Xcel Energy®

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5/13/2021

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10 CFR 50, Appendix I

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

2020 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 2020.

Summary of Commitments

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

Kevin J. Nyberg – Kevin Nyberg for Tom Conboy Per telecon

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

Enclosure

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

ENCLOSURE

RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
JANUARY 1 – DECEMBER 31, 2020

2020 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT (AREOR)

Monticello Nuclear Generating Plant

Last Updated: 5/10/2021

2020 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

Monticello Nuclear Generating Plant

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CONTENTS

TABLES

DATA TABLES

FIGURES

EQUATIONS

APPENDICES

ACRYONYMS AND ABBREVIATIONS

AREOR	Annual Radiological Environmental Operating Report
BTP	Radiological Assessment Branch Technical Position, Rev. 1, on Radiological Monitoring
CFR	Code of Federal Regulations
d/b/a	doing business as
D/Q	deposition coefficient
E	East
EDC	Environmental Dosimetry Company
ENE	East-Northeast
ESE	East-Southeast
ft	feet
ft^2	square feet
GEL	General Engineering Laboratories LLC
GPS	Global Positioning System
ISFSI	Independent Spent Fuel Storage Installation
LLD	lower limit of detection
MDA	minimum detectable activity
mi	mile
MNGP	Monticello Nuclear Generating Plant
MOC	Management of Change
mrem	millirem
MWe	megawatt electric
N	North
NE	Northeast
NIST	National Institute of Standards and Technology
NNE	North-Northeast
NNW	North-Northwest
NRC	Nuclear Regulatory Commission
NW	Northwest
OCA	owner-controlled area

ODCM	Offsite Dose Calculation Manual
pCi/g	picocurie per gram
pCi/L	picocurie per liter
pCi/kg	picocurie per kilogram
pCi/m^3	picocurie per cubic meter
REMP	Radiological Environmental Monitoring Program
S	South
SE	Southeast
SSE	South-Southeast
std quarter	Standard quarter, 91 days
SSW	South-Southwest
SW	Southwest
TLD	thermoluminescent dosimeter
UFSAR	Updated Final Safety Analysis Report
USB	Universal Serial Bus
W	West
WNW	West-Northwest
WSW	West-Southwest

REFERENCES

Arnold, J.R., and H.A. Al-Salih. 1955. Beryllium-7 Produced by Cosmic Rays. *Science*. April 121(3144): 451-453.

MNGP Chemistry Manual, Procedure I.05.41, “Annual Land Use Census and Critical Receptor Identification”.

NRC Generic Letter 79-65 Radiological Environmental Monitoring Program Requirements Enclosing Branch Technical Position (BTP), Revision 1, November 1979.

NUREG 1302 Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Boiling Water Reactors, April 1991

Offsite Dose Calculation Manual (ODCM) 07.01 Monticello Nuclear Generating Plant, Revision 26.

Regulatory Guide 4.15 Quality Assurance for Radiological Monitoring Programs, Revision 1, 1979.

EXECUTIVE SUMMARY

This 2020 Annual Radiological Environmental Operating Report (AREOR) describes the Monticello Nuclear Generating Plant (MNGP) Radiological Environmental Monitoring Program (REMP) and program results for the 2020 calendar year[1]. MNGP is operated by Northern States Power Company, a Minnesota corporation, d/b/a Xcel Energy (Xcel) under a license granted by the U.S. Nuclear Regulatory Commission (NRC).

Provisions of NRC's NUREG-1302, NRC Generic Letter 79-65 Branch Technical Position, MNGP Technical Specifications, and MNGP's Offsite Dose Calculation Manual (ODCM) establish the requirements of the REMP. This AREOR describes the purpose and scope of MNGP's REMP, along with the monitoring and sampling results for the reporting period.

AREOR Contents

This AREOR includes the following:

- Identification of sampling locations
- Descriptions of environmental sampling and analysis procedures
- Comparisons of present environmental radioactivity levels and historical environmental data
- Analyses of trends in environmental radiological data as potentially affected by MNGP operations
- A summary of environmental radiological sampling results
- Quality assurance practices, sampling deviations, unavailable samples, and program changes

Photo Credit: Daniel Thurston, Chemistry Supervisor, MNGP

Plant Stack, used for dispersing treated gaseous effluents, Monticello Nuclear Generating Plant in Winter

Summary of Activities and Results

Sampling activities were conducted as prescribed by MNGP's ODCM. Required analyses were performed and detection capabilities were met for the collected samples required by the ODCM. To compile data for this AREOR, 844 samples were analyzed, yielding 1,961 test results. Based on the annual MNGP Land Use Census, the current number of sampling sites for MNGP is sufficient. Concentrations observed in the environment in 2020 for MNGP-related radionuclides were within the ranges of concentrations observed in the past. The continued operation of MNGP has not contributed measurable radiation to the environment.

[1] Some of the composite samples corresponding to Quarter 4 and December 2020 extended to January 4th 2021.

