Organisms:

M-8 upstream bottom organisms were not found during either the first or second half of 2017.

Deviations from the program are summarized in Table 5.3.

3.4 Program Modifications

No significant modifications were made to the MNGP Radiological Environmental Monitoring Program in 2017.

3.5 Laboratory Procedures

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

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

Tritium concentrations are determined by liquid scintillation.

Analytical Procedures used by Environmental, Inc. are on file and are available for inspection. Procedures are based on those prescribed by the Health and Safety Laboratory of the U.S. 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 (ATI Environmental, Inc., Midwest Laboratory, 2017). 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

The 2017 land use census was conducted between September 12 and September 22, 2017 by the REMP Coordinator in accordance with the MNGP Chemistry Manual, Procedure I.05.41, “Annual Land Use Census and Critical Receptor Identification”, The survey was performed in order to identify the nearest residence, milk animals, meat animals, and gardens of greater than 500 ft^2 with leafy green vegetables, in each of the 16 meteorological sectors within a five mile radius. In addition all milk animals, meat animals and all gardens of 500 ft^2 or greater with leafy green vegetables within a three mile radius of the plant were located. Distance, direction and dose pathway information is used to determine if any sampling locations need to be changed in the REMP sampling program and for determining Critical Receptor data.

The 2017 survey was performed using door-to-door surveys and visual observations while driving; additionally, inputs from the 2016 field data forms and Homeland Security Emergency Management Monticello Basemap were used in determining changes in land use. The GPS unit for performing the LUC was found to have degraded functionality at the start of the census; the first day of census was performed with Street Atlas using the GPS unit that intermittently worked. Subsequent locations identified were mapped on the Commander Compass application for the iPhone. Data was imported into Google Earth Pro to be compiled, placed into sectors and measured.

There were three sectors in which the highest D/Q values for gardens increased by greater than 20%. These increases in D/Q were due to a closer garden being grown in 2017 that was not present in 2016. The highest D/Q garden for 2017 did not change from the 2016 highest D/Q garden.

There was one sector where the highest D/Q value for Meat increased by greater than 20%. The change was due to a closer residence raising animals for meat consumption in the Northwest sector. The highest D/Q meat animal changed in the 2016 census.

There was one sector in which the highest D/Q values for the nearest residence increased by more than 20%. The cause of the increase was a minor difference in determining the location using Google Earth; the housing unit is not new, but exists right on the line between the SE and SSE sectors and is very sensitive to angular measurements due to its close proximity to the plant.

There are no milking animals within a five mile radius of the plant. Vegetation sampling is being performed in lieu of milk sampling. There are no crops being irrigated from the Mississippi River within five miles downstream of the plant. The nearest downstream drinking water supplies drawn from the Mississippi River remain St. Paul and Minneapolis water supplies as currently documented in the ODCM and USAR.

Doses due to ground plane, inhalation and ingestion of vegetables and meat were calculated for the highest *DIQ* Residence, Meat Animal, Vegetable Garden, and combined Vegetable/Meat locations identified in the 2017 Land Use Census. In accordance with the ODCM, the long- and short-duration gaseous releases from the Reactor Building Vent and the Off-gas Stack for the previous calendar year were used as the source terms.

Doses were calculated using the RADEAS computer program with the 2016 Annual Effluent Data report source term as input. This resulted in identifying the same location and the same pathway as compared to last year's Critical Receptor. The location is residence GH garden located 1.18 miles away in the SSE sector (designated GH) and the pathway identified is the combination of ground plane, inhalation and vegetable ingestion to the THYROID of the CHILD Age Group. The critical receptor for purposes of compliance with 10CFR50 Appendix I for this period is defined as follows:

Sector: SSE;
Distance: 1.18 miles;
Pathways: Ground Plane, Inhalation and Vegetable;
mrem/year: 3.01E-1;
Age Group: Child;
Organ: Thyroid.

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 2017. The Fukushima Daiichi nuclear accident occurred March 11, 2011.

There were no reported atmospheric nuclear tests in 2017. The last reported atmospheric 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 of 0.03 pCi/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 Owner Controlled Area in 2017.

Ambient Radiation (TLD's)

Ambient radiation was measured in the general area of the site boundary, inner ring, at an outer ring 4 - 5 mi. distant from the Plant, at special interest areas and at four control locations. The means were similar for both inner and outer rings (16.1 and 15.1 mRem/91 days, respectively). The mean for special interest locations was 15.0 mRem/91 days and the mean for the control locations was 14.7 mRem/91 days. Dose rates measured at the inner and outer ring locations were similar to those observed from 1999 through 2016 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)	
1999	15.1	14.3
2000	15.1	14.5
2001	14.3	13.7
2002	15.9	14.8
2003	15.6	15.0
2004	16.0	15.4
2005	15.6	15.2
2006	16.5	15.6
2007	16.1	15.1
2008	15.2	14.6
2009	14.9	14.4
2010	14.7	14.3
2011	14.8	14.3
2012	16.2	15.5
2013	14.4	14.0
2014	13.5	12.9
2015	14.8	14.2
2016	15.1	14.3
2017	16.1	15.1

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

Airborne Particulates

The average annual gross beta concentrations in airborne particulates were identical at the indicator and control locations (0.028 pCi/m^3 for both), similar to levels observed from 1999 through 2016. The results are tabulated below.

Year	Indicators	Control
	Concentration (pCi/m^3)	
1999	0.023	0.025
2000	0.027	0.026
2001	0.027	0.026
2002	0.028	0.028
2003	0.027	0.027
2004	0.024	0.024
2005	0.025	0.025
2006	0.024	0.025
2007	0.027	0.028
2008	0.028	0.029
2009	0.029	0.030
2010	0.026	0.026
2011	0.029	0.027
2012	0.032	0.031
2013	0.029	0.032
2014	0.027	0.028
2015	0.030	0.028
2016	0.026	0.024
2017	0.028	0.028

Average annual gross beta concentrations in airborne particulates.

Typically, the highest average readings occur during the months of January and December, and the first and fourth quarters, as observed in 1999 through 2016.

Gamma spectroscopic analysis of quarterly composites of air particulate filters yielded similar results for indicator and control locations. Beryllium-7, which is produced continuously in the upper atmosphere by cosmic radiation (Arnold and Al-Salih, 1955) was detected in all samples, with an average activity of 0.077 pCi/m^3 for the indicator locations and 0.080 pCi/m^3 for the control location. 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. Gamma isotopic results were all below detection limits. Gross beta was detected in 10 out of 12 samples tested at an average of 2.0 pCi/L and was similar to average levels observed from 2000 through 2016. Gross beta averages are tabulated below. There was no indication of a plant effect.

Year	Gross Beta (pCi/L)		Year	Gross Beta (pCi/L)
2000	2.5		2009	2.3
2001	2.5		2010	2.9
2002	2.9		2011	2.2
2003	3.0		2012	2.4
2004	2.7		2013	2.6
2005	2.8		2014	2.8
2006	2.1		2015	2.3
2007	2.8		2016	2.6
2008	2.1		2017	2.0

Average annual concentrations; Gross beta in drinking water.

Well Water

At the four indicator and control locations, tritium was below the detection limit for all samples. Gamma isotopic results were also below detection limits.

The data for 2017 were consistent with previous year's results and no plant operational effects were indicated.

Vegetation in lieu of Milk Sampling

Vegetation samples were collected in July, August and September, 2017. Iodine-131 concentrations measured below 0.028 pCi/g wet weight in all samples. These samples are required when milk samples are not available.

Crops

A corn and potatoes collection was not required for 2017. No crops within five miles of the plant were found using irrigation water from the Mississippi River, and the plant did not discharge radioactive liquid effluents during the growing season.

Fish

Eight fish were analyzed in 2017 consisting of two fish collected from upstream locations and two collected from downstream locations in June and then again in September. Flesh was separated from the bones and analyzed by gamma spectroscopy. Only naturally-occurring potassium-40 was found with an average of 2.85 pCi/g wet weight for four upstream samples and 2.83 pCi/g wet weight for the four downstream samples. These results agree with 2016 results. Other gamma-emitting isotopes remained below detection limits. There was no indication of a plant effect.

Aquatic Invertebrates

Downstream invertebrate sample collections were made in June and September 2017. No gamma-emitting isotopes were detected in either sample. There was no indication of a plant effect.

Shoreline Sediments

Upstream, downstream and downstream recreational area shoreline sediment collections were made in June and September 2017, and analyzed for gamma-emitting isotopes. A level of cesium-137 was detected in both downstream samples (M-9) and (M-15), at an average concentration of 0.042 pCi/g dry weight at location M-9 and an average concentration of 0.032 pCi/g dry weight at location M-15. Similar levels of activity have been observed since 1978, and are indicative of the influence of fallout deposition. Naturally-occurring potassium-40 was also detected. There was no indication of a plant effect.

ISFSI TLD Monitoring

Gamma and Neutron TLDs are located around the Independent Spent Fuel Storage Installation (ISFSI) to monitor direct radiation from stored fuel. Results for gamma monitoring are included in the Complete Data Analysis Tables. In the 2015 AREOR it was stated that MNGP intended to begin reporting results for neutron TLD's. Benchmarking of other nuclear plant annual reports indicates that neutron dose is not reported. MNGP is awaiting industry guidance on how neutron TLD dose should be treated in an environmental monitoring context before reporting neutron monitoring results. Neutron TLD results are used internally for trending of neutron dose rates around the ISFSI.

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]
REMP Ambient radiation(TLDs)	40	M-01A - M-14A, M-01B - M-16B M-01S - M-06S, M-01C - M-04C	C/Q	Ambient gamma
ISFSI Ambient radiation (TLDs)	13	I-01 to I-13	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-55, M-43(C)	G/Q	H-3, GS
Fish (two species, edible portion)	2	M-8(C), M-9	G/SA	GS
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.

Table 5.2. Sampling locations, Monticello Nuclear Generating Plant.

Code	Type [a]	Collection Site	Sample Type [b]	Distance and Direction from Reactor
M-1	C	Air Station M-1	AP, AI	11.0 mi @ 307°/NW
M-2		Air Station M-2	AP, AI	0.8 mi @ 140°/SE
M-3		Air Station M-3	AP, AI	0.6 mi @ 104°/ESE
M-4		Air Station M-4	AP, AI	0.8 mi @ 147°/SSE
M-5		Air Station M-5	AP, AI	2.6 mi @ 134°/SE
M-8	C	Upstream of Plant Intake	SW, SS, BO, F	< 1000' upstream
M-9		Downstream of Plant Discharge	SW, SS, BO, F	< 1000' downstream
M-11		City of Monticello	WW	3.3 mi @ 127°/SE
M-12		Plant Well #11	WW	0.26 mi @ 252°/WSW
M-14		City of Minneapolis	DW	37.0 mi @ 132°/SE
M-15		Montissippi Park	SS	1.27 mi @ 114°/ESE
M-27		Highest D/Q garden		1.15 mi @ 148°/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-55		Hasbrouck Residence	WW	1.60 mi @ 255°/WSW

Table 5.2. Sampling locations, Monticello Nuclear Generating Plant.

Code	Type[a]	Collection Site	Sample Type[b]	Distance and Direction from Reactor
General Area of the Site Boundary				
M-01A		Sherburne Ave. So.	TLD	0.75 mi @ 353°/N
M-02A		Sherburne Ave. So.	TLD	0.79 mi @ 23°/NNE
M-03A		Sherburne Ave. So.	TLD	1.29 mi @ 56°/NE
M-04A		Biology Station Road	TLD	0.5 mi @ 92°/E
M-05A		Biology Station Road	TLD	0.48 mi @ 122°/ESE
M-06A		Biology Station Road	TLD	0.54 mi @ 138°/SE
M-07A		Parking Lot H	TLD	0.47 mi @ 158°/SSE
M-08A		Parking Lot F	TLD	0.45 mi @ 175°/S
M-09A		County Road 75	TLD	0.38 mi @ 206°/SSW
M-10A		County Road 75	TLD	0.38 mi @ 224°/SW
M-11A		County Road 75	TLD	0.4 mi @ 237°/WSW
M-12A		County Road 75	TLD	0.5 mi @ 262°/W
M-13A		North Boundary Road	TLD	0.89 mi @ 322°/NW
M-14A		North Boundary Road	TLD	0.78 mi @ 335°/NNW
Approximately 4 to 5 miles Distant from the Plant				
M-01B		117th Street	TLD	4.65 mi @ 01°/N
M-02B		County Road 11	TLD	4.4 mi @ 18°/NNE
M-03B		County Road 73 & 81	TLD	4.3 mi @ 51°/NE
M-04B		County Road 73 (196th St.)	TLD	4.2 mi @ 67°/ENE
M-05B		City of Big Lake	TLD	4.3 mi @ 89°/E
M-06B		County Road 14 and 196th St.	TLD	4.3 mi @ 117°/ESE
M-07B		Monticello 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		Telephone pole on 127th St. NE	TLD	0.66 mi @ 241°/WSW
M-02S		Krone Residence	TLD	0.5 mi @ 220°/SW
M-03S		Big Oaks Park	TLD	1.53 mi @ 103°/ESE
M-04S		Pinewood School	TLD	2.3 mi @ 131°/SE
M-05S		Rivercrest Christian Academy	TLD	3.0 mi @ 118°/ESE
M-06S		Monticello Public Works	TLD	2.6 mi @ 134°/SE
ISFSI-11		I-11 (gamma)	TLD	OCA fence south, on exit road
ISFSI 12		I-12 (gamma)	TLD	OCA fence middle, on exit road
IFSFI 13		I-13 (gamma	TLD	OCA fence north, on exit road
Control Locations				
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
ISFSI TLD Locations		(Non-REMP TLD's)		
ISFSI-1		I-01 (gamma)	TLD	NE corner of ISFSI
ISFSI-2		I-02 (gamma)	TLD	North side of ISFSI, center
ISFSI-3		I-03 (gamma)	TLD	NW corner of ISFSI
ISFSI-4		I-04 (gamma)	TLD	West side of ISFSI, middle
ISFSI-5		I-05 (gamma)	TLD	West side of ISFSI, at center of array
ISFSI-6		I-06 (gamma)	TLD	SW corner of ISFSI
ISFSI-7		I-07 (gamma)	TLD	South side of ISFSI, center
ISFSI-8		I-08 (gamma)	TLD	SE corner of ISFSI
ISFSI-9		I-09 (gamma)	TLD	East side of ISFSI, at center of array
ISFSI-10		I-10 (gamma)	TLD	East side of ISFSI, middle

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

[b] Sample Codes:

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

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

Table 5.3 Missed Collections and Analyses.

All required samples were collected and analyzed as scheduled with the following exceptions:					
Sample Type	Analysis	Location	Collection Date or Period	Reason for not conducting REMP as required	Plans for Preventing Recurrence
SW	Gamma	M-8c	January '17	Water frozen entire month; No composite.	None
SW	Gamma	M-8c	2/1/17, 2/8/17, 2/15/17	Water frozen. Only one sample in composite.	None
AP/AI	Beta, I-131	M-1	3/8/17	Partial sample due to GFCI failure during thunderstorm.	Replaced GFCI.
AP/AI	Beta, I-131	M-1	3/15/17	Sample not sent; pump found off; only 6 hours of run time.	Replaced pump.
SW	Gamma	M-8c	3/15/17	Water frozen. Not included in composite.	None
TLD	Gamma	M-2C	1st Qtr 2017	TLD missing in field.	None
AP/AI	Beta, I-131	M-3	6/14/17	Partial sample due to an apparent loss of power during a thunderstorm.	None
BO	Gamma	M-8c	1st half 2017	No upstream bottom organisms found.	None
TLD	Gamma	M-15B	3rd Qtr 2017	TLD missing in field.	None
BO	Gamma	M-8c	2nd half 2017	No upstream bottom organisms found.	None
SW	Gamma	M-8c	December '17	Water Frozen entire month, No Composite.	None

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

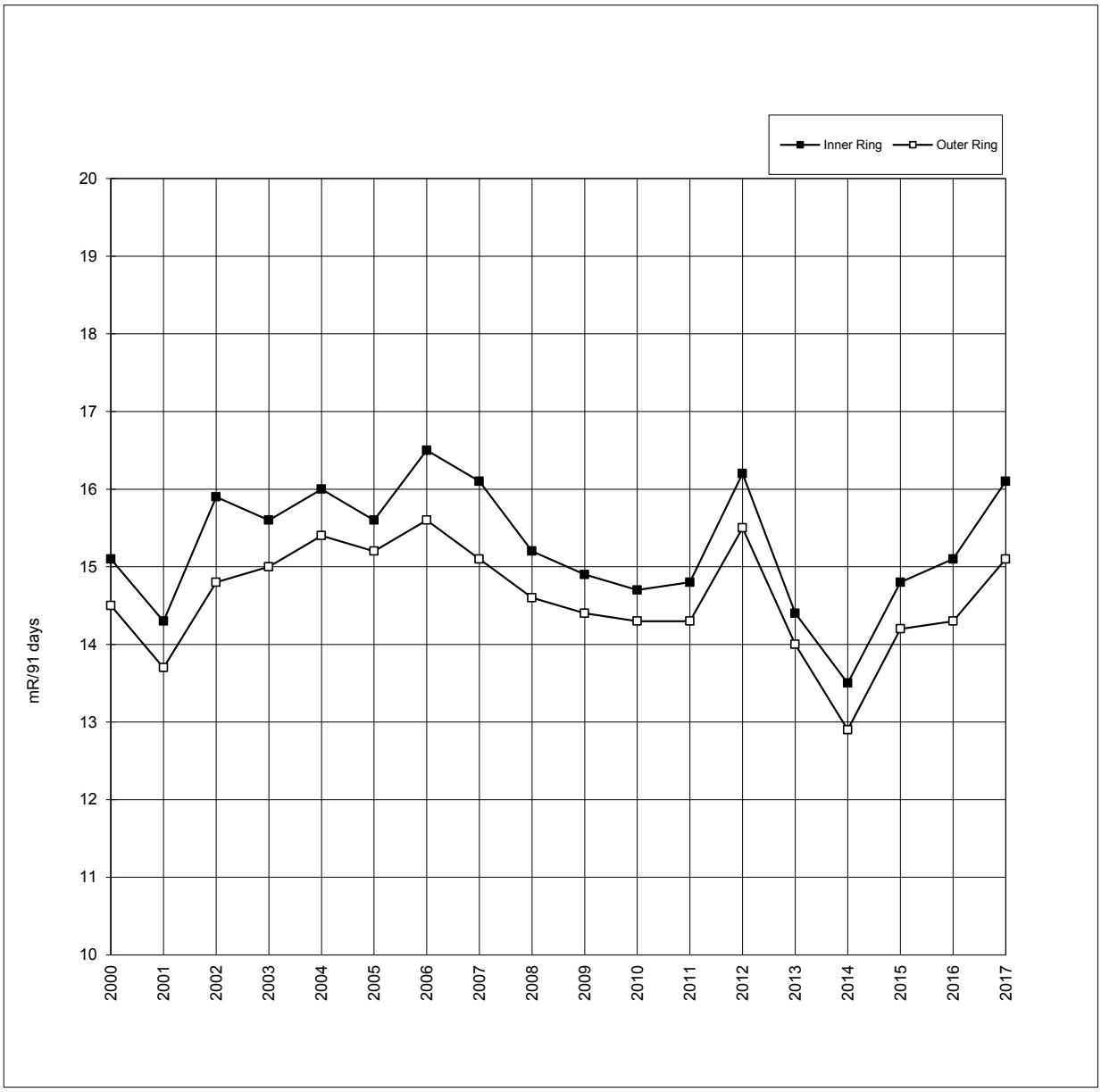

Figure 5-2. Airborne Particulates; analysis for gross beta, average mean of all indicator locations versus control location.

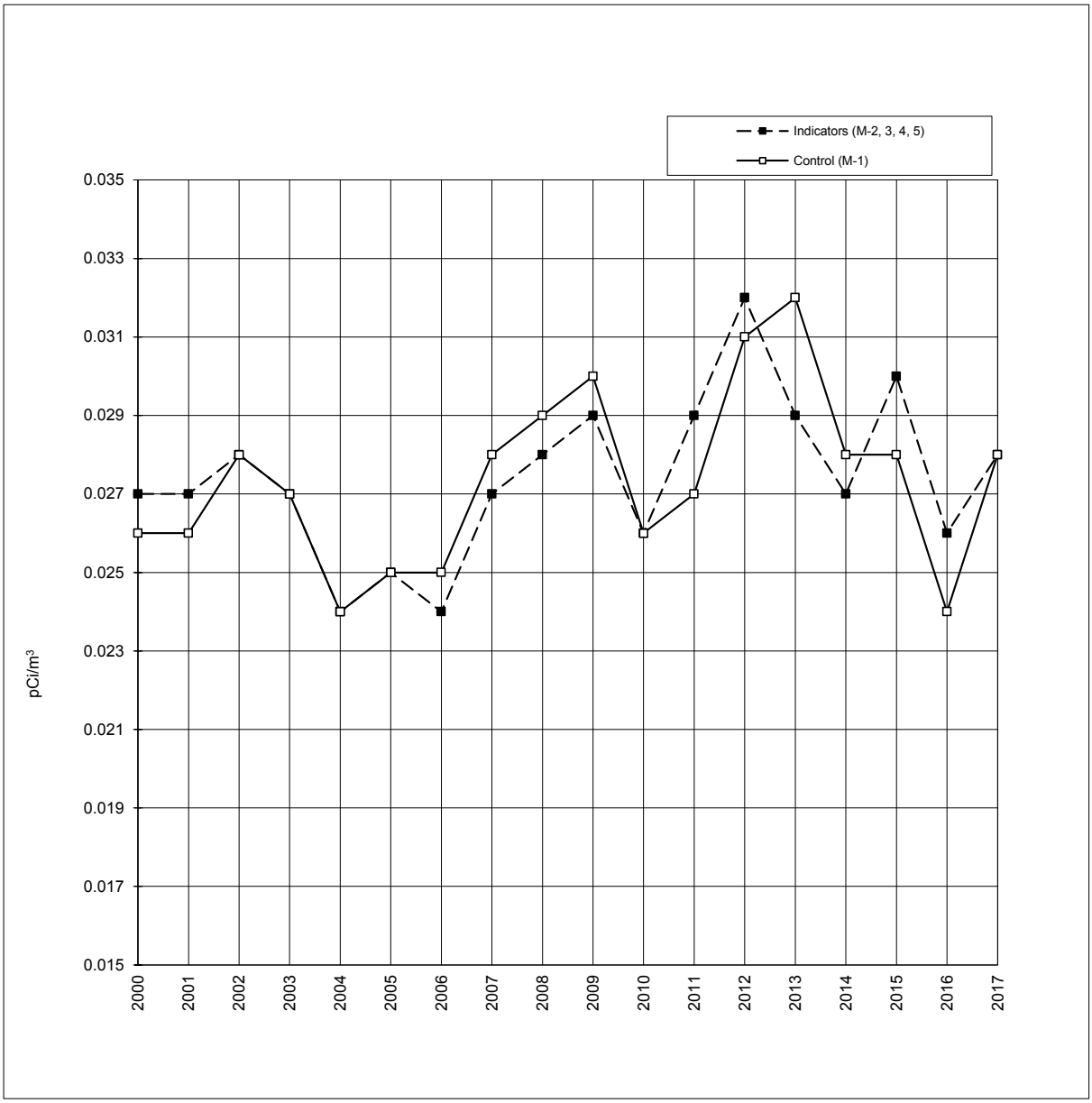

Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility	Monticello Nuclear Generating Plant	Docket No.	50-263
Location of Facility	Wright, Minnesota	Reporting Period	January-December, 2017
	(County, State)		