1 INTRODUCTION

Welcome to Monticello Nuclear Generating Plant

The Radiological Environmental Monitoring Program (REMP) for the Monticello Nuclear Generating Plant (MNGP),[2] located in Monticello, Minnesota, provides data on measurable levels of radiation and radioactive materials in the area surrounding the Site[3] and evaluates the relationship between quantities of radioactive materials released from MNGP and the resultant doses to individuals from principal pathways of exposure. At any given nuclear utility in the United States, REMPs are designed to provide a check on a nuclear utility's Effluent Release Program[4] and dispersion modeling to ensure that radioactive effluent concentrations in the air, terrestrial, and aquatic environments conform to the "As Low As Reasonably Achievable" (ALARA) design objectives of Appendix I of Chapter 10 of the Code of Federal Regulations (CFR) Part 50.

This 2020 Annual Radiological Environmental Operating Report (AREOR) has been prepared by Arcadis U.S., Inc. and presents a summary of the environmental data from exposure pathways, interpretations of that data, along with analyses and trends of the results covering the 2020 calendar year[5].

[2] In this document, a distinction is made between "MNGP," "Site," and "Plant." "MNGP" is the name of the facility. "Site" refers to the entire areal extent of MNGP's property, including the uncontrolled and controlled areas. "Plant" refers to the controlled area. The REMP involves monitoring and sampling at various locations across the Site and offsite locations.

[3] Referred to as the Site "environs."

[4] The Effluent Release Program is separate but related to the REMP. Both are required by federal regulations.

[5] Some of the composite samples corresponding to Quarter 4 and December 2020 extended to January 4th 2021.

Figure 1.0-1[6] below illustrates various exposure pathways[7] for receptors.[8] Routinely monitored pathways include ingestion, inhalation, and direct radiation. Exposure pathways are based on Site-specific information, such as the locations and habitats of receptors, the ages of those receptors, and the distance and relationship of those receptors with respect to release points and water usage around MNGP. A Site-specific REMP has been developed and maintained in accordance with MNGP's Offsite Dose Calculation Manual (ODCM), NUREG-1302, and the Branch Technical Position on Radiological Environmental Monitoring.

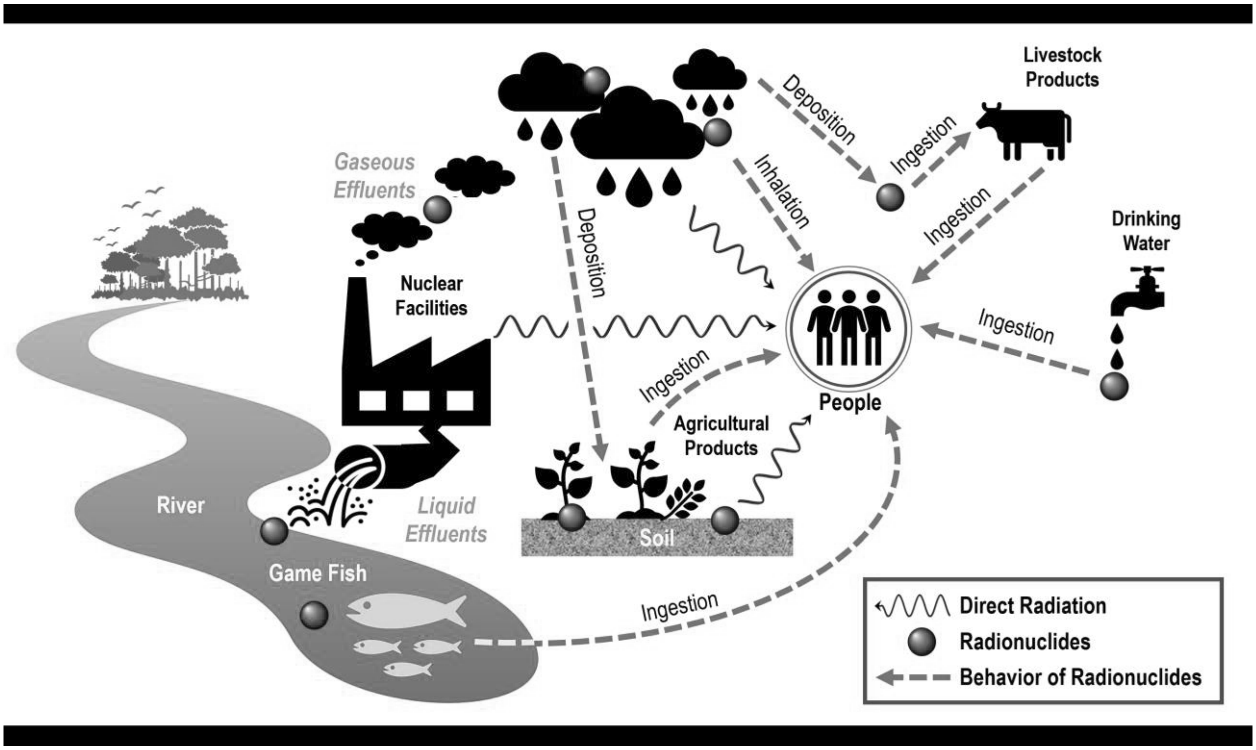

Figure 1.0-1 Monitored Potential Exposure Pathways.