Sample Type (Units)	Type and Number of Analyses[a]	LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean		Control Locations Mean (F)[c] Range[c]	Number Non-Routine Results[e]
				Location[d]	Mean (F)[c] Range[c]		
Direct Radiation							
TLD (Inner Ring, General Area at Site Boundary) mRem/91 days)	Gamma 56	3.0	16.1 (56/56) (14.0-17.6)	M-11A, 0.4 mi @ 250°/WSW	17.3 (4/4) (17.1-17.6)	(See Control below.)	0
TLD (Outer Ring, 4-5 mi. distant) mRem/91 days)	Gamma 63	3.0	15.1 (63/63) (11.7-17.6)	M-14B 4.5 mi @ 228°/NW	17.0 (4/4) (15.8-17.6)	(See Control below.)	0
TLD (Special Interest Areas) mRem/91 days)	Gamma 36	3.0	15.0 (36/36) (12.0-17.8)	M-I-11 OCA fence South	16.5 (4/4) (15.3-17.8)	(See Control below.)	0
TLD (Control) mRem/91 days)	Gamma 15	3.0	None	M-03C 11.6 mi @ 130°/SE	15.4 (4/4) (14.8-15.9)	14.7 (15/15) (13.0-16.7)	0
Airborne Pathway							
Airborne Particulates (pCi/m^3)	GB 263	0.002	0.028 (211/211 (0.010-0.062)	M-3, Air Station 0.6 mi @ 104°/ESE	0.028 (52/52) (0.011-0.059)	0.028 (52/52) (0.011-0.073)	0
	GS 20						
	Be-7	0.015	0.077 (16/16) (0.052-0.103)	M-5, Air Station 2.6 mi @ 134°/SE	0.081 (4/4) (0.062-0.103)	0.080 (4/4) (0.058-0.107)	0
	Mn-54	0.0009	< LLD	-	-	< LLD	0
	Co-58	0.0010	< LLD	-	-	< LLD	0
	Co-60	0.0009	< LLD	-	-	< LLD	0
	Zn-65	0.0025	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.0015	< LLD	-	-	< LLD	0
	Ru-103	0.0014	< LLD	-	-	< LLD	0
	Ru-106	0.0082	< LLD	-	-	< LLD	0
	Cs-134	0.0010	< LLD	-	-	< LLD	0
	Cs-137	0.0010	< LLD	-	-	< LLD	0
	Ba-La-140	0.0036	< LLD	-	-	< LLD	0
	Ce-141	0.0023	< LLD	-	-	< LLD	0
	Ce-144	0.0063	< LLD	-	-	< LLD	0
Airborne Iodine (pCi/m^3)	I-131 263	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	Reporting Period	January-December,2017
	(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]
Waterborne Pathway							
River Water (pCi/L)	H-3 12	500	< LLD	-	-	< LLD	0
	GS 12						
	Mn-54	10	< LLD	-	-	< LLD	0
	Fe-59	30	< LLD	-	-	< LLD	0
	Co-58	10	< LLD	-	-	< LLD	0
	Co-60	10	< LLD	-	-	< LLD	0
	Zn-65	30	< LLD	-	-	< LLD	0
	Zr-Nb-95	15	< LLD	-	-	< LLD	0
	Cs-134	10	< LLD	-	-	< LLD	0
	Cs-137	10	< LLD	-	-	< LLD	0
	Ba-La-140	15	< LLD	-	-	< LLD	0
	Ce-144	42	< LLD	-	-	< LLD	0
Drinking Water (pCi/L)	GB 12	2.5	2.0 (10/12) (1.3-4.4)	M-14 City of Minneapolis 37.0 mi @ 132°/SE	2.0 (10/12) (1.3-4.4)	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	42	< LLD	-	-	None	0
Well Water (pCi/L)	H-3 16	500	< LLD	-	-	< LLD	0
	GS 16						
	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	39	< LLD	-	-	< LLD	0

Table 5.4 Radiological Environmental Monitoring Program Summary

Name of Facility	Monticello Nuclear Generating Plant	Docket No.	50-263
Location of Facility	Wright, Minnesota	Reporting Period	January-December, 2017
	(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]		
Waterborne Pathway							
Aquatic Invertebrates (pCi/g wet)	GS 2						
	Be-7	1.27	< LLD	-	-	None	0
	K-40	2.23	< LLD	-	-	None	0
	Mn-54	0.097	< LLD	-	-	None	0
	Fe-59	0.30	< LLD	-	-	None	0
	Co-58	0.076	< LLD	-	-	None	0
	Co-60	0.096	< LLD	-	-	None	0
	Zn-65	0.22	< LLD	-	-	None	0
	Zr-Nb-95	0.22	< LLD	-	-	None	0
	Ru103	0.18	< LLD	-	-	None	0
	Ru-106	0.76	< LLD	-	-	None	0
	Cs-134	0.11	< LLD	-	-	None	0
	Cs-137	0.13	< LLD	-	-	None	0
	Ba-La-140	0.54	< LLD	-	-	None	0
	Ce-144	0.45	< LLD	-	-	None	0
Shoreline Sediments (pCi/g dry)	GS 6						
	Be-7	0.12	< LLD	-	-	< LLD	0
	K-40	0.10	9.97 (4/4) (9.49-10.58)	M-8, Upstream < 1000 ft upstream	10.82 (2/2) (10.41-11.24)	10.82 (2/2) (10.41-11.24)	0
	Mn-54	0.018	< LLD	-	-	< LLD	0
	Fe-59	0.042	< LLD	-	-	< LLD	0
	Co-58	0.015	< LLD	-	-	< LLD	0
	Co-60	0.041	< LLD	-	-	< LLD	0
	Zn-65	0.027	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.034	< LLD	-	-	< LLD	0
	Ru103	0.019	< LLD	-	-	< LLD	0
	Ru-106	0.12	< LLD	-	-	< LLD	0
	Cs-134	0.016	< LLD	-	-	< LLD	0
	Cs-137		0.037 (4/4) (0.030-0.045)	M-9, Downstream < 1000 ft downstream	0.042 (2/2) (0.038-0.045)	< LLD	0
	Ba-La-140	0.16	< LLD	-	-	< LLD	0
	Ce-144	0.082	< 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, 2017

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]
Ingestion Pathway							
Vegetation (Pasture Grass, Weeds, Leaves) (pCi/gwet)	GS 9						
	Mn-54	0.014	< LLD	-	-	< LLD	0
	Fe-59	0.035	< LLD	-	-	< LLD	0
	Co-58	0.016	< LLD	-	-	< LLD	0
	Co-60	0.016	< LLD	-	-	< LLD	0
	Zn-65	0.026	< LLD	-	-	< LLD	0
	Nb-95	0.019	< LLD	-	-	< LLD	0
	I-131	0.028	< LLD	-	-	< LLD	0
	Cs-134	0.017	< LLD	-	-	< LLD	0
	Cs-137	0.017	< LLD	-	-	< LLD	0
Fish (pCi/g wet)	GS 8						
	K-40	0.10	2.83 (4/4) (2.34-3.26)	M-8, Upstream < 1000 ft upstream	2.85 (4/4) (2.74-3.08)	2.85 (4/4) (2.74-3.08)	0
	Mn-54	0.017	< LLD	-	-	< LLD	0
	Fe-59	0.065	< LLD	-	-	< LLD	0
	Co-58	0.023	< LLD	-	-	< LLD	0
	Co-60	0.020	< LLD	-	-	< LLD	0
	Zn-65	0.038	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.037	< LLD	-	-	< LLD	0
	Cs-134	0.020	< LLD	-	-	< LLD	0
	Cs-137	0.018	< LLD	-	-	< LLD	0
	Ba-La-140	0.161	< LLD	-	-	< LLD	0
	Ce144	0.110	< 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.

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APPENDIX A

INTERLABORATORY COMPARISON PROGRAM RESULTS
AND INTRALABORATORY COMPARISON PROGRAM RESULTS

NOTE: Appendix A is updated four times a year. The complete appendix is included in March, June, September and December monthly progress reports only.

January, 2017 through December, 2017

Appendix A

Interlaboratory/ Intralaboratory Comparison Program Results

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

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

Results in Table A-1 were obtained through participation in the RAD PT Study Proficiency Testing 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 irradiation and evaluation by the University of Wisconsin-Madison Radiation Calibration Laboratory at the University of Wisconsin Medical Radiation Research Center.

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 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 MRAD PT Study Proficiency Testing 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 acceptance criteria for spiked sample results presented in Table A-3.

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

Attachment A

ACCEPTANCE CRITERIA FOR "SPIKED" SAMPLES

Analysis	Ratio of lab result to known value.
Gamma Emitters	0.8 to 1.2
Strontium-89	0.8 to 1.2
Strontium-90	0.8 to 1.2
Potassium-40	0.8 to 1.2
Gross alpha	0.5 to 1.5
Gross beta	0.8 to 1.2
Tritium	0.8 to 1.2
Radium-226,-228	0.7 to 1.3
Plutonium	0.8 to 1.2
Iodine-131, Iodine-129	0.8 to 1.2
Uranium-238, Nickel-63 Technetium-99	0.7 to 1.3
Iron-55	0.8 to 1.2
Other Analyses	0.8 to 1.2

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

RAD study

Lab Code	Date	Concentration (pCi/L)				
		Analysis	Laboratory Result	ERA Result	Control Limits	Acceptance
ERW-95	1/9/2017	Sr-89	51.9 ± 4.6	55.5	44.3 - 63.2	Pass
ERW-95	1/9/2017	Sr-90	43.6 ± 2.4	43.1	31.8 - 49.5	Pass
ERW-97	1/9/2017	Ba-133	78.2 ± 4.1	85.6	72.0 - 94.2	Pass
ERW-97	1/9/2017	Cs-134	53.9 ± 3.8	52.6	42.4 - 57.9	Pass
ERW-97	1/9/2017	Cs-137	122 ± 6	112	101 - 126	Pass
ERW-97	1/9/2017	Co-60	117 ± 4	113	102 - 126	Pass
ERW-97	1/9/2017	Zn-65	208 ± 13	189	170 - 222	Pass
ERW-99	1/9/2017	Gr. Alpha	48.9 ± 2.4	52.3	27.3 - 65.5	Pass
ERW-99	1/9/2017	Gr. Beta	37.1 ± 1.3	41.6	27.7 - 49.0	Pass
ERW-101	1/9/2017	I-131	22.3 ± 0.6	24.3	20.2 - 28.8	Pass
ERW-103	1/9/2017	Ra-226	11.3 ± 0.4	12.7	9.5 - 14.7	Pass
ERW-103	1/9/2017	Ra-228	6.10 ± 0.90	6.20	3.8 - 8.1	Pass
ERW-103	1/9/2017	Uranium	11.8 ± 0.8	12.6	9.9 - 14.4	Pass
ERW-106	1/9/2017	H-3	12,600 ± 300	12,500	10,900 - 13,800	Pass
ERW-3344	7/10/2017	Sr-89	29.0 ± 10.0	26.4	18.4 - 32.9	Pass
ERW-3344	7/10/2017	Sr-90	33.8 ± 3.3	36.0	26.4 - 41.5	Pass
ERW-3346	7/10/2017	Ba-133	66.4 ± 4.1	66.3	55.2 - 72.9	Pass
ERW-3346	7/10/2017	Cs-134	27.0 ± 4.3	24.4	18.7 - 27.2	Pass
ERW-3346	7/10/2017	Cs-137	57.4 ± 4.5	51.6	46.4 - 59.6	Pass
ERW-3346	7/10/2017	Co-60	92.6 ± 4.4	88.6	79.7 - 99.8	Pass
ERW-3346	7/10/2017	Zn-65	32.4 ± 6.0	32.7	27.3 - 41.6	Pass
ERW-3348	7/10/2017	Gr. Alpha	23.7 ± 1.9	25.7	13.0 - 34.1	Pass
ERW-3348	7/10/2017	Gr. Beta	54.6 ± 1.6	63.0	43.5 - 69.6	Pass
ERW-3350	7/10/2017	I-131	25.4 ± 1.3	25.5	21.2 - 30.1	Pass
ERW-3352	7/10/2017	Ra-226	1.38 ± 0.15	1.29	1.07 - 1.95	Pass
ERW-3352	7/10/2017	Ra-228	6.70 ± 0.93	5.66	3.45 - 7.47	Pass
ERW-3352	7/10/2017	Uranium	58.4 ± 0.9	66.7	54.3 - 73.9	Pass
ERW-3354	7/10/2017	H-3	5,254 ± 224	5,060	4,340 - 5,570	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).

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

			mrem			
Lab Code	Irradiation Date	Description	Delivered Dose	Reported [b] Dose	Performance [c] Quotient (P)	
Environmental, Inc.		Group 1				
2017-1	10/16/2017	Spike 1	59.0	49.3	-0.16	
2017-1	10/16/2017	Spike 2	59.0	53.2	-0.10	
2017-1	10/16/2017	Spike 3	59.0	52.7	-0.11	
2017-1	10/16/2017	Spike 4	59.0	53.4	-0.09	
2017-1	10/16/2017	Spike 5	59.0	51.8	-0.12	
2017-1	10/16/2017	Spike 6	59.0	54.0	-0.08	
2017-1	10/16/2017	Spike 7	59.0	52.0	-0.12	
2017-1	10/16/2017	Spike 8	59.0	52.6	-0.11	
2017-1	10/16/2017	Spike 9	59.0	54.6	-0.07	
2017-1	10/16/2017	Spike 10	59.0	50.4	-0.15	
2017-1	10/16/2017	Spike 11	59.0	53.9	-0.09	
2017-1	10/16/2017	Spike 12	59.0	55.7	-0.06	
2017-1	10/16/2017	Spike 13	59.0	50.2	-0.15	
2017-1	10/16/2017	Spike 14	59.0	52.4	-0.11	
2017-1	10/16/2017	Spike 15	59.0	54.3	-0.08	
2017-1	10/16/2017	Spike 16	59.0	53.2	-0.10	
2017-1	10/16/2017	Spike 17	59.0	50.1	-0.15	
2017-1	10/16/2017	Spike 18	59.0	52.3	-0.11	
2017-1	10/16/2017	Spike 19	59.0	50.3	-0.15	
2017-1	10/16/2017	Spike 20	59.0	50.7	-0.14	
2017-1	10/16/2017	Spike 21	59.0	53.1	-0.10	
2017-1	10/16/2017	Spike 22	59.0	51.5	-0.13	
2017-1	10/16/2017	Spike 23	59.0	54.4	-0.08	
2017-1	10/16/2017	Spike 24	59.0	53.3	-0.10	
2017-1	10/16/2017	Spike 25	59.0	53.7	-0.09	
2017-1	10/16/2017	Spike 26	59.0	51.6	-0.13	
2017-1	10/16/2017	Spike 27	59.0	51.5	-0.13	
2017-1	10/16/2017	Spike 28	59.0	51.6	-0.13	
2017-1	10/16/2017	Spike 29	59.0	49.9	-0.15	
2017-1	10/16/2017	Spike 30	59.0	55.3	-0.06	
Mean (Spike 1-30)				52.4	-0.11	Pass[d]
Standard Deviation (Spike 1-30)				1.7	0.03	Pass[d]

a TLD's were irradiated by the University of Wisconsin-Madison Radiation Calibration Laboratory following ANSI N13.37 protocol from a known air kerma rate. TLD's were read and the results were submitted by Environmental Inc. to the University of Wisconsin-Madison Radiation Calibration Laboratory for comparison to the delivered dose.

b Reported dose was converted from exposure (R) to Air Kerma (cGy) using a conversion of 0.876. Conversion from air kerma to ambient dose equivalent for Cs-137 at the reference dose point $H^*(10)K_a = 1.20$. mrem/cGy = 1000.

c Performance Quotient (P) is calculated as ((reported dose - conventially true value) ÷ conventially true value) where the conventially true value is the delivered dose.

d Acceptance is achieved when neither the absolute value of mean of the P values, nor the standard deviation of the P values exceed 0.15.

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

			mrem		
Lab Code	Irradiation Date	Description	Delivered Dose	Reported [b] Dose	Performance [c] Quotient (P)
Environmental, Inc.		Group 2			
2017-2	10/16/2017	Spike 31	186.0	164.7	-0.11
2017-2	10/16/2017	Spike 32	186.0	172.0	-0.08
2017-2	10/16/2017	Spike 33	186.0	167.3	-0.10
2017-2	10/16/2017	Spike 34	186.0	160.6	-0.14
2017-2	10/16/2017	Spike 35	186.0	171.7	-0.08
2017-2	10/16/2017	Spike 36	186.0	177.0	-0.05
2017-2	10/16/2017	Spike 37	186.0	176.7	-0.05
2017-2	10/16/2017	Spike 38	186.0	165.5	-0.11
2017-2	10/16/2017	Spike 39	186.0	174.6	-0.06
2017-2	10/16/2017	Spike 40	186.0	172.7	-0.07
2017-2	10/16/2017	Spike 41	186.0	167.8	-0.10
2017-2	10/16/2017	Spike 42	186.0	161.0	-0.13
2017-2	10/16/2017	Spike 43	186.0	166.3	-0.11
2017-2	10/16/2017	Spike 44	186.0	172.4	-0.07
2017-2	10/16/2017	Spike 45	186.0	173.0	-0.07
2017-2	10/16/2017	Spike 46	186.0	169.5	-0.09
2017-2	10/16/2017	Spike 47	186.0	169.0	-0.09
2017-2	10/16/2017	Spike 48	186.0	166.9	-0.10
2017-2	10/16/2017	Spike 49	186.0	165.9	-0.11
2017-2	10/16/2017	Spike 50	186.0	166.7	-0.10
2017-2	10/16/2017	Spike 51	186.0	161.1	-0.13
2017-2	10/16/2017	Spike 52	186.0	173.4	-0.07
2017-2	10/16/2017	Spike 53	186.0	173.1	-0.07
2017-2	10/16/2017	Spike 54	186.0	160.0	-0.14
2017-2	10/16/2017	Spike 55	186.0	166.1	-0.11
2017-2	10/16/2017	Spike 56	186.0	164.5	-0.12
2017-2	10/16/2017	Spike 57	186.0	163.8	-0.12
2017-2	10/16/2017	Spike 58	186.0	159.9	-0.14
2017-2	10/16/2017	Spike 59	186.0	165.6	-0.11
2017-2	10/16/2017	Spike 60	186.0	165.0	-0.11
Mean (Spike 31-60)				167.8	-0.10 Pass[d]
Standard Deviation (Spike 31-60)				5.0	0.03 Pass[d]

a TLD's were irradiated by the University of Wisconsin-Madison Radiation Calibration Laboratory following ANSI N13.37 protocol from a known air kerma rate. TLD's were read and the results were submitted by Environmental Inc. to the University of Wisconsin-Madison Radiation Calibration Laboratory for comparison to the delivered dose.

b Reported dose was converted from exposure (R) to Air Kerma (cGy) using a conversion of 0.876. Conversion from air kerma to ambient dose equivalent for Cs-137 at the reference dose point $H^*(10)K_a = 1.20$. mrem/cGy = 1000.

c Performance Quotient (P) is calculated as ((reported dose - conventially true value) ÷ conventially true value) where the conventially true value is the delivered dose.

d Acceptance is achieved when neither the absolute value of mean of the P values, nor the standard deviation of the P values exceed 0.15.

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

Lab Code [b]	Date	Concentration [a] Analysis	Laboratory results 2s, n=1 [c]	Known Activity	Control Limits [d]	Acceptance	Ratio Lab/Known
W-010417	4/29/2016	Cs-134	38.2 ± 8.1	36.2	29.0 - 43.4	Pass	1.06
W-010417	4/29/2016	Cs-137	78.0 ± 8.8	71.9	57.5 - 86.3	Pass	1.08
SPW-306	1/4/2017	Ra-226	18.1 ± 0.4	16.7	11.7 - 21.7	Pass	1.08
SPW-32	1/6/2017	H-3	17,849 ± 393	17,243	13,794 - 20,692	Pass	1.04
SPW-46	1/9/2017	Gr. Alpha	20.0 ± 0.4	20.1	10.0 - 30.1	Pass	1.00
SPW-46	1/9/2017	Gr. Beta	29.0 ± 0.3	28.9	23.1 - 34.6	Pass	1.00
SPW-92	1/11/2017	H-3	18,095 ± 397	17,243	13,794 - 20,692	Pass	1.05
SPW-142	1/12/2017	Sr-90	39.4 ± 2.3	36.6	29.2 - 43.9	Pass	1.08
SPW-155	1/19/2017	H-3	17,974 ± 400	17,243	13,794 - 20,692	Pass	1.04
SPW-186	1/23/2017	H-3	17,383 ± 366	17,243	13,794 - 20,692	Pass	1.01
SPW-232	1/19/2017	H-3	17,542 ± 368	17,243	13,794 - 20,692	Pass	1.02
SPW-304	1/26/2017	H-3	17,782 ± 400	17,243	13,794 - 20,692	Pass	1.03
SPW-333	1/30/2017	H-3	17,910 ± 406	17,243	13,794 - 20,692	Pass	1.04
SPW-353	2/2/2017	U-234	47.8 ± 2.3	41.7	29.2 - 54.2	Pass	1.15
SPW-353	2/2/2017	U-238	50.4 ± 2.4	41.7	29.2 - 54.2	Pass	1.21
W-020217	4/29/2016	Cs-134	33.7 ± 6.1	36.2	29.0 - 41.2	Pass	0.93
W-020217	4/29/2016	Cs-137	78.4 ± 7.3	71.9	57.5 - 86.3	Pass	1.09
SPW-412	2/6/2017	Sr-90	36.2 ± 2.4	36.6	29.2 - 43.9	Pass	0.99
SPW-465	2/8/2017	H-3	17,573 ± 396	17,243	13,794 - 20,692	Pass	1.02
SPW-561	2/15/2017	H-3	17,358 ± 395	17,243	13,794 - 20,692	Pass	1.01
SPW-605	2/16/2017	H-3	17,820 ± 401	17,243	13,794 - 20,692	Pass	1.03
SPW-657	2/17/2017	H-3	17,614 ± 376	17,243	13,794 - 20,692	Pass	1.02
SPW-714	2/23/2017	H-3	17,662 ± 400	17,243	13,794 - 20,692	Pass	1.02
SPW-737	2/28/2017	H-3	17,196 ± 395	17,243	13,794 - 20,692	Pass	1.00
SPAP-740	2/28/2017	Gr. Beta	38.9 ± 0.1	41.5	33.2 - 49.8	Pass	0.94
SPAP-742	2/24/2017	Cs-134	1.05 ± 0.60	0.98	0.8 - 6.0	Pass	1.07
SPAP-742	2/24/2017	Cs-137	90.4 ± 2.5	92.9	74.3 - 111	Pass	0.97
SPW-746	2/28/2017	Sr-90	42.8 ± 2.5	36.6	29.2 - 43.9	Pass	1.17
SPW-748	2/28/2017	C-14	4,270 ± 17	4,735	3,788 - 5,682	Pass	0.90
SPW-750	2/28/2017	Ni-63	463 ± 4	400	280 - 520	Pass	1.16
SPF-752	2/28/2017	Cs-134	1033 ± 38	1090	872 - 1308	Pass	0.95
SPF-752	2/28/2017	Cs-137	3071 ± 61	2820	2,256 - 3,384	Pass	1.09
SPW-781	3/1/2017	Ra-226	18.1 ± 0.4	16.7	11.7 - 21.7	Pass	1.08
SPW-783	3/1/2017	H-3	17,653 ± 400	17,243	13,794 - 20,692	Pass	1.02
W-030517	4/29/2016	Cs-134	38.0 ± 9.0	36.2	29.0 - 43.4	Pass	1.05
W-030517	4/29/2016	Cs-137	80.9 ± 9.2	71.9	57.5 - 86.3	Pass	1.13
SPW-1010	3/14/2017	H-3	17,312 ± 395	17,243	13,794 - 20,692	Pass	1.00
SPW-1026	3/16/2017	Gr. Alpha	22.4 ± 0.5	20.1	10.0 - 30.1	Pass	1.11
SPW-1026	3/16/2017	Gr. Beta	29.2 ± 0.3	28.9	23.1 - 34.6	Pass	1.01
SPW-1092	3/21/2017	H-3	17,252 ± 390	17,243	13,794 - 20,692	Pass	1.00
SPW-1151	3/24/2017	H-3	17,009 ± 388	17,243	13,794 - 20,692	Pass	0.99
SPW-1163	3/28/2017	Sr-90	39.0 ± 2.3	36.3	29.0 - 43.5	Pass	1.08
SPW-1178	3/29/2017	Ra-228	15.1 ± 1.9	16.0	11.2 - 20.8	Pass	0.94