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[6] Image Credit: Jesse R. Toepfer, © 2020.

[7] An exposure pathway describes the route of the radiological exposure from a source. The primary radiological emissions from the Site are airborne discharges. The following pathways are monitored as part of MNGP's REMP: external dose, ingestion of radioactive material, and inhalation of radioactive material.

[8] Living things that can be affected by radioactive effluent releases are referred to as environmental "receptors."

1.1 Site Description and Sample Locations

1.1.1 Site Description

Located in Wright County, Minnesota, MNGP is located along the Mississippi River and is about 40 miles northwest of the Twin Cities of Minneapolis and St. Paul. MNGP generates commercial electrical power via a boiling water reactor with a nominal generating capacity of 681 megawatts electric (MWe). Commercial production was initiated on June 30, 1971.

1.1.2 Rationale for Sample Locations

The REMP was established to assess the exposure pathways to humans. Specific methods and different environmental media are required to assess each pathway. Sampling locations for the Site are chosen based upon meteorological factors, preoperational monitoring, and results of the land use surveys. A number of sample points are selected as control locations because they are distant enough to preclude any MNGP effect, and thus, unaffected by Site operations. MNGP's REMP sampling locations and the TLD monitoring locations are discussed in Section 2 of this AREOR.

1.2 Scope and Requirements of the REMP

MNGP's REMP is based on U.S. Nuclear Regulatory Commission (NRC) guidance, is conducted in accordance with MNGP's ODCM, and is furthermore guided by applicable procedures for sample media, sampling locations, sampling frequency, and analytical sensitivity requirements. Indicator and control locations were established for comparison purposes to distinguish radioactivity originating from the Plant versus that from natural or other anthropogenic[9] sources. This program provides for surveillance of appropriate critical exposure pathways to man, protects vital interests of members of the public, and is intended to satisfy compliance with state and federal environmental agencies. Section 3 lists the reporting levels and sample collection frequency for detection of radioactivity in the environment.

[9] An "anthropogenic" source refers to radioactivity from a manmade substance, as well as radioactivity from natural sources that would not otherwise normally be present in the environment either in an amount, concentration, and/or at a specified rate, without human intervention.

Blooming Trees at Monticello Nuclear Generating Plant

The Annual Land Use Census, required by MNGP's ODCM, is performed to ensure changes in the use of areas at or beyond the Site boundary are identified and that appropriate modifications to the REMP are made if necessary. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR 50. Results are described in Section 5 of this document.

In addition, participation in an interlaboratory comparison program is performed in fulfillment of MNGP's ODCM operational requirements. The comparison program provides for independent checks on the precision and accuracy of measurements of radioactive material in REMP sample matrices. These checks are performed as part of the quality assurance (QA) program for environmental monitoring to demonstrate that the results are valid for the purposes of Section IV.B.2 of Appendix I to 10 CFR Part 50 and Regulatory Guide 4.15 "Quality Assurance for Radiological Environmental Monitoring Programs." Appendix A of this 2020 AREOR summarizes the results obtained as part of this comparison program.

2 RADIOLOGICAL ENVIRONMENTAL SAMPLING PROGRAM REQUIREMENTS

Figures 2.2-1 through 2.2-5 depict MNGP's REMP sampling locations and the TLD monitoring locations. The location numbers shown on these maps correspond to those listed in Tables 2.1-2 through 2.1-4. Guidance for the format and layout of these tables and figures is derived from MNGP's ODCM.

2.1 Exposure Pathway and Sample Locations

Table 2.1-1 below presents the sample frequency and collection, analysis type, and number of samples versus their locations for airborne radioiodine and particulates.

Table 2.1-1: Monticello Nuclear Generating Plant Radiological Environmental Monitoring Program Sample Collection and Analysis: Airborne (ODCM 07.01 Table 1)

Exposure Pathway and/or Sample	Number of Samples and Sample Locations**	Sampling and Collection Frequency	Type and Frequency of Analysis
1. Airborne Radioiodine & Particulates	Samples from five locations: three samples from offsite locations (in different sectors) of the highest calculated annual average ground level D/Q, one sample from the vicinity of a community having the highest calculated annual average ground-level D/Q, and one sample from a control location specified in Table 2.1-5.	Continuous sampler operation with sample collection weekly.	Radioiodine analysis Weekly for I-131 Particulate: Gross beta activity on each filter weekly* Analysis **SHALL** be performed more than 24 hours following filter change. Perform gamma isotopic analysis on composite (by location) sample quarterly.

Notes:

* If gross beta activity in any indication sample exceeds 10 times the yearly average of the control sample, a gamma isotopic analysis is required.