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

Lab Code [b]	Date	Concentration [a] Analysis	Laboratory results 2s, n=1 [c]	Known Activity	Control Limits [d]	Acceptance	Ratio Lab/Known
SPW-1232	3/30/2017	H-3	17,150 ± 390	17,243	13,794 - 20,692	Pass	0.99
SPW-1246	3/31/2017	I-131(G)	33.0 ± 7.3	36.6	29.3 - 43.9	Pass	0.90
SPW-1246	3/31/2017	Cs-134	28.9 ± 4.6	26.6	21.3 - 31.9	Pass	1.09
SPW-1246	3/31/2017	Cs-137	80.6 ± 8.2	70.4	56.3 - 84.5	Pass	1.15
SPMI-1248	3/31/2017	I-131(G)	39.8 ± 7.0	36.6	29.3 - 43.9	Pass	1.09
SPMI-1248	3/31/2017	Cs-134	26.9 ± 5.9	26.6	21.3 - 31.9	Pass	1.01
SPMI-1248	3/31/2017	Cs-137	70.4 ± 6.9	70.4	56.3 - 84.5	Pass	1.00
SPMI-1248	3/31/2017	I-131	36.2 ± 0.6	36.6	29.3 - 43.9	Pass	0.99
SPW-1295	3/31/2017	Ra-226	17.9 ± 0.4	16.7	11.7 - 21.7	Pass	1.07
SPW-1304	4/4/2017	H-3	17,741 ± 398	17,243	13,794 - 20,692	Pass	1.03
SPW-1359	4/5/2017	I-131	44.3 ± 0.5	47.6	38.1 - 57.1	Pass	0.93
SPW-1378	4/7/2017	H-3	17,528 ± 395	17,243	13,794 - 20,692	Pass	1.02
SPW-1391	4/7/2017	Gr. Alpha	21.1 ± 0.4	20.1	10.0 - 30.1	Pass	1.05
SPW-1391	4/7/2017	Gr. Beta	27.8 ± 0.3	28.2	22.6 - 33.8	Pass	0.99
SPW-1480	4/12/2017	H-3	17,399 ± 392	17,243	13,794 - 20,692	Pass	1.01
W-041317	4/29/2016	Cs-134	34.6 ± 5.6	36.2	29.0 - 43.4	Pass	0.96
W-041317	4/29/2016	Cs-137	81.9 ± 8.0	71.9	57.5 - 86.3	Pass	1.14
SPW-1480	4/12/2017	H-3	17,399 ± 392	17,243	13,794 - 20,692	Pass	1.01
SPW-1575	4/18/2017	H-3	17,419 ± 393	17,243	13,794 - 20,692	Pass	1.01
SPW-1626	4/20/2017	Sr-90	37.2 ± 2.4	36.3	29.0 - 43.5	Pass	1.02
SPW-1658	4/21/2017	H-3	17,194 ± 391	17,243	13,794 - 20,692	Pass	1.00
SPW-1776	4/26/2017	H-3	16,609 ± 386	17,243	13,794 - 20,692	Pass	0.96
SPW-1806	4/27/2017	H-3	17,203 ± 390	17,243	13,794 - 20,692	Pass	1.00
SPW-1937	5/3/2017	H-3	16,690 ± 385	17,243	13,794 20,692	Pass	0.97
SPW-1971	5/5/2017	Sr-90	41.5 ± 2.2	36.3	29.0 - 43.5	Pass	1.14
SPW-2033	5/8/2017	H-3	16,780 ± 386	17,243	13,794 20,692	Pass	0.97
SPW-2420	5/9/2017	Ra-226	16.3 ± 0.5	16.7	11.7 - 21.7	Pass	0.98
W-051517	4/29/2016	Cs-134	36.3 ± 5.0	36.2	29.0 - 43.4	Pass	1.00
W-051517	4/29/2016	Cs-137	68.9 ± 6.6	71.9	57.5 - 86.3	Pass	0.96
SPW-2284	5/22/2017	H-3	16,935 ± 389	16,703	13,362 - 20,044	Pass	1.01
SPW-2354	5/23/2017	H-3	17,006 ± 390	16,700	13,360 - 20,040	Pass	1.02
SPW-2891	5/23/2017	Ra-226	17.5 ± 0.4	16.7	13.4 - 20.1	Pass	1.05
SPW-2418	5/23/2017	Ra-228	14.0 ± 1.8	16.0	11.2 - 20.8	Pass	0.87
SPW-2439	5/25/2017	Ra-228	13.0 ± 1.8	16.0	11.2 - 20.8	Pass	0.81
SPMI-2378	5/24/2017	Sr-89	83.7 ± 4.9	98.4	78.7 - 118.1	Pass	0.85
SPMI-2378	5/24/2017	Sr-90	39.5 ± 1.5	36.1	28.9 - 43.4	Pass	1.09
SPW-2468	5/26/2017	H-3	17,065 ± 391	16,692	13,354 - 20,030	Pass	1.02
SPW-2848	5/26/2017	I-131	56.4 ± 0.6	58.3	46.6 - 69.9	Pass	0.97
SPW-2502	6/1/2017	H-3	17,596 ± 396	16,677	13,342 - 20,012	Pass	1.06
SPW-2659	6/5/2017	H-3	17,027 ± 390	16,677	13,342 - 20,012	Pass	1.02
SPW-2790	6/9/2017	H-3	17,101 ± 392	17,101	13,681 - 20,521	Pass	1.00

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

Lab Code [b]	Date	Concentration [a] Analysis	Laboratory results 2s, n=1 [c]	Known Activity	Control Limits [d]	Acceptance	Ratio Lab/Known
SPW-2798	6/12/2017	H-3	16,683 ± 364	16,649	13,319 - 19,979	Pass	1.00
SPW-2943	6/19/2017	Sr-90	39.2 ± 2.3	36.1	28.9 - 43.3	Pass	1.09
SPW-3509	6/15/2017	Ra-226	17.6 ± 0.5	16.7	11.7 - 21.7	Pass	1.05
W-061317	4/29/2016	Cs-134	35.0 ± 6.2	36.2	29.0 - 43.4	Pass	0.97
W-061317	4/29/2016	Cs-137	77.4 ± 7.8	71.9	57.5 - 86.3	Pass	1.08
SPW-3041	6/23/2017	H-3	16,419 ± 378	16,620	13,296 - 19,944	Pass	0.99
SPW-3511	6/23/2017	Ra-226	15.5 ± 0.6	16.7	11.7 - 21.7	Pass	0.93
SPW-3103	6/28/2017	H-3	16,507 ± 380	16,507	13,206 - 19,808	Pass	1.00
SPW-3117	6/29/2017	Tc-99	112.7 ± 1.9	107.8	75.5 - 140.1	Pass	1.05
SPW-3513	6/29/2017	Ra-226	17.8 ± 0.5	16.7	11.7 - 21.7	Pass	1.06
SPW-3188	7/3/2017	Sr-90	38.1 ± 2.2	36.1	28.9 - 43.3	Pass	1.06
SPW-3283	7/11/2017	H-3	16,057 ± 347	16,649	13,319 - 19,979	Pass	0.96
SPW-4054	7/11/2017	Ra-226	17.7 ± 0.4	16.0	11.2 - 20.8	Pass	1.11
SPW-3467	7/14/2017	Gr. Alpha	22.3 ± 0.5	20.1	10.0 - 30.1	Pass	1.11
SPW-3467	7/14/2017	Gr. Beta	29.1 ± 0.3	28.2	22.6 - 33.8	Pass	1.03
SPW-3449	7/15/2017	H-3	17,196 ± 393	16,507	13,206 - 19,808	Pass	1.04
SPW-3548	7/19/2017	H-3	16,764 ± 386	16,507	13,206 - 19,808	Pass	1.02
SPW-3728	7/24/2017	H-3	16,117 ± 354	16,507	13,206 - 19,808	Pass	0.98
SPW-3794	7/28/2017	H-3	16,645 ± 384	16,507	13,206 - 19,808	Pass	1.01
W-072817	4/29/2016	Cs-134	38.6 ± 5.6	36.2	29.0 - 43.4	Pass	1.07
W-072817	4/29/2016	Cs-137	76.5 ± 7.6	71.9	57.5 - 86.3	Pass	1.06
SPW-3905	8/3/2017	Gr. Alpha	22.3 ± 0.5	20.1	10.0 - 30.1	Pass	1.11
SPW-3905	8/3/2017	Gr. Beta	27.6 ± 0.3	28.2	22.6 - 33.8	Pass	0.98
SPW-4030	8/9/2017	H-3	17,636 ± 403	16,507	13,206 - 19,808	Pass	1.07
SPW-4086	8/14/2017	H-3	17,472 ± 401	16,507	13,206 - 19,808	Pass	1.06
SPW-4207	8/17/2017	H-3	17,013 ± 393	16,507	13,206 - 19,808	Pass	1.03
W-083017	4/29/2016	Cs-134	34.7 ± 6.4	36.2	29.0 - 43.4	Pass	0.96
W-083017	4/29/2016	Cs-137	78.2 ± 6.7	71.9	57.5 - 86.3	Pass	1.09
SPW-4241	8/19/2017	H-3	17,222 ± 371	16,507	13,206 - 19,808	Pass	1.04
SPW-4458	9/1/2017	Ra-226	14.1 ± 1.8	16.7	11.7 - 21.7	Pass	0.84
SPW-4466	9/6/2017	Sr-89	22.8 ± 8.5	26.4	21.1 - 31.7	Pass	0.86
SPW-4466	9/6/2017	Sr-90	32.5 ± 2.1	33.8	27.0 - 40.6	Pass	0.96
SPW-4512	9/8/2017	Gr. Alpha	19.2 ± 0.4	20.1	10.1 - 30.2	Pass	0.96
SPW-4512	9/8/2017	Gr. Beta	27.8 ± 0.3	27.9	22.3 - 33.5	Pass	0.99
SPW-4586	9/9/2017	H-3	16,586 ± 362	16,507	13,206 - 19,808	Pass	1.00
SPW-4720	9/16/2017	H-3	16,439 ± 362	16,507	13,206 - 19,808	Pass	1.00
SPW-4834	9/22/2017	H-3	16,238 ± 378	16,507	13,206 - 19,808	Pass	0.98
SPW-4935	9/27/2017	H-3	16,595 ± 381	16,507	13,206 - 19,808	Pass	1.01
SPW-4937	9/27/2017	Ra-228	5.7 ± 0.9	5.8	4.1 - 7.5	Pass	0.98
W-092717	4/29/2016	Cs-134	36.0 ± 5.9	36.2	29.0 - 43.4	Pass	0.99
W-092717	4/29/2016	Cs-137	82.6 ± 8.5	71.9	57.5 - 86.3	Pass	1.15
SPW-5001	9/29/2017	H-3	16,446 ± 358	16,507	13,206 - 19,808	Pass	1.00

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

Lab Code [b]	Date	Concentration [a] Analysis	Laboratory results 2s, n=1 [c]	Known Activity	Control Limits [d]	Acceptance	Ratio Lab/Known
SPW-5134	10/6/2017	H-3	16,128 ± 373	16,507	13,206 - 19,808	Pass	0.98
SPW-5274	10/12/2017	H-3	16,108 ± 374	16,507	13,206 - 19,808	Pass	0.98
W-101217S	10/12/2017	Fe-55	1,491 ± 77	1,482	1,186 - 1,778	Pass	1.01
SPW-5408	10/18/2017	Ni-63	203 ± 3	199	139.1 - 258.3	Pass	1.02
SPW-5430	10/19/2017	H-3	16,453 ± 380	16,507	13,206 - 19,808	Pass	1.00
W-102017	4/29/2016	Cs-134	31.3 ± 4.9	36.2	29.0 - 43.4	Pass	0.86
W-102017	4/29/2016	Cs-137	80.4 ± 6.9	71.9	57.5 - 86.3	Pass	1.12
SPW-5674	10/25/2017	H-3	16,313 ± 380	16,507	13,206 - 19,808	Pass	0.99
SPW-5719	10/27/2017	H-3	16,113 ± 350	16,507	13,206 - 19,808	Pass	0.98
SPW-5730	10/31/2017	H-3	16,776 ± 387	16,507	13,206 - 19,808	Pass	1.02
SPW-5944	10/27/2017	Ra-226	16.4 ± 0.5	16.7	11.7 - 21.7	Pass	0.98
SPW-5915	11/9/2017	H-3	16,930 ± 390	16,507	13,206 - 19,808	Pass	1.03
SPW-5989	11/11/2017	H-3	16,084 ± 352	16,507	13,206 - 19,808	Pass	0.97
W-111417	4/29/2016	Cs-134	38.1 ± 6.2	36.2	29.0 - 43.4	Pass	1.05
W-111417	4/29/2016	Cs-137	74.0 ± 7.5	71.9	57.5 - 86.3	Pass	1.03
SPW-6121	11/16/2017	H-3	16,276 ± 378	16,507	13,206 - 19,808	Pass	0.99
SPW-6132	11/20/2017	H-3	15,897 ± 374	16,507	13,206 - 19,808	Pass	0.96
SPW-6249	11/30/2017	Ra-226	12.2 ± 0.4	12.3	8.6 - 16.0	Pass	1.00
SPW-6226	12/1/2017	H-3	16,164 ± 378	16,507	13,206 - 19,808	Pass	0.98
SPW-6318	12/7/2017	H-3	15,779 ± 372	16,507	13,206 - 19,808	Pass	0.96
W-120817	4/29/2016	Cs-134	29.5 ± 5.6	36.2	29.0 - 43.4	Pass	0.81
W-120817	4/29/2016	Cs-137	78.8 ± 9.6	71.9	57.5 - 86.3	Pass	1.10
SPW-65	12/11/2017	Ra-226	12.5 ± 0.4	12.3	8.6 - 16.0	Pass	1.01
SPW-6437	12/13/2017	Gr. Alpha	19.6 ± 0.4	20.1	10.1 - 30.2	Pass	0.98
SPW-6437	12/13/2017	Gr. Beta	28.2 ± 0.3	27.9	22.3 - 33.5	Pass	1.01
SPW-6463	12/15/2017	H-3	15,560 ± 372	16,507	13,206 - 19,808	Pass	0.94

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

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

[c] Results are based on single determinations.

[d] Control limits are listed in Attachment A of this report.

NOTE: For fish, gelatin 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 [a]		
				Laboratory results (4.66σ)		Acceptance
				LLD	Activity[c]	Criteria (4.66 σ)
SPW-31	Water	1/6/2017	H-3	143	71 ± 75	200
SPW-45	Water	1/9/2017	Gr. Alpha	0.41	0.09 ± 0.30	2
SPW-45	Water	1/9/2017	Gr. Beta	0.74	-0.56 ± 0.50	4
SPW-91	Water	1/11/2017	H-3	151	-23 ± 71	200
SPW-141	Water	1/12/2017	Sr-89	0.55	0.29 ± 0.47	5
SPW-141	Water	1/12/2017	Sr-90	0.67	-0.02 ± 0.31	1
SPW-154	Water	1/19/2017	H-3	155	-17 ± 73	200
SPW-185	Water	1/23/2017	H-3	176	44 ± 94	200
SPW-231	Water	1/19/2017	H-3	179	26 ± 87	200
SPW-303	Water	1/26/2017	H-3	160	8 ± 77	200
SPW-305	Water	1/4/2017	Ra-226	0.02	0.02 ± 0.01	2
SPW-307	Water	1/27/2017	I-131	0.21	0.01 ± 0.11	1.00
SPW-332	Water	1/30/2017	H-3	169	-52 ± 86	200
SPW-352	Water	2/2/2017	U-234	0.14	0.00 ± 0.08	1
SPW-352	Water	2/2/2017	U-238	0.14	0.12 ± 0.15	1
SPW-411	Water	2/6/2017	Sr-89	0.49	0.30 ± 0.35	5
SPW-411	Water	2/6/2017	Sr-90	0.52	-0.22 ± 0.21	1
SPW-464	Water	2/8/2017	H-3	155	2 ± 74	200
SPW-560	Water	2/15/2017	H-3	156	38 ± 77	200
SPW-604	Water	2/16/2017	H-3	154	59 ± 77	200
SPW-656	Water	2/17/2017	H-3	187	28 ± 94	200
SPW-713	Water	2/23/2017	H-3	161	20 ± 81	200
SPW-736	Water	2/28/2017	H-3	161	-75 ± 76	200
SPAP-739	AP	2/28/2017	Gr. Beta	0.002	0.004 ± 0.001	0.01
SPAP-741	AP	2/24/2017	Cs-134	2.27	-0.95 ± 1.29	100
SPAP-741	AP	2/24/2017	Cs-137	2.65	0.17 ± 1.67	100
SPW-747	Water	2/28/2017	C-14	161	-28 ± 97	200
SPW-749	Water	2/28/2017	Ni-63	17	-3 ± 10	200
SPF-751	Fish	2/28/2017	Cs-134	0.008	0.002 ± 0.004	100
SPF-751	Fish	2/28/2017	Cs-137	0.008	0.000 ± 0.005	100
SPW-780	Water	3/1/2017	Ra-226	0.02	0.02 ± 0.01	2
SPW-782	Water	3/1/2017	H-3	154	35 ± 78	200
SPW-3506	Water	3/1/2017	Ra-226	0.03	0.02 ± 0.02	2
SPW-836	Water	3/3/2017	I-131	0.38	0.04 ± 0.18	1
SPW-1009	Water	3/14/2017	H-3	154	-31 ± 72	200
SPW-1025	Water	3/16/2017	Gr. Alpha	0.43	-0.16 ± 0.28	2
SPW-1025	Water	3/16/2017	Gr. Beta	0.75	-0.24 ± 0.52	4
SPW-1091	Water	3/21/2017	H-3	145	60 ± 73	200
SPW-1150	Water	3/24/2017	H-3	152	-31 ± 71	200
SPW-1162	Water	3/28/2017	Sr-89	0.61	-0.39 ± 0.45	5
SPW-1162	Water	3/28/2017	Sr-90	0.52	0.18 ± 0.27	1

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

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

[c] Activity reported is a net activity result.

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

Lab Code	Sample Type	Date	Analysis[b]	Concentration [a]		
				Laboratory results (4.66σ)		Acceptance
				LLD	Activity[c]	Criteria (4.66 σ)
SPW-1177	Water	3/29/2017	Ra-228	0.83	-0.14 ± 0.36	2
SPW-1231	Water	3/30/2017	H-3	150	24 ± 73	200
SPW-1245	Water	3/31/2017	Cs-134	3.73	0.43 ± 2.18	100
SPW-1245	Water	3/31/2017	Cs-137	3.01	-1.23 ± 2.12	100
SPW-1245	Water	3/31/2017	I-131(G)	5.39	0.92 ± 2.15	100
SPW-1245	Water	3/31/2017	I-131	0.32	0.03 ± 0.18	1
SPMI-1247	Milk	3/31/2017	Cs-134	3.70	1.23 ± 1.96	100
SPMI-1247	Milk	3/31/2017	Cs-137	3.62	-0.84 ± 2.15	100
SPMI-1247	Milk	3/31/2017	I-131(G)	4.42	0.39 ± 2.14	100
SPW-1294	Water	3/31/2017	Ra-226	0.02	0.18 ± 0.02	2
SPW-1303	Water	4/4/2017	H-3	151	8 ± 75	200
SPW-1377	Water	4/7/2017	H-3	150	29 ± 72	200
SPW-1390	Water	4/7/2017	Gr. Alpha	0.42	0.15 ± 0.31	2
SPW-1390	Water	4/7/2017	Gr. Beta	0.73	-0.17 ± 0.51	4
SPW-1479	Water	4/12/2017	H-3	151	89 ± 77	200
SPW-1574	Water	4/18/2017	H-3	144	55 ± 79	200
SPW-1625	Water	4/20/2017	Sr-89	0.59	-0.01 ± 0.50	5
SPW-1625	Water	4/20/2017	Sr-90	0.71	0.16 ± 0.35	1
SPW-1657	Water	4/21/2017	H-3	147	34 ± 73	200
SPW-1775	Water	4/26/2017	H-3	155	67 ± 80	200
SPW-1805	Water	4/27/2017	H-3	153	15 ± 74	200
SPW-1936	Water	5/3/2017	H-3	148	33 ± 71	200
SPW-1970	Water	5/5/2017	Sr-89	0.66	0.34 ± 0.54	5
SPW-1970	Water	5/5/2017	Sr-90	0.62	-0.08 ± 0.28	1
SPW-2032	Water	5/8/2017	H-3	147	66 ± 73	200
SPW-2419	Water	5/9/2017	Ra-226	0.03	0.01 ± 0.03	2
SPW-2283	Water	5/22/2017	H-3	155	24 ± 78	200
SPW-2353	Water	5/23/2017	H-3	151	56 ± 76	200
SPW-2890	Water	5/23/2017	Ra-226	0.03	-0.01 ± 0.02	2
SPMI-2377	Milk	5/24/2017	Sr-89	0.78	0.86 ± 0.93	5
SPMI-2377	Milk	5/24/2017	Sr-90	0.49	0.95 ± 0.33	1
SPW-2438	Water	5/25/2017	Ra-228	0.90	-0.28 ± 0.38	2
SPW-2467	Water	5/26/2017	H-3	152	27 ± 77	200
SPW-2417	Water	5/26/2017	Ra-228	0.80	1.58 ± 0.54	2
SPW-2447	Water	5/26/2017	I-131	0.21	-0.05 ± 0.12	1
SPW-2501	Water	6/1/2017	H-3	151	-23 ± 70	200
SPW-2658	Water	6/5/2017	H-3	152	107 ± 78	200
SPW-2789	Water	6/9/2017	H-3	150	52 ± 77	200
SPW-2797	Water	6/12/2017	H-3	177	7 ± 93	200
SPW-2847	Water	6/14/2017	I-131	0.18	0.03 ± 0.10	1

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

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

[c] Activity reported is a net activity result.

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

Lab Code	Sample Type	Date	Analysis[b]	Concentration [a]		
				Laboratory results (4.66σ)		Acceptance
				LLD	Activity[c]	Criteria (4.66 σ)
SPW-3508	Water	6/15/2017	Ra-226	0.03	0.00 ± 0.02	2
SPW-2942	Water	6/19/2017	Sr-89	0.58	0.80 ± 0.53	5
SPW-2942	Water	6/19/2017	Sr-90	0.50	0.15 ± 0.25	1
SPW-3042	Water	6/23/2017	H-3	146	25 ± 74	200
SPW-3510	Water	6/23/2017	Ra-226	0.02	0.03 ± 0.02	2
SPW-3102	Water	6/28/2017	H-3	148	-7 ± 73	200
SPW-3116	Water	6/29/2017	Tc-99	5.91	-0.39 ± 3.58	10
SPW-3512	Water	6/29/2017	Ra-226	0.02	-0.01 ± 0.02	2
SPW-3187	Water	7/3/2017	Sr-89	0.62	0.00 ± 0.48	5
SPW-3187	Water	7/3/2017	Sr-90	0.48	0.07 ± 0.23	1
SPW-3282	Water	7/11/2017	H-3	178	-37 ± 84	200
SPW-4053	Water	7/11/2017	Ra-226	0.03	0.02 ± 0.02	2
SPW-3466	Water	7/14/2017	Gr. Alpha	0.42	-0.09 ± 0.28	2
SPW-3466	Water	7/14/2017	Gr. Beta	0.76	-0.18 ± 0.53	4
SPW-3448	Water	7/15/2017	H-3	150	54 ± 77	200
SPW-3727	Water	7/27/2017	Ni-63	90	18 ± 55	200
SPW-3793	Water	7/28/2017	H-3	151	47 ± 82	200
SPW-3904	Water	8/3/2017	Gr. Alpha	0.47	-0.02 ± 0.33	2
SPW-3904	Water	8/3/2017	Gr. Beta	0.75	-0.11 ± 0.52	4
SPW-4029	Water	8/9/2017	H-3	159	11 ± 79	200
SPW-4206	Water	8/17/2017	H-3	157	55 ± 76	200
SPW-4241	Water	8/19/2017	H-3	190	61 ± 96	200
SPW-4085	Water	8/14/2017	H-3	159	-28 ± 77	200
SPW-4206	Water	8/17/2017	H-3	157	55 ± 76	200
SPW-4241	Water	8/19/2017	H-3	190	61 ± 96	200
SPW-4457	Water	9/1/2017	Ra-228	0.78	-0.02 ± 0.36	2
SPW-4465	Water	9/6/2017	Sr-89	0.51	0.30 ± 0.37	5
SPW-4465	Water	9/6/2017	Sr-90	0.46	-0.09 ± 0.20	1
SPW-4585	Water	9/9/2017	H-3	187	-86 ± 83	200
SPW-5720	Water	9/13/2017	Ra-226	0.02	0.13 ± 0.02	2
SPW-4703	Water	9/15/2017	I-131	0.17	0.10 ± 0.10	1
SPW-4719	Water	9/16/2017	H-3	184	-86 ± 93	200
SPW-4833	Water	9/22/2017	H-3	150	5 ± 72	200
SPW-4934	Water	9/27/2017	H-3	148	5 ± 70	200
SPW-4936	Water	9/27/2017	Ra-228	0.80	0.55 ± 0.44	2
SPW-5000	Water	9/29/2017	H-3	183	-13 ± 90	200
SPW-5133	Water	10/6/2017	H-3	144	64 ± 71	200
SPW-5273	Water	10/12/2017	H-3	142	106 ± 72	200

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

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

[c] Activity reported is a net activity result.