** Sample locations are further described in Table 2.1-5.

Table 2.1-2 below presents the sample frequency and collection, analysis type, and number of samples versus their locations for direct radiation.

Table 2.1-2: Monticello Nuclear Generating Plant Radiological Environmental Monitoring Program Sample Collection and Analysis: Direct Radiation (ODCM 07.01 Table 1)

Exposure Pathway and/or Sample	Number of Samples and Sample Locations**	Sampling and Collection Frequency	Type and Frequency of Analysis
2. Direct Radiation	40 TLD stations established with duplicate dosimeters placed at the following locations:**** 1. Using the 16 meteorological sectors as guidelines, an inner ring of stations in the general area of the site boundary is established and an outer ring of stations at a distance of 4 to 5 miles distance from the plant site is established. Because of inaccessibility, two sectors in the inner ring are not covered. 2. Ten dosimeters are established at special interest areas and four control stations. 3. Three neutron and gamma dosimeter sets are located along the OCA fence. Additionally, three neutron dosimeters are stationed with special interest and inner ring TLDs and four neutron control dosimeters are stationed with the REMP control TLDs.	Quarterly	Gamma/Neutron Dose quarterly

Notes:
** Sample locations are further described in Table 2.1-5.
**** Three control TLD locations have only one dosimeter.

Table 2.1-3 below presents the sample frequency and collection, analysis type, and number of samples versus their locations for waterborne pathways.

Table 2.1-3: Monticello Nuclear Generating Plant Radiological Environmental Monitoring Program Sample Collection and Analysis: Waterborne (ODCM 07.01 Table 1)

Exposure Pathway and/or Sample	Number of Samples and Sample Locations**	Sampling and Collection Frequency	Type and Frequency of Analysis
3. Waterborne			
a. Surface Water	Upstream and downstream locations	Monthly composite of weekly samples (water and ice conditions permitting)	Gamma Isotopic analysis of each monthly composite Tritium analysis of quarterly composites of monthly composites
b. Groundwater	Three samples from wells within 5 miles of the MNGP and one sample from a well greater than 10 miles from the MNGP	Quarterly	Gamma Isotopic and tritium analyses of each sample
c. Drinking Water	One sample from the City of Minneapolis water supply	Composite of 2 weekly samples when I-131 analysis is performed; monthly composite of weekly samples otherwise	I-131 analysis on each bi-weekly composite when the dose calculated for the consumption of the water is greater than 1 millirem (mrem) per year# Composite for gross beta and gamma isotopic analyses monthly Composite for tritium analysis quarterly
d. Sediment from Shoreline	One sample upstream of the MNGP, one sample downstream of the MNGP, and one sample from the shoreline of the recreational area	Semiannually	Gamma isotopic analysis of each sample

Notes:

The dose shall be calculated for the maximum organ and age group, using the methodology and parameters in the ODCM.

** Sample locations are further described in Table 2.1-5.

Table 2.1-4 below presents the sample frequency and collection, analysis type, and number of samples versus their locations for ingestion pathways.

Table 2.1-4: Monticello Nuclear Generating Plant Radiological Environmental Monitoring Program Sample Collection and Analysis: Ingestion (ODCM 07.01 Table 1)

Exposure Pathway and/or Sample	Number of Samples and Sample Locations**	Sampling and Collection Frequency	Type and Frequency of Analysis
4. Ingestion			
a. Milk	Samples from milking animals in three locations within 3 miles from the MNGP having the highest dose potential; if there are none, then one sample from milking animals in each of three areas between 3 to 5 miles from the MNGP where doses are calculated to be greater than 1 mrem per year# One sample from milking animals at a control location, 10 to 20 miles from the MNGP and in the least prevalent wind direction	Biweekly when animals are on pasture; monthly at other times	Gamma Isotopic and Iodine-131 analysis of each sample
b. Vegetation	Samples of vegetation grown closest to each of the two offsite locations of highest predicted annual average D/Q if milk sampling is not performed, and one sample from 10 to 20 miles in the least prevalent wind direction	Monthly during growing season	Gamma Isotopic and Iodine-131 analysis of each sample
c. Fish	One sample of one game species of fish located upstream and downstream of the MNGP	Samples collected semi-annually	Gamma isotopic analysis on each sample (edible portion only on fish)
d. Food Products	One sample of corn and potatoes from any area that is irrigated by water in which liquid radioactive effluent has been discharged***	At time of harvest	Gamma isotopic analysis of edible portion of each sample

Notes:

** Sample locations are further described in Table 2.1-5.

*** As determined by methods outlined in Section 2.3 of the ODCM 07.01.

The dose shall be calculated for the maximum organ and age group, using the methodology and parameters in the ODCM.

Table 2.1-5 below presents the location, code designation, and referenced collection site for a given sample type.

Table 2.1-5: Monticello Nuclear Generating Plant Radiological Environmental Monitoring Program Sample Collection and Analysis (ODCM 07.01 Table 4)

Type of Sample	Code	Collection Site	Location		
			Distance Miles	Compass Heading	Sector
River water	M-8c	Upstream of Plant	within 1,000 ft upstream of Plant intake		
River water	M-9	Downstream of Plant	within 1,000 ft downstream of Plant discharge		
Drinking water	M-14	City of Minneapolis	37.0	132	SE
Groundwater	M-43c	Imholte Farm	12.3	313	NW
Groundwater	M-11	City of Monticello	3.3	127	SE
Groundwater	M-12	Plant Well No. 11	0.26	252	WSW
Groundwater	M-55	Hasbrouck Residence	1.60	255	WSW
Sediment-River	M-8c	Upstream of Plant	within 1,000 ft upstream of Plant intake		
Sediment-River	M-9	Downstream of Plant	within 1,000 ft downstream of Plant discharge		
Sediment-Shoreline	M-15	Montissippi Park	1.27	114	ESE
Fish	M-8c	Upstream of Plant	within 1,000 ft upstream of Plant intake		
Fish	M-9	Downstream of Plant	within 1,000 ft downstream of Plant discharge		
Vegetation*	M-41	Training Center	Near 0.8	151	SSE
Vegetation*	M-42**	Biology Station Road	Near 0.7	136	SE
	M-42A**		Near 0.7	108	ESE
Vegetation*	M-43c	Imholte Farm	Near 12.3	313	NW
Cultivated Crops					
(corn)***	-	-			
(potatoes)***	-	-			

Notes:

* Actual location for vegetation sampling may vary depending on availability of broad leaf plant species. The nearest available broad leaf specimens to the location should be used.

** M-42 is the preferred sampling location; however, M-42A may be used in place of M-42, if samples are not available at the preferred location.

*** Collected only if Plant discharges radioactive effluent into the river, then only from river irrigated fields. (See Section 2.1 of the ODCM 07.01)

Code letters are defined below:

A = Locations in the general area of the site boundary

c = Locations of control samples (used for control air sampler and water control sample)

Table 2.1-5: Monticello Nuclear Generating Plant Radiological Environmental Monitoring Program Sample Collection and Analysis (ODCM 07.01 Table 4) (Continued)

Type of Sample	Code	Collection Site	Location		
			Distance Miles	Compass Heading	Sector
Particulates and Radioiodine					
(air)	M-1c	Air Station M-1	11.0	307	NW
(air)	M-2	Air Station M-2	0.8	140	SE
(air)	M-3	Air Station M-3	0.6	104	ESE
(air)	M-4	Air Station M-4	0.8	147	SSE
(air)	M-5	Air Station M-5	2.6	134	SE
Direct Radiation Inner Ring - (general area of the site boundary)					
(TLD)	M01A	Sherburne Ave. So.	0.75	353	N
(TLD)	M02A	Sherburne Ave. So.	0.79	23	NNE
(TLD)	M03A	Sherburne Ave. So.	1.29	56	NE
(TLD)	M04A	Biology Station Rd.	0.5	92	E
(TLD)	M05A	Biology Station Rd.	0.48	122	ESE
(TLD)	M06A	Biology Station Rd.	0.54	138	SE
(TLD)	M07A	Parking Lot H	0.43	157	SSE
(TLD)	M08A	Parking Lot F	0.45	175	S
(TLD)	M09A	County Road 75	0.38	206	SSW
(TLD)	M10A & ISFSI-15 (neutron)	County Road 75	0.38	224	SW
(TLD)	M11A	County Road 75	0.4	237	WSW
(TLD)	M12A & ISFSI-14 (neutron)	County Road 75	0.5	262	W
(TLD)	M13A	North Boundary Rd.	0.89	322	NW
(TLD)	M14A	North Boundary Rd.	0.78	335	NNW

Notes:

Code letters are defined below:

A = Locations in the general area of the site boundary

C = Locations of control samples (used for control air sampler and water control sample)

Table 2.1-5: Monticello Nuclear Generating Plant Radiological Environmental Monitoring Program Sample Collection and Analysis (ODCM 07.01 Table 4) (Continued)

Type of Sample	Code	Collection Site	Location Distance Miles	Location Compass Heading	Location Sector
Direct Radiation Outer Ring - (about 4 to 5 miles distant from the Plant)					
(TLD)	M01B	117th Street	4.65	1	N
(TLD)	M02B	County Road 11	4.4	18	NNE
(TLD)	M03B	County Rd. 73 & 81	4.3	51	NE
(TLD)	M04B	County Rd. 73 (196th Street)	4.2	67	ENE
(TLD)	M05B	City of Big Lake	4.3	89	E
(TLD)	M06B	County Rd 14 & 196th Street	4.3	117	ESE
(TLD)	M07B	Monticello Industrial Dr.	4.3	136	SE
(TLD)	M08B	Residence Hwy 25 & Davidson Ave	4.6	162	SSE
(TLD)	M09B	Weinand Farm	4.7	178	S
(TLD)	M10B	Reisewitz Farm - Acacia Ave	4.2	204	SSW
(TLD)	M11B	Vanlith Farm - 97th Ave	4.0	228	SW
(TLD)	M12B	Lake Maria St. Park	4.2	254	WSW
(TLD)	M13B	Bridgewater Sta.	4.1	270	W
(TLD)	M14B	Anderson Res. - Cty Rd 111	4.3	289	WNW
(TLD)	M15B	Red Oak Wild Bird Farm	4.3	309	NW
(TLD)	M16B	University Ave and Hancock St, Becker	4.4	341	NNW