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

Lab Code	Sample Type	Date	Analysis[b]	Concentration [a]		
				Laboratory results (4.66σ)		Acceptance
				LLD	Activity[c]	Criteria (4.66 σ)
SPW-5407	Water	10/18/2017	Ni-63	69	43 ± 43	200
SPW-5429	Water	10/19/2017	H-3	148	54 ± 72	200
SPW-5603	Water	10/23/2017	Sr-89	0.57	0.16 ± 0.47	5
SPW-5603	Water	10/23/2017	Sr-90	0.70	-0.12 ± 0.31	1
SPW-5673	Water	10/25/2017	H-3	156	-36 ± 71	200
SPW-5718	Water	10/27/2017	H-3	182	45 ± 92	200
SPW-5943	Water	10/27/2017	Ra-226	0.02	0.08 ± 0.02	2
SPW-5723	Water	10/30/2017	I-131	0.10	0.03 ± 0.07	1
SPW-5914	Water	11/09/17	H-3	149	-39 ± 68	200
SPW-5988	Water	11/11/2017	H-3	183	-8 ± 88	200
SPW-6120	Water	11/16/2017	H-3	146	83 ± 75	200
SPW-6131	Water	11/20/2017	H-3	151	16 ± 72	200
SPW-6197	Water	11/29/2017	I-131	0.38	0.01 ± 0.18	1
SPW-6248	Water	11/30/2017	Ra-226	0.03	0.15 ± 0.03	2
SPW-6225	Water	12/1/2017	H-3	154	-10 ± 72	200
SPW-6317	Water	12/7/2017	H-3	148	44 ± 74	200
SPW-64	Water	12/11/2017	Ra-226	0.03	0.18 ± 0.03	2
SPW-6436	Water	12/13/2017	Gr. Alpha	0.54	-0.17 ± 0.37	2
SPW-6436	Water	12/13/2017	Gr. Beta	0.74	0.12 ± 0.52	4
SPW-6464	Water	12/15/2017	H-3	148	31 ± 75	200

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

[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 [a]			
Lab Code	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
AP-7178,7179	1/3/2017	Be-7	0.047 ± 0.015	0.062 ± 0.017	0.054 ± 0.012	Pass
SW-6986,6987	1/3/2017	Gr. Beta	1.39 ± 0.41	0.77 ± 0.41	1.08 ± 0.29	Pass
E-66,67	1/3/2017	Gr. Beta	1.62 ± 0.05	1.45 ± 0.04	1.54 ± 0.11	Pass
E-66,67	1/3/2017	K-40	1.26 ± 0.14	1.39 ± 0.16	1.32 ± 0.11	Pass
CF-87,88	1/3/2017	Be-7	0.25 ± 0.11	0.30 ± 0.12	0.28 ± 0.08	Pass
CF-87,88	1/3/2017	K-40	7.77 ± 0.39	6.84 ± 0.37	7.31 ± 0.27	Pass
AP-011217	1/12/2017	Be-7	0.137 ± 0.078	0.139 ± 0.082	0.138 ± 0.056	Pass
MI-212,213	1/16/2017	K-40	1,515 ± 98	1,347 ± 107	1,431 ± 73	Pass
WW-321,322	1/19/2017	H-3	675 ± 118	506 ± 133	590 ± 89	Pass
WW-674,675	1/20/2017	H-3	7,326 ± 254	7,717 ± 259	7,522 ± 181	Pass
AP-012317	1/23/2017	Gr. Beta	0.034 ± 0.005	0.038 ± 0.005	0.036 ± 0.004	Pass
WW-298,299	1/24/2017	H-3	5,916 ± 239	5764 ± 237	5840 ± 168	Pass
AP-013117	1/30/2017	Gr. Beta	0.027 ± 0.004	0.028 ± 0.004	0.028 ± 0.003	Pass
WW-500,501	1/31/2017	H-3	1,058 ± 122	1,054 ± 121	1,056 ± 86	Pass
SW-391,392	1/31/2017	Gr. Beta	1.40 ± 0.56	1.62 ± 0.61	1.51 ± 0.41	Pass
SPS-370,371	2/1/2017	K-40	23.47 ± 0.66	23.11 ± 0.72	23.29 ± 0.49	Pass
AP-456,457	2/2/2017	Be-7	0.129 ± 0.076	0.167 ± 0.092	0.148 ± 0.060	Pass
AP-020217	2/2/2017	Gr. Beta	0.021 ± 0.004	0.027 ± 0.004	0.024 ± 0.003	Pass
SPS-414,415	2/3/2017	K-40	19.45 ± 1.85	21.58 ± 1.99	20.52 ± 1.36	Pass
AP-020617	2/6/2017	Gr. Beta	0.023 ± 0.004	0.023 ± 0.004	0.023 ± 0.003	Pass
AP-021417A	2/14/2017	Gr. Beta	0.031 ± 0.004	0.030 ± 0.004	0.030 ± 0.003	Pass
SPW-543	2/14/2017	Gr. Beta	7.99 ± 0.82	9.45 ± 0.88	8.72 ± 0.60	Pass
AP-021417B	2/14/2017	Gr. Beta	0.024 ± 0.004	0.028 ± 0.004	0.026 ± 0.003	Pass
WW-718,719	2/14/2017	H-3	737 ± 113	643 ± 110	690 ± 79	Pass
AP-022017	2/20/2017	Gr. Beta	0.018 ± 0.005	0.021 ± 0.005	0.020 ± 0.004	Pass
WW-755,756	2/22/2017	H-3	3,709 ± 196	3,823 ± 198	3,766 ± 139	Pass
AP-022717	2/27/2017	Gr. Beta	0.021 ± 0.004	0.019 ± 0.004	0.020 ± 0.003	Pass
SPDW-80011,2	3/2/2017	Ra-226	7.29 ± 0.32	6.76 ± 0.30	7.03 ± 0.22	Pass
SPDW-80011,2	3/2/2017	Ra-228	4.68 ± 0.82	6.29 ± 1.03	5.49 ± 0.66	Pass
SPDW-80013,4	3/2/2017	Gr. Alpha	13.57 ± 1.43	12.44 ± 1.37	13.01 ± 0.99	Pass
WW-845,846	3/2/2017	H-3	314 ± 93	249 ± 90	281 ± 65	Pass
AP-030617	3/6/2017	Gr. Beta	0.022 ± 0.004	0.019 ± 0.004	0.020 ± 0.003	Pass
WW-1050,1051	3/8/2017	H-3	14,994 ± 364	14,745 ± 362	14,870 ± 257	Pass
SPS-920,921	3/9/2017	K-40	23.30 ± 1.76	23.13 ± 1.64	23.21 ± 1.20	Pass
WW-1004,1005	3/13/2017	H-3	182 ± 80	158 ± 79	170 ± 56	Pass
SPS-1029,1030	3/15/2017	K-40	11.82 ± 0.68	12.01 ± 0.68	11.92 ± 0.48	Pass
AP-031517	3/15/2017	Gr. Beta	0.020 ± 0.003	0.020 ± 0.003	0.020 ± 0.002	Pass
SPDW-80037,8	3/20/2017	Gr. Alpha	4.54 ± 0.82	5.29 ± 0.91	4.91 ± 0.61	Pass
AP-032017	3/20/2017	Gr. Beta	0.021 ± 0.006	0.021 ± 0.006	0.021 ± 0.005	Pass
WW-1094,1095	3/20/2017	H-3	1,571 ± 137	1,595 ± 138	1,583 ± 175	Pass

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

			Concentration [a]			
Lab Code	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
WW-1175,1176	3/20/2017	H-3	218 ± 84	211 ± 84	214 ± 59	Pass
WW-1129,1130	3/21/2017	Gr. Beta	3.51 ± 1.24	2.99 ± 1.17	3.25 ± 0.85	Pass
WW-1219,1220	3/22/2017	H-3	11,467 ± 322	11,516 ± 323	11,492 ± 200	Pass
SPS-1152,1153	3/27/2017	Ac-228	20.39 ± 0.75	20.43 ± 0.88	20.41 ± 0.58	Pass
SPS-1152,1153	3/27/2017	Pb-214	17.22 ± 0.50	16.44 ± 0.52	16.83 ± 0.36	Pass
SPDW-80047,8	3/28/2017	Ra-226	2.06 ± 0.23	1.60 ± 0.32	1.83 ± 0.20	Pass
SPDW-80047,8	3/28/2017	Ra-228	0.53 ± 0.48	0.78 ± 0.49	0.66 ± 0.34	Pass
SWU-1242,1243	3/28/2017	Gr. Beta	2.04 ± 0.81	2.47 ± 0.69	2.26 ± 0.53	Pass
SPS-1198,1199	3/29/2017	K-40	16.95 ± 1.85	18.33 ± 1.71	17.64 ± 1.26	Pass
SPDW-80050,1	3/29/2017	Gr. Alpha	3.19 ± 0.80	3.39 ± 0.78	3.29 ± 0.56	Pass
SPDW-80050,1	3/29/2017	Gr. Beta	1.58 ± 0.60	2.08 ± 0.63	1.83 ± 0.44	Pass
AP-1706,1707	3/30/2017	Be-7	0.068 ± 0.018	0.072 ± 0.017	0.070 ± 0.012	Pass
SW-1381,1382	4/5/2017	H-3	402 ± 92	309 ± 88	356 ± 64	Pass
WW-1446,1447	4/6/2017	H-3	305 ± 89	358 ± 91	332 ± 64	Pass
WW-1532,1533	4/10/2017	H-3	19,124 ± 412	18,991 ± 410	19,058 ± 291	Pass
WW-1618,1619	4/12/2017	H-3	4,187 ± 203	4,305 ± 205	4,246 ± 144	Pass
SS-1553,1554	4/13/2017	Gr. Beta	7.16 ± 0.99	6.09 ± 0.91	6.63 ± 0.67	Pass
SS-1553,1554	4/13/2017	K-40	4.60 ± 0.32	4.84 ± 0.34	4.72 ± 0.23	Pass
SS-1553,1554	4/13/2017	Tl-208	0.038 ± 0.016	0.032 ± 0.011	0.035 ± 0.010	Pass
SS-1553,1554	4/13/2017	Pb-212	0.101 ± 0.015	0.096 ± 0.015	0.098 ± 0.010	Pass
SS-1553,1554	4/13/2017	Bi-214	0.094 ± 0.032	0.109 ± 0.022	0.101 ± 0.019	Pass
SS-1553,1554	4/13/2017	Ac-228	0.089 ± 0.042	0.111 ± 0.046	0.100 ± 0.031	Pass
P-2015,2016	5/4/2017	H-3	189 ± 80	212 ± 81	200 ± 57	Pass
WW-2336,2337	5/8/2017	H-3	422 ± 97	298 ± 91	360 ± 66	Pass
AP-051117	5/11/2017	Gr. Beta	0.018 ± 0.003	0.025 ± 0.004	0.021 ± 0.002	Pass
WW-2497,2498	5/23/2017	H-3	1,268 ± 127	1,247 ± 126	1,257 ± 89	Pass
WW-2583,2584	5/23/2017	H-3	5,159 ± 224	5,223 ± 126	5,191 ± 129	Pass
WW-2732,2733	5/23/2017	H-3	8,559 ± 282	8,570 ± 283	8,564 ± 200	Pass
XW-1218,1219	5/23/2017	H-3	11,467 ± 282	11,516 ± 283	11,492 ± 200	Pass
MI-2428,2429	5/24/2017	K-40	1,752 ± 137	1,805 ± 132	1,778 ± 95	Pass
SO-2562,2563	5/24/2017	K-40	7.87 ± 0.50	8.64 ± 0.49	8.25 ± 0.35	Pass
WW-3023,3024	5/24/2017	H-3	27,398 ± 486	27,733 ± 489	27,565 ± 344	Pass
SO-2453,2454	5/25/2017	Gr. Beta	14.38 ± 0.93	15.70 ± 1.06	15.04 ± 0.70	Pass
SO-2453,2454	5/25/2017	Cs-137	0.17 ± 0.03	0.18 ± 0.03	0.17 ± 0.02	Pass
SO-2453,2454	5/25/2017	K-40	9.80 ± 0.50	9.19 ± 0.57	9.50 ± 0.38	Pass
SO-2453,2454	5/25/2017	Tl-208	0.09 ± 0.02	0.10 ± 0.03	0.09 ± 0.02	Pass
SO-2453,2454	5/25/2017	Pb-212	0.29 ± 0.03	0.30 ± 0.03	0.29 ± 0.02	Pass
SO-2453,2454	5/25/2017	Bi-214	0.24 ± 0.03	0.18 ± 0.04	0.21 ± 0.03	Pass
SO-2453,2454	5/25/2017	Ra-226	0.82 ± 0.22	0.62 ± 0.27	0.72 ± 0.17	Pass
SO-2453,2454	5/25/2017	Ac-228	0.32 ± 0.07	0.28 ± 0.08	0.30 ± 0.05	Pass

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

			Concentration [a]			
Lab Code	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
SWT-2625,2626	5/30/2017	Gr. Beta	0.64 ± 0.53	1.08 ± 0.55	0.86 ± 0.38	Pass
AP-053117	5/31/2017	Gr. Beta	0.013 ± 0.003	0.011 ± 0.003	0.012 ± 0.002	Pass
G-2646,2647	6/1/2017	Be-7	1.02 ± 0.17	1.06 ± 0.26	1.04 ± 0.15	Pass
G-2646,2647	6/1/2017	K-40	7.51 ± 0.49	6.55 ± 0.51	7.03 ± 0.36	Pass
SL-2669,70	6/1/2017	Be-7	0.34 ± 0.06	0.30 ± 0.06	0.32 ± 0.04	Pass
SL-2669,70	6/1/2017	K-40	4.35 ± 0.14	4.39 ± 0.15	4.37 ± 0.10	Pass
F-2711,2712	6/2/2017	K-40	2.56 ± 0.32	2.77 ± 0.44	2.66 ± 0.27	Pass
AP-060617	6/6/2017	Gr. Beta	0.026 ± 0.005	0.027 ± 0.005	0.027 ± 0.004	Pass
SW-2849,50	6/8/2017	H-3	8,178 ± 273	8,563 ± 279	8,371 ± 195	Pass
AP-061217	6/12/2017	Gr. Beta	0.027 ± 0.005	0.027 ± 0.005	0.027 ± 0.004	Pass
BS-3446,3447	6/12/2017	K-40	8.30 ± 0.47	8.57 ± 0.47	8.44 ± 0.33	Pass
VE-2870,2871	6/13/2017	K-40	3.65 ± 0.25	3.90 ± 0.26	3.77 ± 0.18	Pass
AP-2914,5	6/15/2017	Be-7	0.269 ± 0.146	0.212 ± 0.123	0.240 ± 0.095	Pass
AP-3067,8	6/15/2017	Be-7	0.204 ± 0.113	0.328 ± 0.126	0.266 ± 0.085	Pass
AP-061917	6/19/2017	Gr. Beta	0.020 ± 0.004	0.019 ± 0.004	0.020 ± 0.003	Pass
AP-3610,1	6/26/2017	Be-7	0.107 ± 0.015	0.116 ± 0.021	0.111 ± 0.013	Pass
AP-062617	6/26/2017	Gr. Beta	0.017 ± 0.004	0.021 ± 0.004	0.019 ± 0.003	Pass
AP-3673,3674	7/3/2017	Be-7	0.087 ± 0.008	0.078 ± 0.008	0.083 ± 0.006	Pass
AP-3287,3288	7/6/2017	Be-7	0.207 ± 0.112	0.244 ± 0.096	0.226 ± 0.074	Pass
WW-3308,3309	7/7/2017	H-3	549 ± 108	501 ± 107	525 ± 76	Pass
VE-3362,3363	7/12/2017	K-40	2.32 ± 0.17	2.40 ± 0.16	2.36 ± 0.12	Pass
VE-3589,3590	7/18/2017	K-40	5.25 ± 0.33	4.64 ± 0.33	4.94 ± 0.23	Pass
SG-3631,3632	7/18/2017	Pb-214	3.03 ± 0.11	2.97 ± 0.11	3.00 ± 0.08	Pass
SG-3631,3632	7/18/2017	Ac-228	2.47 ± 0.22	2.56 ± 0.23	2.52 ± 0.16	Pass
WW-3846,3847	7/25/2017	H-3	505 ± 101	446 ± 98	475 ± 70	Pass
F-4509,4510	7/26/2017	K-40	0.85 ± 0.25	1.00 ± 0.25	0.93 ± 0.18	Pass
F-4509,4510	7/26/2017	Gr. Beta	1.19 ± 0.03	1.18 ± 0.03	1.18 ± 0.02	Pass
G-3804,3805	7/27/2017	Be-7	3.72 ± 0.39	3.47 ± 0.40	3.59 ± 0.28	Pass
G-3804,3805	7/27/2017	K-40	4.21 ± 0.52	4.46 ± 0.52	4.34 ± 0.33	Pass
SL-3888,3889	8/1/2017	Be-7	0.77 ± 0.04	0.73 ± 0.07	0.75 ± 0.04	Pass
SL-3888,3889	8/1/2017	K-40	0.94 ± 0.04	0.87 ± 0.08	0.90 ± 0.23	Pass
WW-4158,4159	8/8/2017	H-3	321 ± 90	270 ± 88	295 ± 63	Pass
VE-4179,4180	8/14/2017	K-40	1.84 ± 0.18	1.90 ± 0.21	1.87 ± 0.14	Pass
AP-4289,4290	8/17/2017	Be-7	0.212 ± 0.095	0.162 ± 0.080	0.187 ± 0.062	Pass
F-4333,4334	8/18/2017	K-40	3.22 ± 0.41	3.62 ± 0.42	3.42 ± 0.29	Pass
CF-4310,4311	8/21/2017	K-40	10.94 ± 0.74	11.48 ± 0.50	11.21 ± 0.45	Pass
DW-80161,80162	8/22/2017	Ra-226	1.22 ± 0.15	1.19 ± 0.17	1.21 ± 0.11	Pass
DW-80161,80162	8/22/2017	Ra-228	1.99 ± 0.63	0.70 ± 0.49	1.35 ± 0.40	Pass
VE-4398,4399	8/28/2017	Be-7	0.13 ± 0.07	0.13 ± 0.08	0.13 ± 0.05	Pass

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

			Concentration [a]			
Lab Code	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
VE-4398,4399	8/28/2017	K-40	3.32 ± 0.22	3.48 ± 0.25	3.40 ± 0.17	Pass
SW-4463,4464	8/29/2017	H-3	495 ± 106	491 ± 106	493 ± 75	Pass
LW-4486,4487	8/31/2017	Gr. Beta	0.425 ± 0.471	1.358 ± 0.571	0.892 ± 0.370	Pass
VE-4561,4562	9/6/2017	Be-7	5.89 ± 0.29	5.76 ± 0.25	5.83 ± 0.19	Pass
VE-4561,4562	9/6/2017	K-40	3.73 ± 0.34	3.77 ± 0.29	3.75 ± 0.22	Pass
BO-5122,5123	9/8/2017	K-40	4.50 ± 0.36	4.50 ± 0.36	4.50 ± 0.25	Pass
VE-4692,4693	9/12/2017	K-40	5.16 ± 0.13	5.31 ± 0.36	5.24 ± 0.19	Pass
SS-4650,4651	9/12/2017	K-40	10.55 ± 0.51	10.41 ± 0.54	10.48 ± 0.37	Pass
MI-4671,4672	9/13/2017	K-40	1,347 ± 115	1,283 ± 118	1,315 ± 82	Pass
MI-4671,4672	9/13/2017	Sr-90	0.7 ± 0.3	0.5 ± 0.3	0.6 ± 0.2	Pass
VE-4973,4974	9/17/2017	K-40	1.11 ± 0.15	1.17 ± 0.13	1.14 ± 0.10	Pass
F-4928,4929	9/19/2017	K-40	1.84 ± 0.31	1.68 ± 0.34	1.76 ± 0.23	Pass
S-4865,4866	9/20/2017	K-40	21.07 ± 2.39	19.09 ± 2.51	20.08 ± 1.73	Pass
VE-4907,4908	9/20/2017	K-40	3.83 ± 0.44	4.28 ± 0.31	4.05 ± 0.27	Pass
VE-4844,4845	9/21/2017	K-40	1.81 ± 0.22	1.88 ± 0.21	1.84 ± 0.15	Pass
AP-5572,5573	9/27/2017	Be-7	0.082 ± 0.015	0.075 ± 0.014	0.078 ± 0.010	Pass
LW-5145,5146	9/28/2017	Gr. Beta	0.84 ± 0.49	1.47 ± 0.57	1.16 ± 0.38	Pass
AP-092917	9/29/2017	Gr. Beta	0.038 ± 0.004	0.031 ± 0.004	0.035 ± 0.003	Pass
WW-5080,5081	10/2/2017	H-3	208 ± 79	223 ± 80	215 ± 56	Pass
AP-100217	10/2/2017	Gr. Beta	0.025 ± 0.005	0.028 ± 0.005	0.026 ± 0.003	Pass
AP-100317	10/3/2017	Gr. Beta	0.037 ± 0.004	0.033 ± 0.004	0.035 ± 0.003	Pass
S-5165,5166	10/4/2017	K-40	15.93 ± 2.30	20.34 ± 3.15	18.14 ± 1.95	Pass
VE-5228,5229	10/5/2017	K-40	3.25 ± 0.25	2.82 ± 0.24	3.04 ± 0.17	Pass
AP-100917	10/9/2017	Gr. Beta	0.021 ± 0.004	0.025 ± 0.004	0.023 ± 0.003	Pass
VE-5293,5294	10/10/2017	K-40	3.89 ± 0.30	4.08 ± 0.34	3.99 ± 0.22	Pass
DW-80184,80185	10/11/2017	Gr. Alpha	2.17 ± 0.81	2.50 ± 0.81	2.34 ± 0.57	Pass
DW-80184,80185	10/11/2017	Gr. Beta	9.45 ± 0.79	10.20 ± 0.83	9.83 ± 0.57	Pass
S-5421,5422	10/12/2017	K-40	8.82 ± 1.94	7.97 ± 0.72	8.40 ± 1.03	Pass
AP-101617	10/16/2017	Gr. Beta	0.025 ± 0.005	0.022 ± 0.004	0.024 ± 0.003	Pass
F-5658,5659	10/19/2017	K-40	2.44 ± 0.41	2.57 ± 0.39	2.51 ± 0.28	Pass
SO-5704,5705	10/25/2017	Cs-137	0.05 ± 0.02	0.04 ± 0.02	0.04 ± 0.01	Pass
SO-5704,5705	10/25/2017	K-40	10.08 ± 0.51	9.57 ± 0.56	9.83 ± 0.38	Pass
SO-5704,5705	10/25/2017	Tl-208	0.10 ± 0.02	0.09 ± 0.02	0.10 ± 0.01	Pass
SO-5704,5705	10/25/2017	Bi-214	0.34 ± 0.04	0.27 ± 0.04	0.30 ± 0.03	Pass
SO-5704,5705	10/25/2017	Pb-212	0.28 ± 0.03	0.27 ± 0.03	0.27 ± 0.02	Pass
SO-5704,5705	10/25/2017	Ra-226	1.15 ± 0.52	0.59 ± 0.22	0.87 ± 0.28	Pass
SO-5704,5705	10/25/2017	Ac-228	0.33 ± 0.05	0.31 ± 0.07	0.32 ± 0.04	Pass
SO-5704,5705	10/25/2017	Gr. Beta	18.34 ± 1.80	16.50 ± 1.03	17.42 ± 1.04	Pass
AP-5732,5733	10/26/2017	Be-7	0.139 ± 0.064	0.175 ± 0.075	0.157 ± 0.049	Pass

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

			Concentration [a]			
Lab Code	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
SW-5753,5754	10/31/2017	H-3	220 ± 83	279 ± 86	249 ± 60	Pass
SWU-5816,5817	10/31/2017	Gr. Beta	1.51 ± 1.00	2.02 ± 1.02	1.76 ± 0.71	Pass
AP-103117	10/31/2017	Gr. Beta	0.015 ± 0.004	0.014 ± 0.004	0.015 ± 0.003	Pass
SO-5923,5924	11/1/2017	Cs-137	0.30 ± 0.04	0.31 ± 0.04	0.31 ± 0.03	Pass
SO-5923,5924	11/1/2017	K-40	10.52 ± 0.61	10.56 ± 0.67	10.54 ± 0.45	Pass
AP-5858,5859	11/2/2017	Be-7	0.145 ± 0.075	0.146 ± 0.084	0.145 ± 0.056	Pass
AP-110717	11/7/2017	Be-7	0.026 ± 0.004	0.030 ± 0.004	0.028 ± 0.003	Pass
WW-6032,6033	11/7/2017	H-3	204 ± 86	298 ± 80	251 ± 59	Pass
WW-6074,6075	11/8/2017	H-3	72,247 ± 786	73,062 ± 791	72,655 ± 558	Pass
BS-6053,6054	11/13/2017	K-40	7.99 ± 0.62	9.20 ± 0.68	8.60 ± 0.46	Pass
BS-6053,6054	11/13/2017	Cs-137	0.07 ± 0.03	0.08 ± 0.03	0.07 ± 0.02	Pass
DW-80211,80212	11/14/2017	Gr. Alpha	2.30 ± 0.80	3.60 ± 1.00	2.95 ± 0.64	Pass
DW-80211,80212	11/14/2017	Gr. Beta	9.32 ± 0.81	8.99 ± 0.81	9.16 ± 0.57	Pass
DW-80214,80215	11/14/2017	Ra-226	1.36 ± 0.22	1.35 ± 0.15	1.355 ± 0.13	Pass
DW-80214,80215	11/14/2017	Ra-228	1.41 ± 0.51	0.90 ± 0.45	1.16 ± 0.34	Pass
WW-6152,6153	11/15/2017	H-3	416 ± 94	328 ± 90	372 ± 65	Pass
SWU-6219,6220	11/28/2017	Gr. Beta	1.04 ± 0.54	1.75 ± 0.58	1.39 ± 0.39	Pass
SS-6242,6243	11/29/2017	K-40	24.17 ± 1.05	22.31 ± 1.03	23.24 ± 0.74	Pass
SS-6242,6243	11/29/2017	Cs-137	0.11 ± 0.03	0.08 ± 0.03	0.10 ± 0.02	Pass
SG-6938,6939	11/28/2017	Pb-214	15.28 ± 0.34	14.96 ± 0.43	15.12 ± 0.27	Pass
SG-6938,6939	11/28/2017	Ac-228	18.99 ± 0.59	19.92 ± 0.79	19.46 ± 0.49	Pass
AP-112817	11/28/2017	Gr. Beta	0.026 ± 0.004	0.030 ± 0.004	0.028 ± 0.003	Pass
SQ-6286,6287	12/1/2017	Gr. Alpha	70.6 ± 6.2	60.9 ± 6.0	65.8 ± 4.3	Pass
SQ-6286,6287	12/1/2017	Gr. Beta	48.9 ± 2.7	53.7 ± 2.8	51.3 ± 1.9	Pass
SQ-6286,6287	12/1/2017	Ra-226	11.3 ± 0.4	10.7 ± 0.5	11.0 ± 0.3	Pass
SQ-6286,6287	12/1/2017	Ra-228	13.5 ± 0.9	13.2 ± 1.0	13.4 ± 0.7	Pass
SG-6286,6287	12/1/2017	K-40	5.10 ± 1.82	6.65 ± 1.53	5.88 ± 1.19	Pass
AP-120417	12/4/2017	Gr. Beta	0.037 ± 0.006	0.035 ± 0.005	0.036 ± 0.004	Pass
WW-6548,6549	12/19/2017	H-3	8,428 ± 280	8,604 ± 282	8,516 ± 199	Pass
AP-122717	12/27/2017	Gr. Beta	0.047 ± 0.004	0.043 ± 0.004	0.045 ± 0.003	Pass
XAP-6762,6763	12/31/2017	Co-60	2.43 ± 1.30	2.24 ± 0.82	2.34 ± 0.77	Pass
XAP-6762,6763	12/31/2017	Cs-137	4.21 ± 1.11	4.05 ± 0.96	4.14 ± 0.73	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 or pCi/m3), food products, vegetation, soil and sediment (pCi/g).

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

			Concentration [a]			
Lab Code [b]	Reference Date	Analysis	Laboratory result	Known Activity	Control Limits [c]	Acceptance
MASO-903	2/1/2017	Am-241	60.9 ± 6.9	67.0	46.9 - 87.1	Pass
MASO-903	2/1/2017	Cs-134	1360 ± 14	1550	1085 - 2015	Pass
MASO-903	2/1/2017	Cs-137	678 ± 13	611	428 - 794	Pass
MASO-903	2/1/2017	Co-57	1.63 ± 1.69	0.00	NA [c]	Pass
MASO-903	2/1/2017	Co-60	909 ± 12	891	624 - 1158	Pass
MASO-903	2/1/2017	Mn-54	1052 ± 17	967	677 - 1257	Pass
MASO-903	2/1/2017	K-40	657 ± 68	607	425 - 789	Pass
MASO-903	2/1/2017	Zn-65	-0.52 ± 7.40	0.00	NA [c]	Pass
MASO-903	2/1/2017	Ni-63	3.25 ± 7.17	0.00	NA [c]	Pass
MASO-903	2/1/2017	Pu-238	0.46 ± 0.69	0.41	NA [e]	Pass
MASO-903	2/1/2017	Pu-239/240	56.8 ± 5.9	59.8	41.9 - 77.7	Pass
MASO-903	2/1/2017	Sr-90	501 ± 17	624	437 - 811	Pass
MASO-903	2/1/2017	Tc-99	748 ± 16	656	459 - 853	Pass
MAW-849	2/1/2017	I-129	-0.05 ± 0.12	0.00	NA [c]	Pass
MAVE-905	2/1/2017	Cs-134	6.61 ± 0.16	6.95	4.87 - 9.04	Pass
MAVE-905	2/1/2017	Cs-137	4.97 ± 0.18	4.60	3.22 - 5.98	Pass
MAVE-905	2/1/2017	Co-57	-0.01 ± 0.03	0.00	NA [c]	Pass
MAVE-905	2/1/2017	Co-60	9.51 ± 0.17	8.75	6.13 - 11.38	Pass
MAVE-905	2/1/2017	Mn-54	3.67 ± 0.17	3.28	2.30 - 4.26	Pass
MAVE-905	2/1/2017	Zn-65	6.12 ± 0.44	5.39	3.77 - 7.01	Pass
MAW-847	2/1/2017	Am-241	0.679 ± 0.079	0.846	0.592 - 1.100	Pass
MAW-847	2/1/2017	Cs-134	0.03 ± 0.10	0.00	NA [c]	Pass
MAW-847	2/1/2017	Cs-137	12.7 ± 0.4	11.1	7.8 - 14.4	Pass
MAW-847 [d]	2/1/2017	Co-57	2.7 ± 0.3	28.5	20.0 - 37.1	Fail
MAW-847	2/1/2017	Co-60	13.5 ± 0.3	12.3	8.6 - 16.0	Pass
MAW-847	2/1/2017	Mn-54	16.5 ± 0.4	14.9	10.4 - 19.4	Pass
MAW-847	2/1/2017	K-40	287 ± 6	254	178 - 330	Pass
MAW-847	2/1/2017	Zn-65	-0.15 ± 0.23	0.00	NA [c]	Pass
MAW-847	2/1/2017	H-3	275 ± 10	249	174 - 324	Pass
MAW-847	2/1/2017	Fe-55	2.4 ± 13.6	1.7	NA [e]	Pass
MAW-847	2/1/2017	Ni-63	10.1 ± 2.8	12.2	8.5 - 15.9	Pass
MAW-847	2/1/2017	Pu-238	0.729 ± 0.097	0.703	0.492 - 0.914	Pass
MAW-847	2/1/2017	Pu-239/240	0.866 ± 0.102	0.934	0.654 - 1.214	Pass
MAW-847	2/1/2017	Ra-226	0.506 ± 0.053	0.504	0.353 - 0.655	Pass
MAW-847	2/1/2017	Sr-90	10.0 ± 0.8	10.1	7.1 - 13.1	Pass

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

			Concentration [a]			
Lab Code [b]	Reference Date	Analysis	Laboratory result	Known Activity	Control Limits [c]	Acceptance
MAW-847	2/1/2017	Tc-99	4.77 ± 0.62	6.25	4.38 - 8.13	Pass
MAW-847	2/1/2017	U-234/233	1.19 ± 0.10	1.16	0.81 - 1.51	Pass
MAW-847	2/1/2017	U-238	1.15 ± 0.10	1.20	0.84 - 1.56	Pass
MAAP-907[f]	2/1/2017	Am-241	0.0540 ± 0.0140	0.0376	0.0263 - 0.0489	Fail
MAAP-907	2/1/2017	Cs-134	1.31 ± 0.06	1.42	0.99 - 1.85	Pass
MAAP-907	2/1/2017	Cs-137	0.797 ± 0.080	0.685	0.480 - 0.891	Pass
MAAP-907	2/1/2017	Co-57	1.86 ± 0.06	1.70	1.19 - 2.21	Pass
MAAP-907	2/1/2017	Co-60	0.86 ± 0.05	0.78	0.55 - 1.01	Pass
MAAP-907	2/1/2017	Mn-54	0.01 ± 0.03	0.00	NA [c]	Pass
MAAP-907	2/1/2017	Zn-65	1.62 ± 0.13	1.29	0.90 - 1.68	Pass
MAAP-907	2/1/2017	Pu-238	0.0530 ± 0.0190	0.0598	0.0419 - 0.0777	Pass
MAAP-907	2/1/2017	Pu-239/240	0.0490 ± 0.0160	0.0460	0.0322 - 0.0598	Pass
MAAP-907	2/1/2017	Sr-90	0.648 ± 0.120	0.651	0.456 - 0.846	Pass
MAAP-907	2/1/2017	U-234/233	0.086 ± 0.024	0.104	0.073 - 0.135	Pass
MAAP-907	2/1/2017	U-238	0.097 ± 0.024	0.107	0.075 - 0.139	Pass
MASO-4515	8/1/2017	Am-241	45.9 ± 7.0	58.8	41.2 - 76.4	Pass[g]
MASO-4515	8/1/2017	Cs-134	409 ± 7	448	314 - 582	Pass[g]
MASO-4515	8/1/2017	Cs-137	798 ± 12	722	505 - 939	Pass[g]
MASO-4515	8/1/2017	Co-57	1572 ± 10	1458	1021 - 1895	Pass[g]
MASO-4515	8/1/2017	Co-60	0.2 ± 1.4	0.00	NA [c]	Pass[g]
MASO-4515	8/1/2017	Mn-54	934 ± 13	825	578 - 1073	Pass[g]
MASO-4515	8/1/2017	K-40	704 ± 53	592	414 - 770	Pass[g]
MASO-4515	8/1/2017	Zn-65	667 ± 17	559	391 - 727	Pass[g]
MASO-4515	8/1/2017	Pu-238	101 ± 9	92	64 - 120	Pass[g]
MASO-4515	8/1/2017	Pu-239/240	74.8 ± 7.7	68.8	48.2 - 89.4	Pass[g]
MASO-4515	8/1/2017	Sr-90	252 ± 7	289	202 - 376	Pass[g]
MAW-4494	8/1/2017	I-129	2.31 ± 0.10	2.31	1.62 - 3.00	Pass
MAVE-4517	8/1/2017	Cs-134	2.40 ± 0.10	2.32	1.62 - 3.02	Pass
MAVE-4517	8/1/2017	Cs-137	-0.002 ± 0.048	0.000	NA [c]	Pass
MAVE-4517	8/1/2017	Co-57	3.3 ± 0.1	2.8	2.0 - 3.6	Pass
MAVE-4517	8/1/2017	Co-60	2.10 ± 0.10	2.07	1.45 - 2.69	Pass
MAVE-4517	8/1/2017	Mn-54	3.00 ± 0.20	2.62	1.83 - 3.41	Pass
MAVE-4517	8/1/2017	Zn-65	5.90 ± 0.30	5.37	3.76 - 6.98	Pass

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

			Concentration [a]			
Lab Code [b]	Reference Date	Analysis	Laboratory result	Known Activity	Control Limits [c]	Acceptance
MAW-4513	8/1/2017	Am-241	0.820 ± 0.220	0.892	0.624 - 1.160	Pass
MAW-4513	8/1/2017	Cs-134	10.3 ± 0.3	11.5	8.1 - 15.0	Pass
MAW-4513	8/1/2017	Cs-137	17.2 ± 0.5	16.3	11.4 - 21.2	Pass
MAW-4513	8/1/2017	Co-57	12.7 ± 0.4	12.1	8.5 - 15.7	Pass
MAW-4513	8/1/2017	Co-60	10.6 ± 0.3	10.7	7.5 - 13.9	Pass
MAW-4513	8/1/2017	Mn-54	15.6 ± 0.4	14.9	10.4 - 19.4	Pass
MAW-4513	8/1/2017	Zn-65	15.9 ± 0.7	15.5	10.9 - 20.2	Pass
MAW-4513	8/1/2017	H-3	255 ± 9	258	181 - 335	Pass
MAW-4513	8/1/2017	Fe-55	21.6 ± 6.6	19.4	13.6 - 25.2	Pass
MAW-4513	8/1/2017	Ni-63	-0.1 ± 2.0	0.0	NA [c]	Pass
MAW-4513	8/1/2017	Pu-238	0.590 ± 0.080	0.603	0.422 - 0.784	Pass
MAW-4513	8/1/2017	Pu-239/240	0.740 ± 0.090	0.781	0.547 - 1.015	Pass
MAW-4513	8/1/2017	Ra-226	1.000 ± 0.100	0.858	0.601 - 1.115	Pass
MAW-4513	8/1/2017	Sr-90	7.80 ± 0.60	7.77	5.44 - 10.10	Pass
MAW-4513	8/1/2017	Tc-99	6.70 ± 0.40	6.73	4.71 - 8.75	Pass
MAW-4513	8/1/2017	U-2344/233	0.94 ± 0.06	1.01	0.71 - 1.31	Pass
MAW-4513	8/1/2017	U-238	0.97 ± 0.07	1.04	0.73 - 1.35	Pass
MAAP-4519[h]	8/1/2017	Am-241	0.0400 ± 0.0100	0.0612	0.0428 - 0.0796	Fail
MAAP-4519	8/1/2017	Cs-134	0.90 ± 0.10	1.00	0.70 - 1.30	Pass
MAAP-4519	8/1/2017	Cs-137	0.90 ± 0.10	0.82	0.57 - 1.07	Pass
MAAP-4519	8/1/2017	Co-57	0.01 ± 0.01	0.00	NA [c]	Pass
MAAP-4519	8/1/2017	Co-60	0.70 ± 0.10	0.68	0.48 - 0.88	Pass
MAAP-4519	8/1/2017	Mn-54	1.50 ± 0.10	1.30	0.91 - 1.69	Pass
MAAP-4519	8/1/2017	Zn-65	1.30 ± 0.10	1.08	0.76 - 1.40	Pass
MAAP-4519	8/1/2017	Pu-238	0.0300 ± 0.0100	0.0298	0.0209 - 0.0387	Pass
MAAP-4519	8/1/2017	Pu-239/240	0.0400 ± 0.0200	0.0468	0.0328 - 0.0608	Pass
MAAP-4519	8/1/2017	Sr-90	0.800 ± 0.100	0.801	0.561 - 1.041	Pass
MAAP-4519	8/1/2017	U-234/233	0.070 ± 0.010	0.084	0.059 - 0.109	Pass
MAAP-4519	8/1/2017	U-238	0.090 ± 0.010	0.087	0.061 - 0.113	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] Decimal point was misplaced while performing a unit conversion. The result is within control limits when the proper unit conversion is performed.

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

[f] Sample was reanalyzed in duplicate with acceptable results. Original plating was inferior to platings obtained during reanalysis. It is believed that isotopic tracer was not accurately quantified due to poor resolution of its peak.

[g] Data were erroneously submitted in units of Bq/g. All results pass MAPEP criteria when evaluated in units of Bq/Kg.

[h] Laboratory is not currently offering analysis for Am-241 in Air Particulate samples.

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

MRAD Study

Lab Code [b]	Concentration [a]					
	Date	Analysis	Laboratory Result	ERA Result	Control Limits [c]	Acceptance
ERAP-1112	3/20/2017	Am-241	55.3 ± 2.8	76.4	47.1 - 103.0	Pass
ERAP-1112	3/20/2017	Co-60	1,230 ± 8	1030	797 - 1290	Pass
ERAP-1112	3/20/2017	Cs-134	1,110 ± 9	1100	700 - 1360	Pass
ERAP-1112	3/20/2017	Cs-137	1,810 ± 12	1,390	1,040 - 1,830	Pass
ERAP-1112 [d]	3/20/2017	Fe-55	590 ± 385	256	79.4 - 500	Fail
ERAP-1112	3/20/2017	Mn-54	< 5.14	< 50.0	0.00 - 50.0	Pass
ERAP-1112	3/20/2017	Pu-238	54.6 ± 2.8	54.3	37.2 - 71.4	Pass
ERAP-1112	3/20/2017	Pu-239/240	63.6 ± 3.0	62.0	44.9 - 81.0	Pass
ERAP-1112	3/20/2017	Sr-90	55.3 ± 8.3	52.4	25.6 - 78.5	Pass
ERAP-1112	3/20/2017	U-233/234	65.7 ± 3.0	73.1	45.3 - 110	Pass
ERAP-1112	3/20/2017	U-238	67.3 ± 3.0	72.4	46.8 - 100	Pass
ERAP-1112	3/20/2017	Zn-65	1,355 ± 16	984	705 - 1,360	Pass
ERAP-1114	3/20/2017	Gr. Alpha	106 ± 5	85.5	28.6 - 133	Pass
ERAP-1114 [e]	3/20/2017	Gr. Beta	67.6 ± 3.0	45.2	28.6 - 65.9	Fail
ERSO-1116	3/20/2017	Am-241	418 ± 98	448	262 - 582	Pass
ERSO-1116	3/20/2017	Ac-228	1,540 ± 260	1,240	795 - 1,720	Pass
ERSO-1116	3/20/2017	Bi-212	1,550 ± 90	1,240	330 - 1,820	Pass
ERSO-1116	3/20/2017	Bi-214	2,560 ± 20	2,750	1,660 - 3,960	Pass
ERSO-1116	3/20/2017	Co-60	4,620 ± 100	4,430	3,000 - 6,100	Pass
ERSO-1116	3/20/2017	Cs-134	8,340 ± 100	8,860	5,790 - 10,600	Pass
ERSO-1116	3/20/2017	Cs-137	8,420 ± 100	7,500	5,750 - 9,650	Pass
ERSO-1116	3/20/2017	K-40	13,600 ± 900	10,600	7,740 - 14,200	Pass
ERSO-1116	3/20/2017	Mn-54	< 68.1	< 1000	0.00 - 1,000	Pass
ERSO-1116	3/20/2017	Pb-212	1,060 ± 70	1,240	812 - 1,730	Pass
ERSO-1116	3/20/2017	Pb-214	2,620 ± 160	2,890	1,690 - 4,310	Pass
ERSO-1116	3/20/2017	Pu-238	424 ± 154	648	390 - 894	Pass
ERSO-1116 [f]	3/20/2017	Pu-239/240	252 ± 112	484	316 - 669	Fail
ERSO-1116 [g]	3/20/2017	Pu-239/240	436 ± 106	484	316 - 669	Pass
ERSO-1116	3/20/2017	Sr-90	7,930 ± 250	9,150	3,490 - 14,500	Pass
ERSO-1116	3/20/2017	Th-234	1,820 ± 200	1,940	614 - 3,650	Pass
ERSO-1116 [h]	3/20/2017	U-233/234	1,030 ± 130	1,950	1,190 - 2,500	Fail
ERSO-1116 [i]	3/20/2017	U-233/234	1,820 ± 200	1,950	1,190 - 2,500	Pass
ERSO-1116	3/20/2017	U-238	1,240 ± 140	1,940	1,200 - 2,460	Pass
ERSO-1116 [i]	3/20/2017	U-238	1,930 ± 200	1,940	1,200 - 2,460	Pass
ERSO-1116	3/20/2017	Zn-65	7,190 ± 240	6,090	4,850 - 8,090	Pass
ERW-1122	3/20/2017	Gr. Alpha	65.3 ± 2.4	89.5	31.8 - 139	Pass
ERW-1122	3/20/2017	Gr. Beta	54.8 ± 1.5	61.0	34.9 - 90.4	Pass
ERW-1124	3/20/2017	H-3	19,000 ± 410	19,400	13,000 - 27,700	Pass

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

MRAD Study

Lab Code [b]	Concentration [a]					
	Date	Analysis	Laboratory Result	ERA Result	Control Limits [c]	Acceptance
ERVE-1118	3/20/2017	Am-241	1,560 ± 140	1,860	1,140 - 2,470	Pass
ERVE-1118	3/20/2017	Cm-244	530 ± 80	734	360 - 1,140	Pass
ERVE-1118	3/20/2017	Co-60	1,400 ± 350	1,390	959 - 1,940	Pass
ERVE-1118	3/20/2017	Cs-134	1,650 ± 460	1,830	1,180 - 2,380	Pass
ERVE-1118	3/20/2017	Cs-137	2,580 ± 540	2,500	1,810 - 3,480	Pass
ERVE-1118	3/20/2017	K-40	32,100 ± 700	30,900	22,300 - 43,400	Pass
ERVE-1118	3/20/2017	Mn-54	< 27.3	< 300	0.00 - 300	Pass
ERVE-1118	3/20/2017	Zn-65	889 ± 64	853	615 - 1,200	Pass
ERVE-1118	3/20/2017	Pu-238	3,250 ± 210	3,250	1,940 - 4,450	Pass
ERVE-1118	3/20/2017	Pu-239/240	2,180 ± 170	2,150	1,320 - 2,960	Pass
ERVE-1118	3/20/2017	Sr-90	665 ± 135	726	414 - 963	Pass
ERVE-1118	3/20/2017	U-233/234	2,840 ± 200	3,090	2,030 - 3,970	Pass
ERVE-1118	3/20/2017	U-238	2,990 ± 200	3,060	2,040 - 3,890	Pass
ERW-1120	3/20/2017	Am-241	108 ± 7	140	94.3 - 188	Pass
ERW-1120	3/20/2017	Co-60	2,600 ± 198	2,540	2,210 - 2,970	Pass
ERW-1120	3/20/2017	Cs-134	2,380 ± 250	2,510	1,840 - 2880	Pass
ERW-1120	3/20/2017	Cs-137	1,470 ± 243	1,400	1,190 - 1,680	Pass
ERW-1120	3/20/2017	Mn-54	< 12.3	< 100	0.00 - 100	Pass
ERW-1120	3/20/2017	Pu-238	117 ± 4	128	94.7 - 159	Pass
ERW-1120	3/20/2017	Pu-239/240	74.8 ± 3.3	85.8	66.6 - 108	Pass
ERW-1120	3/20/2017	U-233/234	75.3 ± 3.2	90.3	67.8 - 116	Pass
ERW-1120	3/20/2017	U-238	76.4 ± 3.2	89.5	68.2 - 110	Pass
ERW-1120	3/20/2017	Zn-65	2,130 ± 378	1,960	1630 - 2,470	Pass
ERW-1120 [j]	3/20/2017	Fe-55	1,400 ± 403	984	587 - 1,340	Fail
ERW-1120 [k]	3/20/2017	Fe-55	1,081 ± 383	984	587 - 1,340	Pass
ERW-1120	3/20/2017	Sr-90	652 ± 12	714	465 - 944	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] Results are presented as the known values, expected laboratory precision (2 sigma, 1 determination) and control limits as provided by ERA.

[d] Fe-55 analysis result was outside the acceptable range. Recounting the sample disk for 1000 minutes resulted in 254 ± 364 with an LLD calculation of < 342. Insufficient sample was available after performing other required analyses on the sample to quantify the activity with an uncertainty less than the activity.

[e] ERA appears to have applied the standard material to the filter in a pattern closer to the center of the filter compared to previous studies and different from the filter efficiency utilized by the laboratory. This likely caused the efficency used the calculation to be understated and the result obtained by the laboratory to be overstated. For comparison the in-house spike for gross beta in AP (table A-3 SPAP-740 2/28/17) was acceptable with a ratio of 0.94 of lab result to known.