Notes:

Code letters are defined below:

B = Locations about 4 to 5 miles distant from MNGP

Table 2.1-5: Monticello Nuclear Generating Plant Radiological Environmental Monitoring Program Sample Collection and Analysis (ODCM 07.01 Table 4) (Continued)

Type of Sample	Code	Collection Site	Location		
			Distance Miles	Compass Heading	Sector
Direct Radiation - (special interest locations)					
(TLD)	M01S	127th Street NE	0.66	241	WSW
(TLD)	M02S & ISFSI-16 (neutron)	Krone Residence	0.5	220	SW
(TLD)	M03S	Big Oaks Park	1.53	103	ESE
(TLD)	M04S	Pinewood School	2.3	131	SE
(TLD)	M05S	20500 Co. Rd 11, Big Lake	3.0	118	ESE
(TLD)	M06S	Monticello Public Works	2.6	134	SE
(TLD)	I-11 & ISFSI-11 (neutron)	OCA Fence South, on exit road	0.31	222	SW
(TLD)	I-12 & ISFSI-12 (neutron)	OCA Fence Middle, on exit road	0.32	230	SW
(TLD)	I-13 & ISFSI-13 (neutron)	OCA Fence North, on exit road	0.34	240	WSW
Direct Radiation Controls - (10 to 12 miles distant from Plant)					
(TLD)	M01C & Neutron Control D	Kirchenbauer Farm	11.5	323	NW
(TLD)	M02C & Neutron Control C	Cty Rd 4 & 15	11.2	47	NE
(TLD)	M03C & Neutron Control A	Cty Rd 19 & Jason Ave	11.6	130	SE
(TLD)	M04C & Neutron Control B	Maple Lake Water Tower	10.3	226	SW

Notes:

Code letters are defined below:

A = Locations in the general area of the site boundary

B = Locations about 4 to 5 miles distant from MNGP

C = Locations of control samples (used for control air sampler and water control sample)

S = Special interest locations

2.2 Maps of Sample Locations

Figure 2.2-1 below illustrates the sampling locations associated with surface water, well water, air, and vegetation.