[f] Analysis result for Plutonium-239/240 was below the lower limit of acceptance.

[g] Samples were reanalyzed in duplicate with acceptable results for each. Original analysis had poor resolution possibly due to a poor elctroplating and is suspected in contributing to poor results.

[h] Analysis result for U-233/234 was below the lower limit of acceptance.

[I] The reanalysis result for U-233/234 was within the acceptance limits and U-238 reanalysis result was closer to the known value. Original analysis had poor resolution possibly due to a poor electroplating and is suspected in contributing to poor results.

[j] Fe-55 analysis result was outside acceptable range.

[k] Result of recounting was acceptable. No reason for intial failure determined.

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

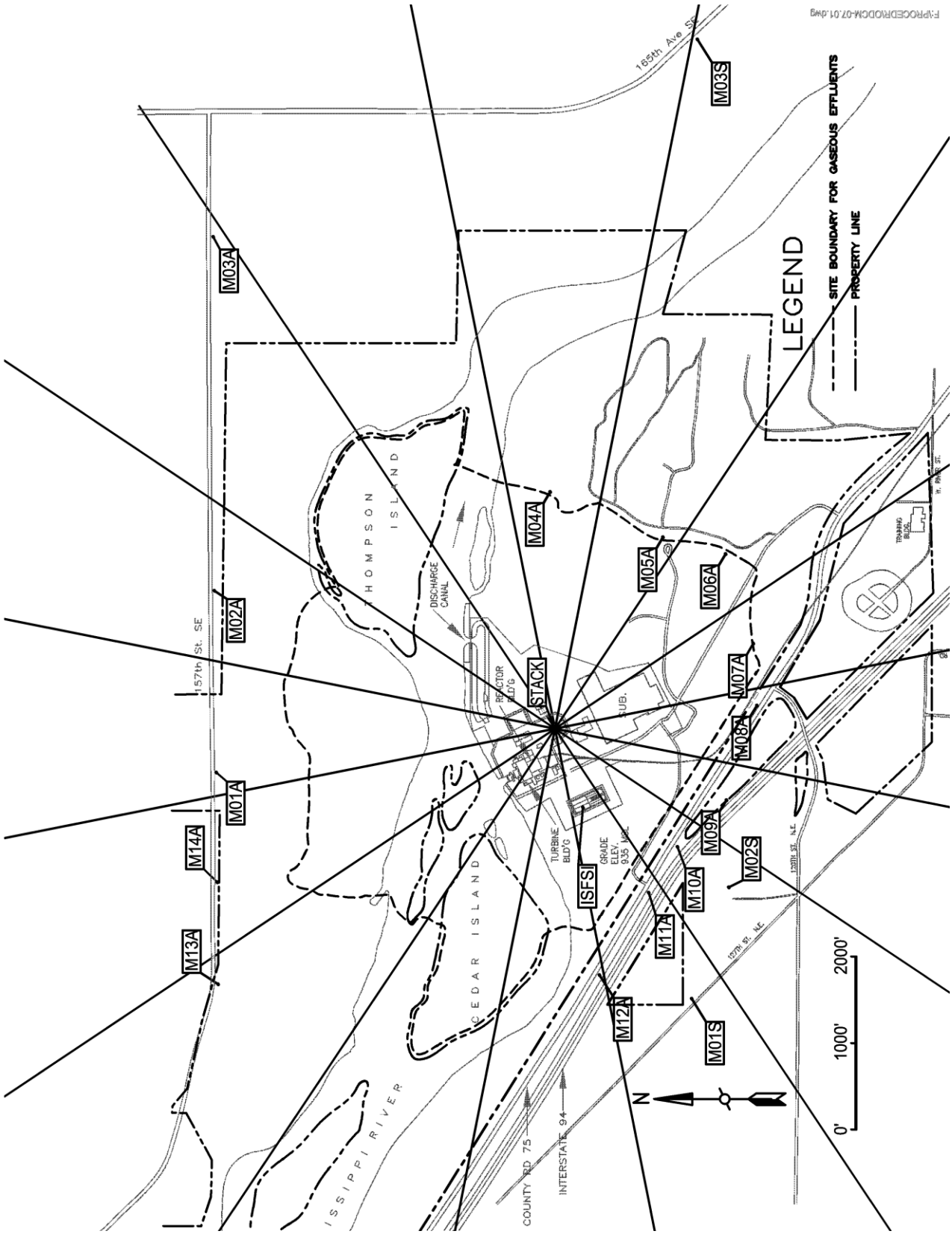


Figure D-1, Sample Collection and Analysis Program: TLD locations, Inner Ring (Table 5.2)

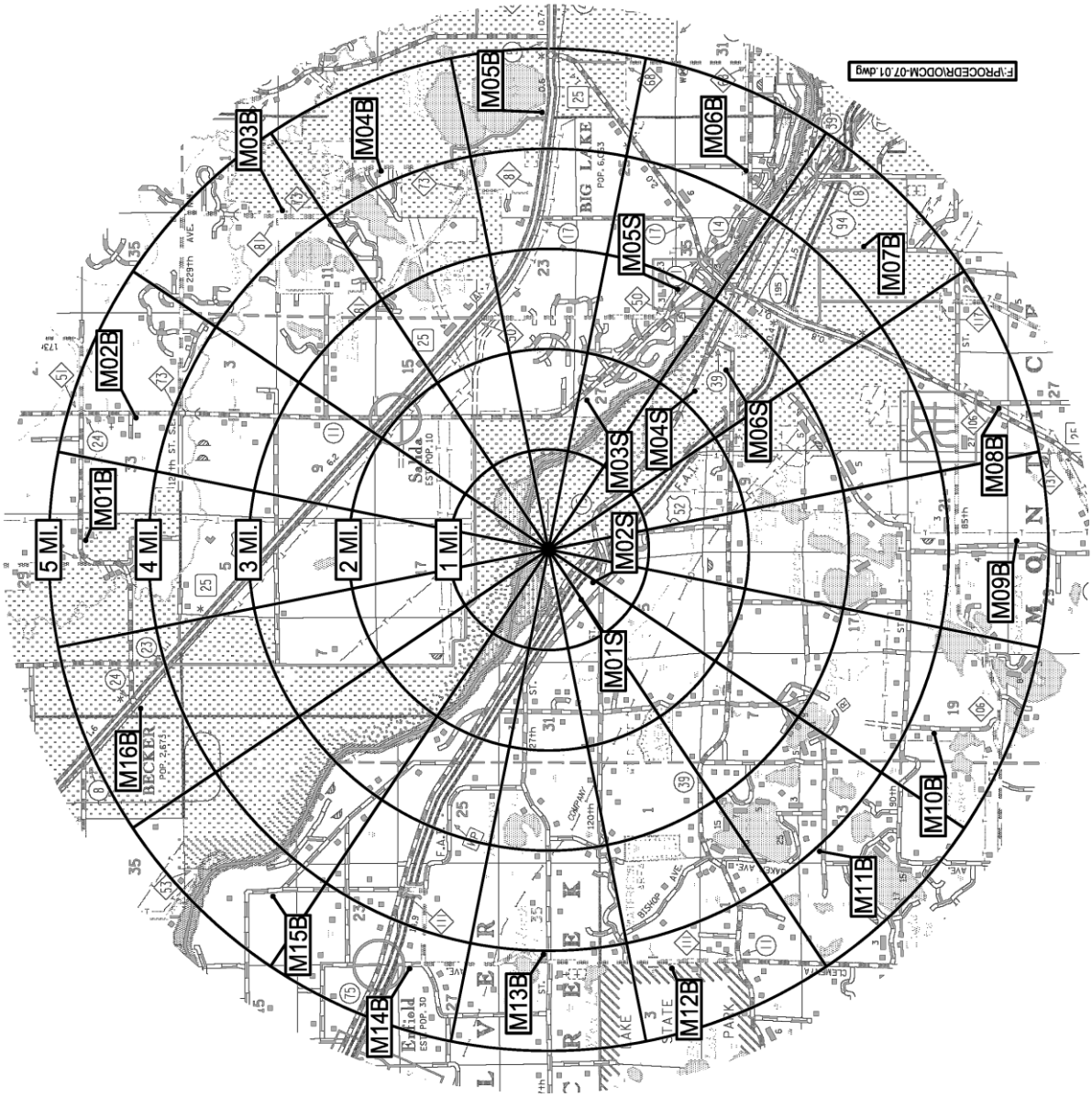


Figure D-2, Sample Collection and Analysis Program: TLD locations, Outer Ring. (Table 5.2)

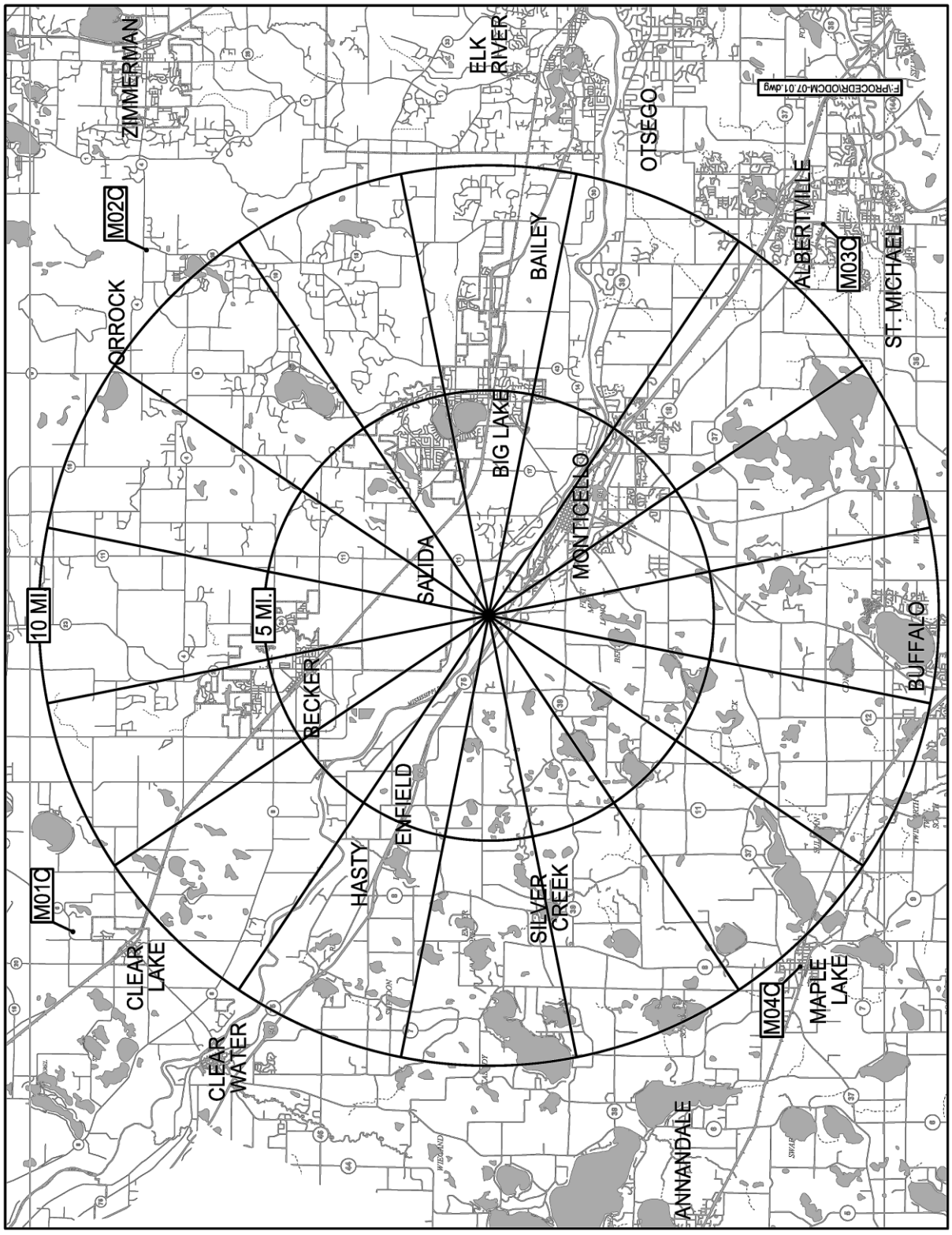


Figure D-3, Sample Collection and Analysis Program: TLD locations, Controls. (Table 5.2)

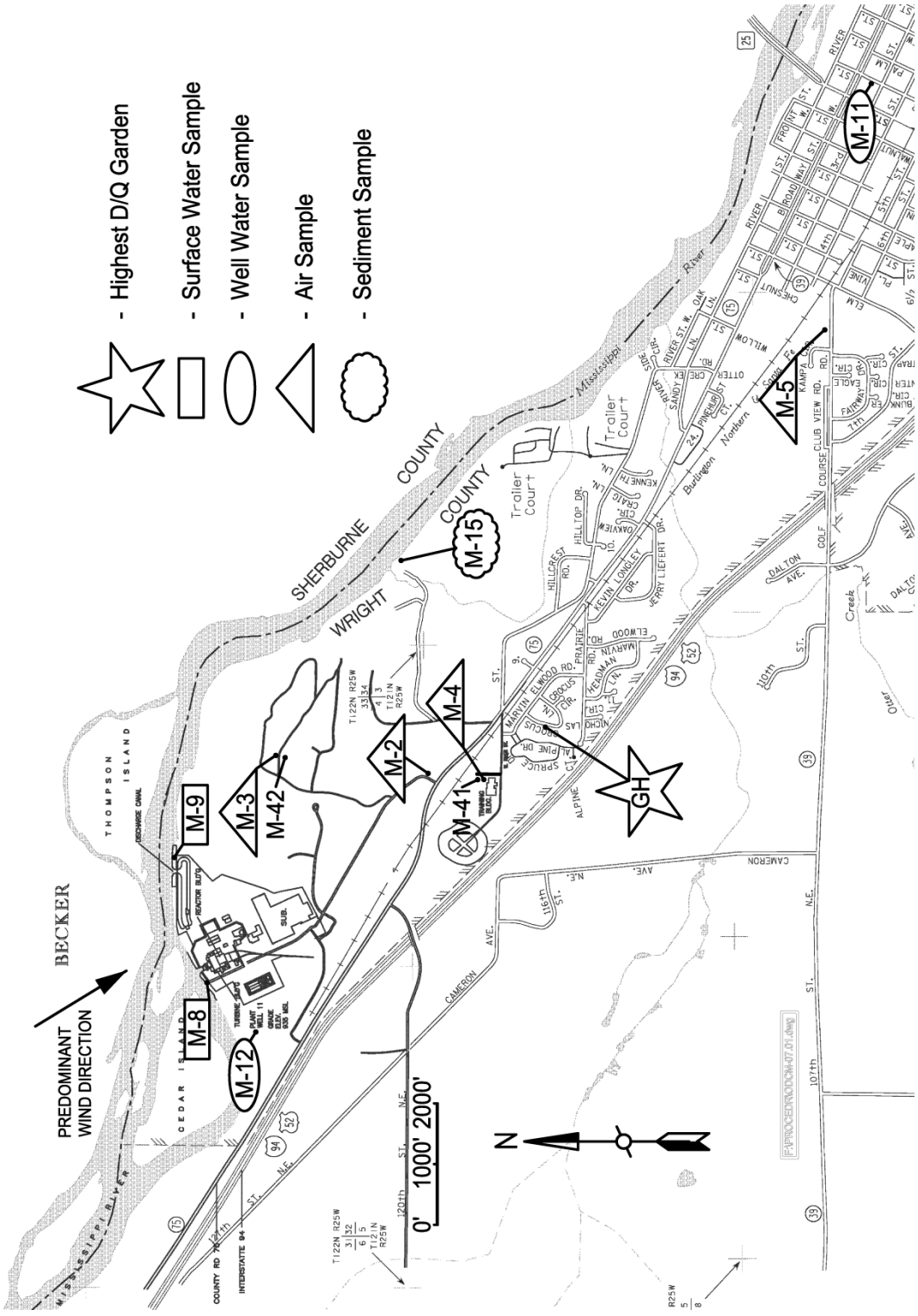
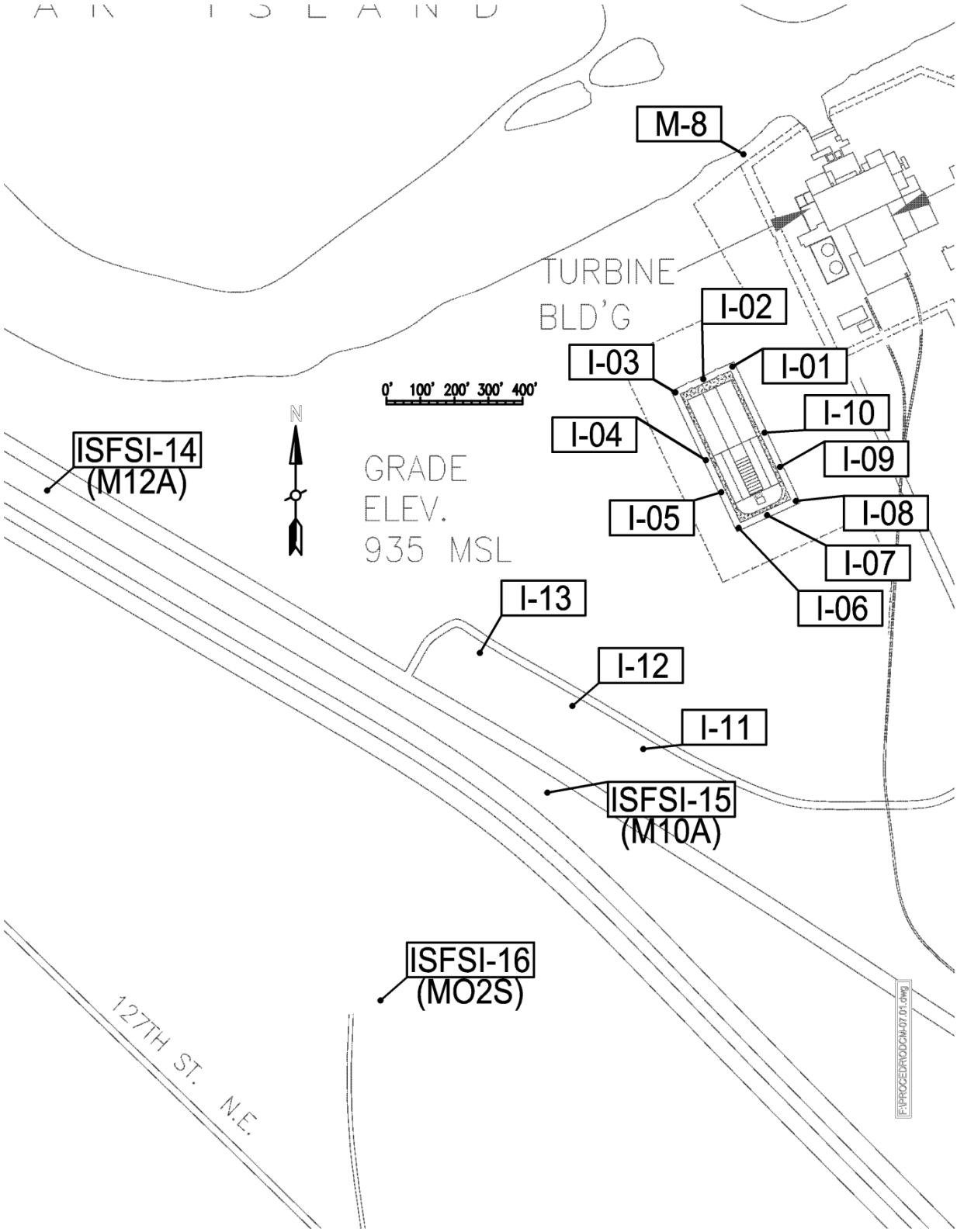


Figure D-4, Sample Collection and Analysis Program: Radiological Environmental Monitoring Program, Well Water and Shoreline sampling locations. (Table 5.2)


M-8
TURBINE
BLD'G
I-02
I-03
I-01
I-10
I-04
I-09
I-05
I-08
I-07
I-06
I-13
I-12
I-11
ISFSI-15
(M10A)
ISFSI-14
(M12A)
ISFSI-16
(MO2S)
0' 100' 200' 300' 400'
N
GRADE
ELEV.
935' MSL
127TH ST. N.E.

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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
PART II

Radiological Environmental Monitoring Program
Complete Analyses Data Tables

January - December, 2017

Prepared under contract by

ENVIRONMENTAL, INC
MIDWEST LABORATORY

PROJECT No. 8010

Reviewed and
Approved

Forrest G. Shaw III
Quality Assurance Manager

TABLE OF CONTENTS

LIST OF TABLES

10 INTRODUCTION

The following constitutes the final 2017 report for the Environmental Radiological Monitoring Program conducted at the Monticello Nuclear Generating Plant in Monticello, Minnesota Results of completed analyses are presented in the attached tables

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

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

2.0 LISTING OF MISSED SAMPLES

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

Sample Type	Analysis	Location	Collection Date or Period	Reason for not conducting REMP as required	Plans for Preventing Recurrence
SW	Gamma	M-8c	January '17	Water frozen entire month; No composite.	None
SW	Gamma	M-8c	2/1/17, 2/8/17, 2/15/17	Water frozen. Only one sample in composite.	None
AP/AI	Beta, I-131	M-1	3/8/17	Partial sample due to GFCI failure during thunderstorm.	Replaced GFCI.
AP/AI	Beta, I-131	M-1	3/15/17	Sample not sent; pump found off; only 6 hours of run time.	Replaced pump.
SW	Gamma	M-8c	3/15/17	Water frozen. Not included in composite.	None
TLD	Gamma	M-2C	1st Qtr 2017	TLD missing in field.	None
AP/AI	Beta, I-131	M-03	6/14/17	Partial sample due to an apparent loss of power during a thunderstorm.	None
BO	Gamma	M-8c	1st half 2017	No upstream bottom organisms found.	None
TLD	Gamma	M-15B	3rd Qtr 2017	TLD missing in field.	None
BO	Gamma	M-8c	2nd half 2017	No upstream bottom organisms found.	None
SW	Gamma	M-8c	December '17	Water Frozen entire month, No Composite.	None

30 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	17.5 ± 1.7	16.0 ± 1.5	16.9 ± 1.7	16.0 ± 1.5	16.6	15.8
M-02A	16.3 ± 2.1	15.8 ± 0.7	16.5 ± 1.2	16.4 ± 0.8	16.2	14.7
M-03A	15.9 ± 1.3	15.8 ± 0.7	15.1 ± 1.2	16.1 ± 1.0	15.7	13.4
M-04A	14.1 ± 1.4	15.7 ± 1.0	14.0 ± 1.1	16.4 ± 1.2	15.1	14.3
M-05A	17.1 ± 0.9	14.3 ± 1.0	16.2 ± 0.9	14.7 ± 0.7	15.6	14.4
M-06A	17.5 ± 1.0	17.1 ± 0.9	16.4 ± 0.8	14.5 ± 0.8	16.4	17.2
M-07A	15.3 ± 1.1	16.2 ± 0.8	14.5 ± 1.0	16.9 ± 0.8	15.7	14.2
M-08A	16.3 ± 1.0	16.1 ± 0.6	16.2 ± 0.7	16.1 ± 0.6	16.2	15.3
M-09A	16.1 ± 1.1	14.9 ± 0.9	15.4 ± 1.0	15.7 ± 1.2	15.5	14.6
M-10A	15.8 ± 1.3	15.4 ± 0.9	15.0 ± 0.9	16.3 ± 0.9	15.6	14.5
M-11A	17.5 ± 0.9	17.1 ± 0.6	17.6 ± 0.6	17.2 ± 0.8	17.3	16.2
M-12A	17.6 ± 1.2	16.7 ± 1.1	17.1 ± 1.1	17.0 ± 0.9	17.1	15.9
M-13A	16.5 ± 1.1	15.4 ± 1.0	15.5 ± 1.0	15.4 ± 0.8	15.7	15.0
M-14A	16.0 ± 1.1	16.1 ± 0.6	15.8 ± 0.8	16.2 ± 0.7	16.0	15.4
Mean ± s.d.	16.4 ± 1.0	15.9 ± 0.8	15.9 ± 1.0	16.0 ± 0.8	16.1	15.1
			Indicators (Outer Ring, 4-5 Miles Distant)			
M-01B	14.9 ± 1.3	15.6 ± 1.5	14.9 ± 0.9	15.1 ± 1.0	15.1	14.7
M-02B	15.4 ± 1.0	15.1 ± 0.7	15.4 ± 0.8	14.4 ± 0.7	15.1	14.8
M-03B	11.7 ± 1.0	12.0 ± 0.7	12.4 ± 0.8	13.1 ± 0.7	12.3	11.7
M-04B	14.5 ± 0.9	13.9 ± 0.8	14.9 ± 1.1	14.5 ± 0.9	14.5	14.0
M-05B	14.7 ± 1.1	15.2 ± 0.8	14.7 ± 0.7	15.7 ± 0.9	15.1	13.6
M-06B	12.7 ± 1.1	15.8 ± 0.6	14.3 ± 1.0	16.0 ± 0.8	14.7	13.9
M-07B	16.2 ± 1.1	15.1 ± 1.1	16.3 ± 1.1	15.9 ± 1.2	15.9	14.8
M-08B	14.6 ± 1.1	14.1 ± 0.9	15.2 ± 0.9	14.7 ± 1.0	14.7	13.9
M-09B	14.8 ± 1.2	16.6 ± 0.8	15.8 ± 0.9	15.7 ± 0.8	15.7	14.7
M-10B	15.4 ± 1.2	15.2 ± 1.0	16.3 ± 0.8	15.8 ± 0.9	15.7	15.3
M-11B	15.4 ± 1.5	16.2 ± 1.2	17.0 ± 1.1	17.1 ± 0.9	16.4	14.7
M-12B	13.5 ± 1.4	16.0 ± 1.1	14.8 ± 1.1	16.6 ± 0.7	15.2	14.4
M-13B	15.5 ± 1.2	14.5 ± 0.7	15.8 ± 1.1	15.1 ± 0.8	15.2	14.0
M-14B	15.8 ± 1.8	17.2 ± 0.6	17.3 ± 1.7	17.6 ± 0.8	17.0	16.2
M-15B	14.5 ± 0.9	15.4 ± 0.8	ND[a]	15.2 ± 1.0	15.1	14.6
M-16B	13.6 ± 0.8	14.3 ± 1.2	16.1 ± 1.8	15.0 ± 1.1	14.7	14.2
Mean ± s.d.	14.6 ± 1.2	15.1 ± 1.2	15.4 ± 1.2	15.5 ± 1.1	15.1	14.3

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

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	13.0 ± 1.8	14.0 ± 0.9	14.1 ± 1.3	14.0 ± 0.9	13.8	14.0
M-02C	ND[a]	15.9 ± 1.0	13.5 ± 0.8	13.7 ± 0.7	14.4	17.5
M-03C	14.8 ± 0.9	15.4 ± 0.8	15.5 ± 0.7	15.9 ± 0.8	15.4	15.4
M-04C	14.8 ± 1.0	14.0 ± 0.6	16.7 ± 1.0	14.8 ± 0.8	15.1	14.9
Mean ± s.d.	14.2 ± 1.0	14.8 ± 0.9	14.9 ± 1.4	14.6 ± 1.0	14.7	15.4
			Indicators (Special Interest Areas)			
M-01S	13.3 ± 1.9	12.0 ± 0.6	12.3 ± 1.3	12.6 ± 0.7	12.6	11.2
M-02S	14.7 ± 1.5	13.9 ± 0.8	14.4 ± 1.1	14.5 ± 0.9	14.4	13.9
M-03S	13.6 ± 1.3	14.9 ± 1.0	15.4 ± 1.1	15.5 ± 1.1	14.8	14.3
M-04S	16.3 ± 1.6	15.6 ± 1.1	17.0 ± 0.9	16.5 ± 1.0	16.3	16.2
M-05S	14.1 ± 1.4	14.5 ± 1.1	15.1 ± 0.9	16.1 ± 1.0	15.0	15.7
M-06S	15.2 ± 1.1	15.2 ± 0.8	16.1 ± 0.5	16.2 ± 0.9	15.7	16.1
M-I-11	17.3 ± 2.2	15.3 ± 1.1	17.8 ± 1.5	15.6 ± 1.0	16.5	16.5
M-I-12	15.4 ± 0.9	13.9 ± 0.9	15.9 ± 0.8	14.6 ± 1.0	15.0	14.8
M-I-13	13.8 ± 1.2	14.7 ± 1.2	16.6 ± 1.1	15.5 ± 1.2	15.2	17.4
Mean ± s.d.	14.9 ± 1.3	14.4 ± 1.3	15.6 ± 1.6	15.2 ± 1.5	15.0	15.1
			ISFSI Fence (Non-REMP TLDs)			
M-I-01	39.7 ± 1.3	32.8 ± 1.8	43.3 ± 1.8	39.1 ± 2.1	38.7	39.8
M-I-02	36.2 ± 1.7	27.5 ± 0.7	38.7 ± 0.5	32.9 ± 0.6	33.8	35.3
M-I-03	33.1 ± 2.0	25.4 ± 1.3	34.0 ± 1.3	29.8 ± 1.4	30.6	30.9
M-I-04	39.7 ± 3.1	31.4 ± 2.1	39.2 ± 1.2	34.9 ± 2.1	36.3	35.4
M-I-05	68.7 ± 4.1	58.2 ± 3.8	49.2 ± 2.5	50.6 ± 2.4	56.7	67.7
M-I-06	27.6 ± 2.5	23.9 ± 1.0	29.2 ± 1.9	25.0 ± 0.8	26.4	27.6
M-I-07	30.9 ± 1.9	26.8 ± 1.1	30.6 ± 1.1	28.5 ± 1.7	29.2	31.3
M-I-08	27.8 ± 2.0	26.3 ± 1.5	28.9 ± 1.9	27.3 ± 1.8	27.6	29.1
M-I-09	46.5 ± 2.3	39.9 ± 2.4	48.0 ± 2.5	43.5 ± 2.3	44.5	56.5
M-I-10	36.7 ± 1.3	28.7 ± 1.1	36.6 ± 1.3	31.3 ± 1.2	33.3	36.8
Mean ± s.d.	38.7 ± 12.1	32.1 ± 10.3	37.8 ± 7.4	34.3 ± 8.0	35.7	33.8

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

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
01-04-17	327	0.029 ± 0.004	07-05-17	349	0.022 ± 0.003
01-11-17	324	0.045 ± 0.004	07-12-17	328	0.022 ± 0.003
01-18-17	352	0.044 ± 0.004	07-19-17	327	0.019 ± 0.003
01-25-17	323	0.035 ± 0.004	07-26-17	329	0.023 ± 0.003
02-01-17	355	0.022 ± 0.003	08-02-17	353	0.025 ± 0.003
02-08-17	322	0.033 ± 0.004	08-09-17	326	0.020 ± 0.003
02-15-17	354	0.028 ± 0.003	08-16-17	354	0.022 ± 0.003
02-22-17	324	0.031 ± 0.004	08-23-17	353	0.023 ± 0.003
03-01-17	323	0.030 ± 0.004	08-30-17	337	0.017 ± 0.003
03-08-17	226[b]	0.036 ± 0.005[b]	09-06-17	324	0.027 ± 0.004
03-15-17		ND[c]	09-13-17	329	0.041 ± 0.004
03-22-17	298	0.029 ± 0.004	09-20-17	326	0.043 ± 0.004
03-29-17	327	0.025 ± 0.003	09-27-17	296	0.023 ± 0.003
1st Quarter Mean ± s.d.		0.032 ± 0.007	3rd Quarter Mean ± s.d.		0.025 ± 0.008
04-05-17	328	0.024 ± 0.003	10-04-17	329	0.024 ± 0.003
04-12-17	323	0.022 ± 0.003	10-11-17	297	0.022 ± 0.003
04-19-17	325	0.020 ± 0.003	10-18-17	297	0.028 ± 0.004
04-26-17	331	0.015 ± 0.003	10-25-17	263	0.028 ± 0.004
05-03-17	321	0.022 ± 0.003	11-01-17	330	0.012 ± 0.003
05-10-17	331	0.026 ± 0.003	11-08-17	360	0.024 ± 0.003
05-17-17	325	0.021 ± 0.003	11-15-17	333	0.059 ± 0.005
05-24-17	328	0.011 ± 0.003	11-22-17	335	0.044 ± 0.004
05-31-17	353	0.011 ± 0.002	11-29-17	333	0.038 ± 0.004
06-07-17	324	0.027 ± 0.004	12-06-17	335	0.042 ± 0.004
06-14-17	331	0.028 ± 0.003	12-13-17	320	0.034 ± 0.004
06-21-17	323	0.019 ± 0.003	12-20-17	335	0.031 ± 0.004
06-28-17	328	0.016 ± 0.003	12-27-17	364	0.030 ± 0.003
			01-03-18	332	0.073 ± 0.005
2nd Quarter Mean ± s.d.		0.020 ± 0.006	4th Quarter Mean ± s.d.		0.035 ± 0.016
			Cumulative Average		0.028
			Previous Annual Average		0.024

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

[b] Partial sample volume due to loss of power during sample period.

[c] "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
01-04-17	356	0.027 ± 0.003	07-05-17	327	0.023 ± 0.003
01-11-17	326	0.046 ± 0.004	07-12-17	321	0.026 ± 0.003
01-18-17	348	0.044 ± 0.004	07-19-17	324	0.022 ± 0.003
01-25-17	327	0.038 ± 0.004	07-26-17	326	0.021 ± 0.003
02-01-17	351	0.022 ± 0.003	08-02-17	381	0.020 ± 0.003
02-08-17	351	0.031 ± 0.003	08-09-17	385	0.019 ± 0.003
02-15-17	327	0.029 ± 0.004	08-16-17	412	0.023 ± 0.003
02-22-17	329	0.026 ± 0.003	08-23-17	416	0.023 ± 0.003
03-01-17	298	0.031 ± 0.004	08-30-17	401	0.019 ± 0.003
03-08-17	341	0.023 ± 0.003	09-06-17	416	0.025 ± 0.003
03-15-17	321	0.028 ± 0.004	09-13-17	383	0.042 ± 0.004
03-22-17	339	0.027 ± 0.003	09-20-17	388	0.044 ± 0.004
03-29-17	353	0.022 ± 0.003	09-27-17	380	0.021 ± 0.003
1st Quarter Mean ± s.d.		0.030 ± 0.008	3rd Quarter Mean ± s.d.		0.025 ± 0.008
04-05-17	328	0.021 ± 0.003	10-04-17	388	0.025 ± 0.003
04-12-17	351	0.018 ± 0.003	10-11-17	383	0.024 ± 0.003
04-19-17	352	0.021 ± 0.003	10-18-17	384	0.025 ± 0.003
04-26-17	374	0.012 ± 0.002	10-25-17	351	0.024 ± 0.003
05-03-17	352	0.024 ± 0.003	11-01-17	383	0.014 ± 0.003
05-10-17	408	0.019 ± 0.003	11-08-17	344	0.047 ± 0.004
05-17-17	382	0.021 ± 0.003	11-15-17	341	0.055 ± 0.005
05-24-17	381	0.010 ± 0.002	11-22-17	344	0.040 ± 0.004
05-31-17	377	0.010 ± 0.002	11-29-17	316	0.035 ± 0.004
06-07-17	381	0.025 ± 0.003	12-06-17	315	0.037 ± 0.004
06-14-17	324	0.025 ± 0.003	12-13-17	284	0.034 ± 0.004
06-21-17	321	0.025 ± 0.003	12-20-17	286	0.038 ± 0.004
06-28-17	321	0.013 ± 0.003	12-27-17	317	0.035 ± 0.004
			01-03-18	313	0.057 ± 0.005
2nd Quarter Mean ± s.d.		0.019 ± 0.006	4th Quarter Mean ± s.d.		0.035 ± 0.012
			Cumulative Average		0.027
			Previous Annual Average		0.025

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

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
01-04-17	328	0.036 ± 0.004	07-05-17	302	0.023 ± 0.003
01-11-17	326	0.049 ± 0.005	07-12-17	323	0.023 ± 0.003
01-18-17	347	0.051 ± 0.004	07-19-17	326	0.021 ± 0.003
01-25-17	328	0.047 ± 0.004	07-26-17	328	0.021 ± 0.003
02-01-17	353	0.023 ± 0.003	08-02-17	351	0.023 ± 0.003
02-08-17	351	0.030 ± 0.003	08-09-17	340	0.024 ± 0.003
02-15-17	326	0.033 ± 0.004	08-16-17	379	0.023 ± 0.003
02-22-17	329	0.035 ± 0.004	08-23-17	416	0.022 ± 0.003
03-01-17	325	0.030 ± 0.004	08-30-17	386	0.015 ± 0.002
03-08-17	341	0.032 ± 0.004	09-06-17	384	0.026 ± 0.003
03-15-17	347	0.031 ± 0.004	09-13-17	383	0.039 ± 0.004
03-22-17	353	0.030 ± 0.004	09-20-17	357	0.044 ± 0.004
03-29-17	353	0.025 ± 0.003	09-27-17	349	0.021 ± 0.003
1st Quarter Mean ± s.d.		0.035 ± 0.009	3rd Quarter Mean ± s.d.		0.025 ± 0.008
04-05-17	323	0.027 ± 0.003	10-04-17	355	0.024 ± 0.003
04-12-17	352	0.021 ± 0.003	10-11-17	352	0.029 ± 0.003
04-19-17	350	0.017 ± 0.003	10-18-17	352	0.021 ± 0.003
04-26-17	324	0.014 ± 0.003	10-25-17	319	0.024 ± 0.003
05-03-17	325	0.020 ± 0.003	11-01-17	350	0.011 ± 0.002
05-10-17	326	0.027 ± 0.003	11-08-17	344	0.026 ± 0.003
05-17-17	328	0.021 ± 0.003	11-15-17	341	0.056 ± 0.005
05-24-17	299	0.012 ± 0.003	11-22-17	344	0.045 ± 0.004
05-31-17	323	0.011 ± 0.003	11-29-17	346	0.033 ± 0.004
06-07-17	328	0.023 ± 0.003	12-06-17	344	0.043 ± 0.004
06-14-17		ND[b]	12-13-17	313	0.032 ± 0.004
06-21-17	323	0.016 ± 0.003	12-20-17	314	0.036 ± 0.004
06-28-17	323	0.016 ± 0.003	12-27-17	317	0.033 ± 0.004
			01-03-18	313	0.059 ± 0.005
2nd Quarter Mean ± s.d.		0.019 ± 0.005	4th Quarter Mean ± s.d.		0.034 ± 0.013
			Cumulative Average		0.028
			Previous Annual Average		0.027

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

[b] Low volume due to power outage from storms. 144 m^3 volume/ result 0.061 ± 0.008 pCi/m^3.

Not included in cumulative or monthly averages or Part I table 5.4. mean and range data.

See Table 2.0, Listing of Missed Samples.

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
01-04-17	357	0.029 ± 0.003	07-05-17	354	0.020 ± 0.003
01-11-17	339	0.042 ± 0.004	07-12-17	325	0.022 ± 0.003
01-18-17	351	0.043 ± 0.004	07-19-17	327	0.018 ± 0.003
01-25-17	352	0.039 ± 0.004	07-26-17	329	0.022 ± 0.003
02-01-17	379	0.021 ± 0.003	08-02-17	375	0.024 ± 0.003
02-08-17	351	0.027 ± 0.003	08-09-17	353	0.023 ± 0.003
02-15-17	327	0.029 ± 0.004	08-16-17	349	0.025 ± 0.003
02-22-17	329	0.027 ± 0.003	08-23-17	377	0.020 ± 0.003
03-01-17	325	0.026 ± 0.004	08-30-17	353	0.022 ± 0.003
03-08-17	342	0.032 ± 0.004	09-06-17	352	0.027 ± 0.003
03-15-17	347	0.028 ± 0.003	09-13-17	352	0.044 ± 0.004
03-22-17	339	0.026 ± 0.003	09-20-17	355	0.044 ± 0.004
03-29-17	354	0.025 ± 0.003	09-27-17	349	0.020 ± 0.003
1st Quarter Mean ± s.d.		0.030 ± 0.007	3rd Quarter Mean ± s.d.		0.025 ± 0.009
04-05-17	356	0.023 ± 0.003	10-04-17	355	0.026 ± 0.003
04-12-17	350	0.020 ± 0.003	10-11-17	351	0.024 ± 0.003
04-19-17	351	0.019 ± 0.003	10-18-17	327	0.027 ± 0.004
04-26-17	351	0.013 ± 0.003	10-25-17	351	0.023 ± 0.003
05-03-17	351	0.020 ± 0.003	11-01-17	302	0.015 ± 0.003
05-10-17	353	0.018 ± 0.003	11-08-17	353	0.027 ± 0.003
05-17-17	328	0.021 ± 0.003	11-15-17	350	0.052 ± 0.004
05-24-17	353	0.011 ± 0.003	11-22-17	353	0.038 ± 0.004
05-31-17	375	0.010 ± 0.002	11-29-17	353	0.034 ± 0.004
06-07-17	327	0.026 ± 0.003	12-06-17	353	0.039 ± 0.004
06-14-17	356	0.024 ± 0.003	12-13-17	350	0.027 ± 0.003
06-21-17	348	0.020 ± 0.003	12-20-17	352	0.033 ± 0.004
06-28-17	351	0.014 ± 0.003	12-27-17	355	0.028 ± 0.003
			01-03-18	350	0.056 ± 0.004
2nd Quarter Mean ± s.d.		0.018 ± 0.005	4th Quarter Mean ± s.d.		0.032 ± 0.011
			Cumulative Average		0.027
			Previous Annual Average		0.026

[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
01-04-17	328	0.033 ± 0.004	07-05-17	296	0.021 ± 0.003
01-11-17	323	0.046 ± 0.004	07-12-17	322	0.023 ± 0.003
01-18-17	353	0.051 ± 0.004	07-19-17	324	0.017 ± 0.003
01-25-17	322	0.038 ± 0.004	07-26-17	326	0.018 ± 0.003
02-01-17	353	0.022 ± 0.003	08-02-17	350	0.024 ± 0.003
02-08-17	322	0.035 ± 0.004	08-09-17	353	0.021 ± 0.003
02-15-17	325	0.031 ± 0.004	08-16-17	392	0.024 ± 0.003
02-22-17	326	0.028 ± 0.004	08-23-17	384	0.019 ± 0.003
03-01-17	294	0.031 ± 0.004	08-30-17	384	0.019 ± 0.003
03-08-17	296	0.034 ± 0.004	09-06-17	384	0.028 ± 0.003
03-15-17	319	0.030 ± 0.004	09-13-17	385	0.042 ± 0.004
03-22-17	323	0.032 ± 0.004	09-20-17	355	0.043 ± 0.004
03-29-17	325	0.024 ± 0.003	09-27-17	349	0.019 ± 0.003
1st Quarter Mean ± s.d.		0.033 ± 0.008	3rd Quarter Mean ± s.d.		0.024 ± 0.008
04-05-17	326	0.022 ± 0.003	10-04-17	355	0.023 ± 0.003
04-12-17	322	0.021 ± 0.003	10-11-17	351	0.025 ± 0.003
04-19-17	351	0.016 ± 0.003	10-18-17	352	0.025 ± 0.003
04-26-17	324	0.015 ± 0.003	10-25-17	319	0.025 ± 0.003
05-03-17	322	0.021 ± 0.003	11-01-17	353	0.011 ± 0.003
05-10-17	325	0.023 ± 0.003	11-08-17	343	0.025 ± 0.003
05-17-17	294	0.022 ± 0.003	11-15-17	342	0.058 ± 0.005
05-24-17	295	0.012 ± 0.003	11-22-17	344	0.044 ± 0.004
05-31-17	322	0.011 ± 0.003	11-29-17	343	0.036 ± 0.004
06-07-17	294	0.027 ± 0.004	12-06-17	344	0.041 ± 0.004
06-14-17	297	0.025 ± 0.004	12-13-17	312	0.034 ± 0.004
06-21-17	320	0.019 ± 0.003	12-20-17	343	0.034 ± 0.004
06-28-17	323	0.016 ± 0.003	12-27-17	317	0.036 ± 0.004
			01-03-18	313	0.062 ± 0.005
2nd Quarter Mean ± s.d.		0.019 ± 0.005	4th Quarter Mean ± s.d.		0.034 ± 0.014
			Cumulative Average		0.028
			Previous Annual Average		0.026

[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
M-1(Control)	0.035	0.022	0.045
Indicators	0.037	0.021	0.051
M-2	0.035	0.022	0.046
M-3	0.041	0.023	0.051
M-4	0.035	0.021	0.043
M-5	0.038	0.022	0.051

February

Location	Average	Minima	Maxima
M-1(Control)	0.031	0.028	0.033
Indicators	0.030	0.026	0.035
M-2	0.029	0.026	0.031
M-3	0.032	0.030	0.035
M-4	0.027	0.026	0.029
M-5	0.031	0.028	0.035

March

Location	Average	Minima	Maxima
M-1(Control)	0.030	0.025	0.036
Indicators	0.028	0.022	0.034
M-2	0.025	0.022	0.028
M-3	0.030	0.025	0.032
M-4	0.028	0.025	0.032
M-5	0.030	0.024	0.034

April

Location	Average	Minima	Maxima
M-1(Control)	0.021	0.015	0.024
Indicators	0.019	0.012	0.027
M-2	0.019	0.012	0.024
M-3	0.020	0.014	0.027
M-4	0.019	0.013	0.023
M-5	0.019	0.015	0.022

May

Location	Average	Minima	Maxima
M-1(Control)	0.017	0.011	0.026
Indicators	0.016	0.010	0.027
M-2	0.015	0.010	0.021
M-3	0.018	0.011	0.027
M-4	0.015	0.010	0.021
M-5	0.017	0.011	0.023

June

Location	Average	Minima	Maxima
M-1(Control)	0.023	0.016	0.028
Indicators	0.021	0.013	0.027
M-2	0.022	0.013	0.025
M-3	0.018	0.016	0.023
M-4	0.021	0.014	0.026
M-5	0.022	0.016	0.027

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
M-1(Control)	0.022	0.019	0.025
Indicators	0.022	0.017	0.026
M-2	0.022	0.020	0.026
M-3	0.022	0.021	0.023
M-4	0.021	0.018	0.024
M-5	0.021	0.017	0.024

August

Location	Average	Minima	Maxima
M-1(Control)	0.021	0.017	0.023
Indicators	0.021	0.015	0.025
M-2	0.021	0.019	0.023
M-3	0.021	0.015	0.024
M-4	0.023	0.020	0.025
M-5	0.021	0.019	0.024

September

Location	Average	Minima	Maxima
M-1(Control)	0.034	0.023	0.043
Indicators	0.033	0.019	0.044
M-2	0.033	0.021	0.044
M-3	0.033	0.021	0.044
M-4	0.034	0.020	0.044
M-5	0.033	0.019	0.043

October

Location	Average	Minima	Maxima
M-1(Control)	0.023	0.012	0.028
Indicators	0.022	0.011	0.029
M-2	0.022	0.014	0.025
M-3	0.022	0.011	0.029
M-4	0.023	0.015	0.027
M-5	0.022	0.011	0.025

November

Location	Average	Minima	Maxima
M-1(Control)	0.041	0.024	0.059
Indicators	0.041	0.025	0.058
M-2	0.044	0.035	0.055
M-3	0.040	0.026	0.056
M-4	0.038	0.027	0.052
M-5	0.041	0.025	0.058

December

Location	Average	Minima	Maxima
M-1(Control)	0.042	0.030	0.073
Indicators	0.040	0.027	0.062
M-2	0.040	0.034	0.057
M-3	0.041	0.032	0.059
M-4	0.037	0.027	0.056
M-5	0.041	0.034	0.062