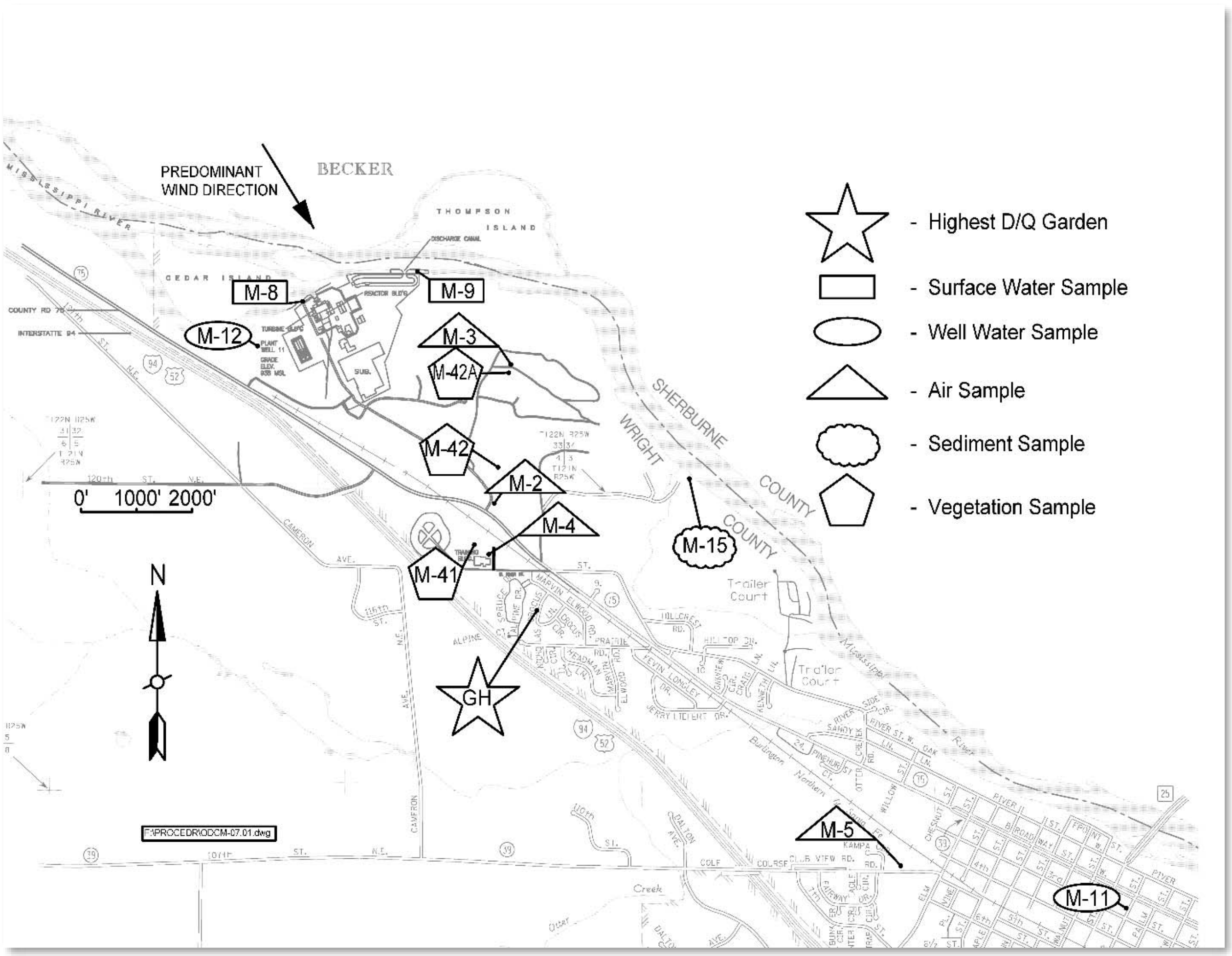

Figure 2.2-1: Radiation Environmental Monitoring Program (ODCM 07.01 Figure 1)

Figure 2.2-2 below illustrates the locations of the 4- to 5-mile ring and special interest TLD monitoring stations.