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- 1688	MAP- 3680	MAP- 5583	MAP- 6842		
Volume(m^3)	3853	4272	4329	4561		
Be-7	0.078 ± 0.013	0.107 ± 0.017	0.076 ± 0.011	0.058 ± 0.012	0.080	0.069
Mn-54	< 0.0005	< 0.0007	< 0.0004	< 0.0006	<0.0007	<0.0010
Co-58	< 0.0007	< 0.0007	< 0.0006	< 0.0009	<0.0007	<0.0008
Co-60	< 0.0008	< 0.0003	< 0.0003	< 0.0009	<0.0008	<0.0008
Zn-65	< 0.0016	< 0.0007	< 0.0006	< 0.0025	<0.0016	<0.0017
Zr-Nb-95	< 0.0009	< 0.0010	< 0.0006	< 0.0010	<0.0010	<0.0012
Ru-103	< 0.0008	< 0.0011	< 0.0010	< 0.0011	<0.0011	<0.0010
Ru-106	< 0.0033	< 0.0063	< 0.0058	< 0.0067	<0.0063	<0.0080
Cs-134	< 0.0009	< 0.0008	< 0.0007	< 0.0010	<0.0009	<0.0008
Cs-137	< 0.0009	< 0.0008	< 0.0006	< 0.0006	<0.0009	<0.0008
Ba-La-140	< 0.0017	< 0.0023	< 0.0015	< 0.0015	<0.0023	<0.0042
Ce-141	< 0.0019	< 0.0012	< 0.0012	< 0.0017	<0.0019	<0.0022
Ce-144	< 0.0051	< 0.0026	< 0.0032	< 0.0045	<0.0051	<0.0044
M-2						
Lab Code	MAP- 1689	MAP- 3681	MAP- 5584	MAP- 6843		
Volume(m^3)	4367	4651	4860	4747		
Be-7	0.067 ± 0.012	0.094 ± 0.014	0.085 ± 0.014	0.052 ± 0.011	0.074	0.073
Mn-54	< 0.0008	< 0.0006	< 0.0007	< 0.0005	<0.0008	<0.0010
Co-58	< 0.0005	< 0.0010	< 0.0004	< 0.0007	<0.0010	<0.0009
Co-60	< 0.0006	< 0.0006	< 0.0002	< 0.0006	<0.0006	<0.0009
Zn-65	< 0.0016	< 0.0006	< 0.0009	< 0.0004	<0.0016	<0.0020
Zr-Nb-95	< 0.0010	< 0.0008	< 0.0015	< 0.0006	<0.0015	<0.0013
Ru-103	< 0.0010	< 0.0008	< 0.0014	< 0.0006	<0.0014	<0.0012
Ru-106	< 0.0050	< 0.0032	< 0.0071	< 0.0051	<0.0071	<0.0081
Cs-134	< 0.0008	< 0.0007	< 0.0007	< 0.0006	<0.0008	<0.0011
Cs-137	< 0.0004	< 0.0004	< 0.0007	< 0.0004	<0.0007	<0.0009
Ba-La-140	< 0.0019	< 0.0015	< 0.0036	< 0.0010	<0.0036	<0.0046
Ce-141	< 0.0020	< 0.0012	< 0.0014	< 0.0012	<0.0020	<0.0022
Ce-144	< 0.0037	< 0.0031	< 0.0042	< 0.0028	<0.0042	<0.0047

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- 1690	MAP- 3682	MAP- 5585	MAP- 6844		
Volume(m^3)	4408	4068	4622	4701		
Be-7	0.073 ± 0.015	0.099 ± 0.015	0.071 ± 0.010	0.062 ± 0.012	0.076	0.081
Mn-54	< 0.0008	< 0.0008	< 0.0005	< 0.0006	<0.0008	<0.0007
Co-58	< 0.0006	< 0.0008	< 0.0006	< 0.0007	<0.0008	<0.0008
Co-60	< 0.0006	< 0.0005	< 0.0005	< 0.0006	<0.0006	<0.0008
Zn-65	< 0.0023	< 0.0006	< 0.0005	< 0.0008	<0.0023	<0.0018
Zr-Nb-95	< 0.0015	< 0.0006	< 0.0009	< 0.0012	<0.0015	<0.0012
Ru-103	< 0.0014	< 0.0012	< 0.0009	< 0.0010	<0.0014	<0.0012
Ru-106	< 0.0082	< 0.0071	< 0.0026	< 0.0044	<0.0082	<0.0064
Cs-134	< 0.0009	< 0.0006	< 0.0006	< 0.0007	<0.0009	<0.0008
Cs-137	< 0.0010	< 0.0007	< 0.0006	< 0.0007	<0.0010	<0.0006
Ba-La-140	< 0.0026	< 0.0021	< 0.0021	< 0.0018	<0.0026	<0.0044
Ce-141	< 0.0023	< 0.0015	< 0.0007	< 0.0011	<0.0023	<0.0020
Ce-144	< 0.0050	< 0.0042	< 0.0021	< 0.0047	<0.0050	<0.0041
M-4						
Lab Code	MAP- 1691	MAP- 3683	MAP- 5586	MAP- 6845		
Volume(m^3)	4489	4549	4549	4855		
Be-7	0.058 ± 0.011	0.096 ± 0.014	0.095 ± 0.016	0.056 ± 0.012	0.076	0.075
Mn-54	< 0.0006	< 0.0009	< 0.0005	< 0.0007	<0.0009	<0.0010
Co-58	< 0.0005	< 0.0007	< 0.0008	< 0.0005	<0.0008	<0.0006
Co-60	< 0.0003	< 0.0003	< 0.0009	< 0.0004	<0.0009	<0.0006
Zn-65	< 0.0009	< 0.0013	< 0.0011	< 0.0009	<0.0013	<0.0023
Zr-Nb-95	< 0.0013	< 0.0010	< 0.0011	< 0.0010	<0.0013	<0.0018
Ru-103	< 0.0009	< 0.0010	< 0.0010	< 0.0008	<0.0010	<0.0014
Ru-106	< 0.0059	< 0.0037	< 0.0072	< 0.0059	<0.0072	<0.0069
Cs-134	< 0.0007	< 0.0008	< 0.0008	< 0.0006	<0.0008	<0.0009
Cs-137	< 0.0006	< 0.0008	< 0.0004	< 0.0003	<0.0008	<0.0007
Ba-La-140	< 0.0014	< 0.0018	< 0.0023	< 0.0016	<0.0023	<0.0041
Ce-141	< 0.0013	< 0.0017	< 0.0015	< 0.0010	<0.0017	<0.0020
Ce-144	< 0.0041	< 0.0035	< 0.0025	< 0.0041	<0.0041	<0.0039

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- 1692	MAP- 3684	MAP- 5587	MAP- 6846		
Volume(m^3)	4206	4117	4600	4731		
Be-7	0.079 ± 0.015	0.103 ± 0.013	0.081 ± 0.016	0.062 ± 0.010	0.081	0.073
Mn-54	< 0.0005	< 0.0008	< 0.0007	< 0.0004	<0.0008	<0.0009
Co-58	< 0.0008	< 0.0006	< 0.0008	< 0.0004	<0.0008	<0.0012
Co-60	< 0.0006	< 0.0008	< 0.0004	< 0.0004	<0.0008	<0.0009
Zn-65	< 0.0011	< 0.0006	< 0.0005	< 0.0011	<0.0011	<0.0019
Zr-Nb-95	< 0.0012	< 0.0009	< 0.0006	< 0.0006	<0.0012	<0.0017
Ru-103	< 0.0011	< 0.0010	< 0.0013	< 0.0007	<0.0013	<0.0018
Ru-106	< 0.0053	< 0.0065	< 0.0048	< 0.0045	<0.0065	<0.0079
Cs-134	< 0.0007	< 0.0008	< 0.0008	< 0.0007	<0.0008	<0.0011
Cs-137	< 0.0005	< 0.0008	< 0.0009	< 0.0005	<0.0009	<0.0008
Ba-La-140	< 0.0023	< 0.0016	< 0.0019	< 0.0016	<0.0023	<0.0045
Ce-141	< 0.0010	< 0.0021	< 0.0021	< 0.0014	<0.0021	<0.0023
Ce-144	< 0.0029	< 0.0063	< 0.0046	< 0.0035	<0.0063	<0.0053

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	07-05-17	08-09-17	09-06-17		
Lab Code	MVE- 3250	MVE- 4087	MVE- 4559		
Mn-54	< 0.009	< 0.007	< 0.005	< 0.009	< 0.009
Fe-59	< 0.028	< 0.029	< 0.020	< 0.029	< 0.029
Co-58	< 0.011	< 0.012	< 0.006	< 0.012	< 0.012
Co-60	< 0.009	< 0.007	< 0.008	< 0.009	< 0.009
Zn-65	< 0.018	< 0.022	< 0.014	< 0.022	< 0.022
Nb-95	< 0.009	< 0.011	< 0.006	< 0.011	< 0.011
I-131	< 0.017	< 0.026	< 0.019	< 0.026	< 0.026
Cs-134	< 0.009	< 0.010	< 0.008	< 0.010	< 0.010
Cs-137	< 0.010	< 0.011	< 0.008	< 0.011	< 0.011
Location:	M-42 (Biology Station Road)				
Date Collected	07-05-17	08-09-17	09-06-17		
Lab Code	MVE- 3251	MVE- 4088	MVE- 4560		
Mn-54	< 0.012	< 0.012	< 0.006	< 0.012	< 0.011
Fe-59	< 0.016	< 0.023	< 0.011	< 0.023	< 0.022
Co-58	< 0.010	< 0.016	< 0.007	< 0.016	< 0.009
Co-60	< 0.005	< 0.016	< 0.005	< 0.016	< 0.008
Zn-65	< 0.015	< 0.026	< 0.017	< 0.026	< 0.024
Nb-95	< 0.013	< 0.017	< 0.011	< 0.017	< 0.013
I-131	< 0.023	< 0.028	< 0.013	< 0.028	< 0.043
Cs-134	< 0.012	< 0.014	< 0.006	< 0.014	< 0.012
Cs-137	< 0.010	< 0.014	< 0.008	< 0.014	< 0.013
Location:	M-43 (Imholte Farm, Control)				
Date Collected	07-05-17	08-09-17	09-06-17		
Lab Code	MVE- 3252	MVE- 4089	MVE- 4561		
Mn-54	< 0.008	< 0.014	< 0.008	< 0.014	< 0.008
Fe-59	< 0.020	< 0.035	< 0.013	< 0.035	< 0.018
Co-58	< 0.008	< 0.012	< 0.009	< 0.012	< 0.009
Co-60	< 0.005	< 0.014	< 0.011	< 0.014	< 0.007
Zn-65	< 0.010	< 0.020	< 0.020	< 0.020	< 0.020
Nb-95	< 0.008	< 0.019	< 0.011	< 0.019	< 0.013
I-131	< 0.017	< 0.023	< 0.015	< 0.023	< 0.034
Cs-134	< 0.009	< 0.017	< 0.012	< 0.017	< 0.013
Cs-137	< 0.010	< 0.017	< 0.008	< 0.017	< 0.014

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]	MSW-1079[b]	MSW-1414[c]	MSW-2274	MSW-2793
Mn-54	-	< 10	< 10	< 10	< 10
Fe-59	-	< 30	< 30	< 30	< 30
Co-58	-	< 10	< 10	< 10	< 10
Co-60	-	< 10	< 10	< 10	< 10
Zn-65	-	< 30	< 30	< 30	< 30
Zr-Nb-95	-	< 15	< 15	< 15	< 15
Cs-134	-	< 10	< 10	< 10	< 10
Cs-137	-	< 10	< 10	< 10	< 10
Ba-La-140	-	< 15	< 15	< 15	< 15
Ce-144	-	< 12	< 42	< 25	< 38
Period Collected	June	July	August	September	October
Lab Code	MSW-3297	MSW-4015	MSW-4590	MSW-5418	MSW-5874
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	< 27	< 22	< 33	< 21	< 20
Period Collected	November	December		Cumulative	Previous Annual
Lab Code	MSW-6441	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	< 24	-		< 42	< 31

[a] "NS" = No sample; see Table 2.0, Listing of Missed Samples.

[b] One sample for month (02-22-17); icy conditions 02-01, 02-08 and 02-15-17.

[c] March 15 sample was not available due to water being frozen.

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-444	MSW-1080	MSW-1415	MSW-2275	MSW-2794
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	< 19	< 10	< 20	< 28	< 39
Period Collected	June	July	August	September	October
Lab Code	MSW-3298	MSW-4016	MSW-4591	MSW-5419	MSW-5875
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	< 18	< 36	< 28	< 19	< 25
Period Collected	November	December		Cumulative	Previous Annual
Lab Code	MSW-6442	MSW-6661		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	< 17	< 35		< 39	< 35

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

Sample Description and Concentration (pCi/L)

Period Collected	January	February	March	April	May
Lab Code	MDW-538	MDW-981	MDW-1416	MDW-2040	MDW-2795
Gross beta	2.2 ± 0.9	1.3 ± 0.6	1.4 ± 0.6	1.3 ± 0.6	< 0.9
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	< 22	< 15	< 16	< 28	< 42

Period Collected	June	July	August	September	October
Lab Code	MDW-3294	MDW-4131	MDW-4772	MDW-5272	MDW-6067
Gross beta	1.4 ± 0.5	< 0.9	4.4 ± 0.8	2.2 ± 0.6	1.3 ± 0.5
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	< 27	< 18	< 22	< 21	< 38

Period Collected	November	December		Cumulative	Previous
Lab Code	MDW-6408	MDW-6768		Average	Average
Gross beta	1.4 ± 0.6	2.8 ± 0.7		2.0	2.5
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	< 18	< 22		< 42	< 28

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)		LLD	MDC
1st Quarter[a]	MSW - 1417	< 500	< 151
2nd Quarter	MSW - 3402	< 500	< 183
3rd Quarter	MSW - 5514	< 500	< 157
4th Quarter[b]	MSW - 6665	< 500	< 155
Cumulative Average		< 500	< 183
Previous Annual Average		< 500	< 150
River Water Downstream, M-9			
1st Quarter	MSW - 1418	< 500	< 151
2nd Quarter	MSW - 3403	< 500	< 183
3rd Quarter	MSW - 5515	< 500	< 157
4th Quarter	MSW - 6666	< 500	< 155
Cumulative Average		< 500	< 183
Previous Annual Average		< 500	< 150
Drinking Water Minneapolis, M-14			
1st Quarter	MDW - 1419	< 500	< 151
2nd Quarter	MDW - 3401	< 500	< 183
3rd Quarter	MDW - 5516	< 500	< 157
4th Quarter	MDW - 6769	< 500	< 152
Cumulative Average		< 500	< 183
Previous Annual Average		< 500	< 150

[a] Water frozen the month of January, first 3 weeks in February, and the week of March 15th.

[b] Water frozen during the entire month of December.

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)							
1/18/2017	MWW-233	< 179	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 15
4/19/2017	MWW-1794	< 153	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 22
7/20/2017	MWW-3744	< 151	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 24
10/18/2017	MWW-5669	< 154	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 26
Cumulative Averages		< 500	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 26
						Plant Well No. 1 (M-12)							
1/18/2017	MWW-234	< 179	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 23
4/19/2017	MWW-1795	< 153	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 21
7/20/2017	MWW-3745	< 151	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 22
10/18/2017	MWW-5670	< 154	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 38
Cumulative Averages		< 500	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 38
						Hasbrouck (M-55)							
1/18/2017	MWW-237	< 179	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 22
4/19/2017	MWW-1797	< 153	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 39
7/20/2017	MWW-3747	< 151	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 29
10/18/2017	MWW-5671	< 154	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 34
Cumulative Averages		< 500	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 39
						Imholte (M-43C)							
1/18/2017	MWW-235	< 179	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 24
4/19/2017	MWW-1796	< 153	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 14
7/20/2017	MWW-3746	< 151	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 18
10/18/2017	MWW-5672	< 154	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 25
Cumulative Averages		< 500	< 10	< 30	< 10	< 10	< 30	< 15	< 10	< 10	< 15	< 25

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

Sample Description and Concentration (pCi/g wet)

Upstream 1000' M-8 (C)

Date Collected	05-23-17	05-23-17	09-14-17	09-14-17
Lab Code	MF- 2433	MF- 2434	MF- 4828	MF- 4829
Sample Type	Smallmouth Bass	Shorthead Redhorse	Shorthead Redhorse	Smallmouth Bass
K-40	2.78 ± 0.47	2.74 ± 0.43	3.08 ± 0.43	2.80 ± 0.48
Mn-54	< 0.010	< 0.014	< 0.016	< 0.017
Fe-59	< 0.048	< 0.065	< 0.059	< 0.052
Co-58	< 0.023	< 0.015	< 0.014	< 0.020
Co-60	< 0.020	< 0.014	< 0.014	< 0.017
Zn-65	< 0.023	< 0.023	< 0.025	< 0.032
Nb-95	< 0.028	< 0.021	< 0.033	< 0.025
Zr-95	< 0.028	< 0.037	< 0.029	< 0.035
Cs-134	< 0.020	< 0.020	< 0.016	< 0.013
Cs-137	< 0.013	< 0.018	< 0.013	< 0.012
Ba-La-140	< 0.084	< 0.071	< 0.161	< 0.105
Ce-144	< 0.081	< 0.110	< 0.078	< 0.089

	Cumulative Average	Previous Average
K-40	2.85	3.28
Mn-54	< 0.017	< 0.025
Fe-59	< 0.065	< 0.070
Co-58	< 0.023	< 0.024
Co-60	< 0.020	< 0.017
Zn-65	< 0.032	< 0.070
Nb-95	< 0.033	< 0.037
Zr-95	< 0.037	< 0.053
Cs-134	< 0.020	< 0.025
Cs-137	< 0.018	< 0.025
Ba-La-140	< 0.161	< 0.112
Ce-144	< 0.110	< 0.158

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

Sample Description and Concentration (pCi/g wet)

	Downstream 1000' M-9			
Date Collected	05-23-17	05-23-17	09-14-17	09-14-17
Lab Code	MF- 2435	MF- 2436	MF- 4830	MF- 4831
Sample Type	Shorthead Redhorse	Smallmouth Bass	Shorthead Redhorse	Shorthead Redhorse
K-40	2.34 ± 0.43	2.74 ± 0.47	2.99 ± 0.36	3.26 ± 0.46
Mn-54	< 0.015	< 0.015	< 0.014	< 0.015
Fe-59	< 0.038	< 0.030	< 0.044	< 0.045
Co-58	< 0.020	< 0.023	< 0.016	< 0.019
Co-60	< 0.014	< 0.020	< 0.013	< 0.014
Zn-65	< 0.021	< 0.038	< 0.016	< 0.030
Nb-95	< 0.028	< 0.034	< 0.019	< 0.030
Zr-95	< 0.031	< 0.032	< 0.018	< 0.036
Cs-134	< 0.019	< 0.019	< 0.015	< 0.019
Cs-137	< 0.012	< 0.011	< 0.009	< 0.014
Ba-La-140	< 0.094	< 0.099	< 0.080	< 0.104
Ce-144	< 0.073	< 0.094	< 0.073	< 0.094

	Cumulative Average	Previous Average
K-40	2.83	3.35
Mn-54	< 0.015	< 0.016
Fe-59	< 0.045	< 0.053
Co-58	< 0.023	< 0.030
Co-60	< 0.020	< 0.017
Zn-65	< 0.038	< 0.033
Nb-95	< 0.034	< 0.034
Zr-95	< 0.036	< 0.048
Cs-134	< 0.019	< 0.021
Cs-137	< 0.014	< 0.017
Ba-La-140	< 0.104	< 0.083
Ce-144	< 0.094	< 0.145

Table 15. Aquatic invertebrates, 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	06-27-17	09-12-17		
Lab Code	ND[a]	ND[a]		
Be-7				< 0.57
K-40				< 0.84
Mn-54				< 0.024
Fe-59				< 0.13
Co-58				< 0.068
Co-60				< 0.052
Zn-65				< 0.094
Zr-Nb-95				< 0.064
Ru-103				< 0.075
Ru-106				< 0.39
Cs-134				< 0.040
Cs-137				< 0.049
Ba-La-140				< 0.41
Ce-144				< 0.20
	Downstream 1000' M-9			
Date Collected	06-27-17	09-12-17		
Lab Code	MBO- 3122	MBO- 4654		
Be-7	< 0.61	< 1.27	< 1.27	< 0.55
K-40	< 1.58	< 2.23	< 2.23	< 0.91
Mn-54	< 0.065	< 0.097	< 0.097	< 0.046
Fe-59	< 0.14	< 0.30	< 0.30	< 0.13
Co-58	< 0.067	< 0.076	< 0.076	< 0.046
Co-60	< 0.064	< 0.096	< 0.096	< 0.041
Zn-65	< 0.10	< 0.22	< 0.22	< 0.077
Zr-Nb-95	< 0.083	< 0.22	< 0.22	< 0.067
Ru-103	< 0.055	< 0.18	< 0.18	< 0.070
Ru-106	< 0.56	< 0.76	< 0.76	< 0.38
Cs-134	< 0.059	< 0.11	< 0.11	< 0.041
Cs-137	< 0.053	< 0.13	< 0.13	< 0.040
Ba-La-140	< 0.22	< 0.54	< 0.54	< 0.22
Ce-144	< 0.24	< 0.45	< 0.45	< 0.24

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

Table 16. 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	06-27-17	09-12-17		
Lab Code	MSS- 3119	MSS- 4650		
Be-7	< 0.10	< 0.13	< 0.13	< 0.26
K-40	11.24 ± 0.57	10.41 ± 0.54	10.82	9.90
Mn-54	< 0.013	< 0.011	< 0.013	< 0.016
Fe-59	< 0.033	< 0.042	< 0.042	< 0.043
Co-58	< 0.018	< 0.015	< 0.018	< 0.020
Co-60	< 0.014	< 0.012	< 0.014	< 0.015
Zn-65	< 0.032	< 0.041	< 0.041	< 0.037
Nb-95	< 0.017	< 0.022	< 0.022	< 0.023
Zr-95	< 0.025	< 0.030	< 0.030	< 0.047
Ru-103	< 0.011	< 0.016	< 0.016	< 0.030
Ru-106	< 0.089	< 0.079	< 0.089	< 0.13
Cs-134	< 0.014	< 0.012	< 0.014	< 0.012
Cs-137	< 0.012	< 0.012	< 0.012	< 0.017
Ba-La-140	< 0.052	< 0.069	< 0.069	<0.09
Ce-144	< 0.077	< 0.070	< 0.077	<0.08
	Downstream 1000' M-9			
Date Collected	06-27-17	09-12-17		
Lab Code	MSS- 3120	MSS- 4652		
Be-7	< 0.13	< 0.15	< 0.15	< 0.18
K-40	10.58 ± 0.57	9.93 ± 0.55	10.25	10.28
Mn-54	< 0.016	< 0.010	< 0.016	< 0.014
Fe-59	< 0.038	< 0.041	< 0.041	< 0.054
Co-58	< 0.018	< 0.014	< 0.018	< 0.023
Co-60	< 0.012	< 0.014	< 0.014	< 0.013
Zn-65	< 0.033	< 0.037	< 0.037	< 0.031
Nb-95	< 0.024	< 0.021	< 0.024	< 0.032
Zr-95	< 0.026	< 0.033	< 0.033	< 0.023
Ru-103	< 0.014	< 0.016	< 0.016	< 0.025
Ru-106	< 0.12	< 0.10	< 0.12	< 0.12
Cs-134	< 0.015	< 0.016	< 0.016	< 0.010
Cs-137	0.045 ± 0.017	0.038 ± 0.017	0.042	0.030
Ba-La-140	< 0.043	< 0.091	< 0.091	< 0.12
Ce-144	< 0.073	< 0.077	< 0.077	< 0.11

Table 16. Shoreline (SS) sediments, analysis for gamma-emitting isotopes (continued).

Sample Description and Concentration (pCi/g dry)			Cumulative Average	Previous Average
	Montissippi Park M-15			
Date Collected	06-27-17	09-12-17		
Lab Code	MSS- 3121	MSS- 4653		
Be-7	< 0.11	< 0.13	< 0.13	< 0.28
K-40	9.89 ± 0.57	9.49 ± 0.55	9.69	10.27
Mn-54	< 0.018	< 0.015	< 0.018	< 0.017
Fe-59	< 0.034	< 0.042	< 0.042	< 0.046
Co-58	< 0.010	< 0.017	< 0.017	< 0.020
Co-60	< 0.012	< 0.015	< 0.015	< 0.008
Zn-65	< 0.032	< 0.032	< 0.032	< 0.044
Nb-95	< 0.018	< 0.027	< 0.027	< 0.020
Zr-95	< 0.025	< 0.034	< 0.034	< 0.025
Ru-103	< 0.014	< 0.019	< 0.019	< 0.018
Ru-106	< 0.097	< 0.12	< 0.12	< 0.16
Cs-134	< 0.013	< 0.012	< 0.013	< 0.014
Cs-137	0.030 ± 0.014	0.034 ± 0.016	0.032	< 0.019
Ba-La-140	< 0.064	< 0.16	< 0.16	< 0.10
Ce-144	< 0.071	< 0.082	< 0.082	< 0.12