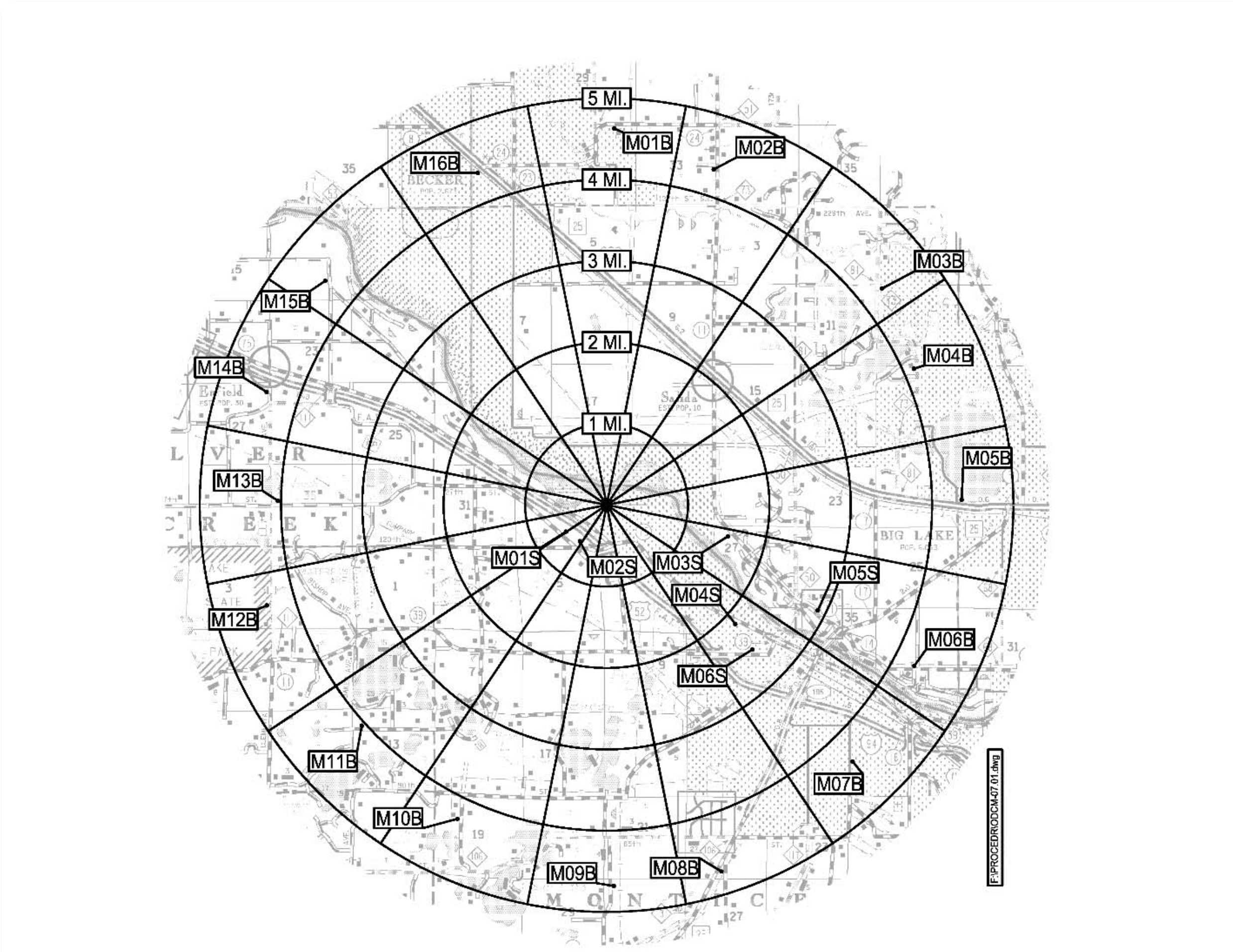

Figure 2.2-2: 4 – 5 Mile Ring and Special Interest TLD Locations (ODCM 07.01 Figure 2)

Figure 2.2-3 below illustrates the locations of site boundary TLD monitoring stations.

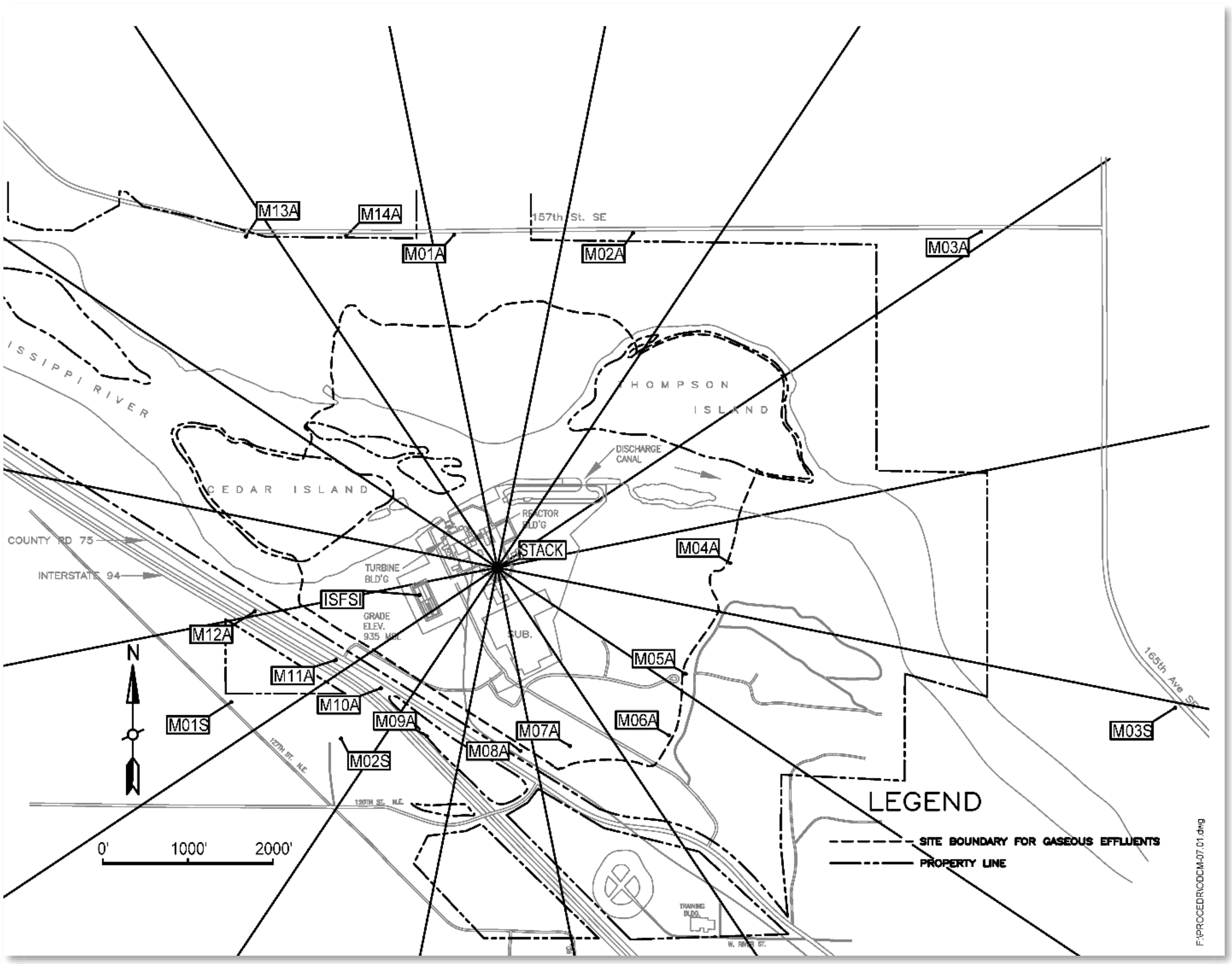

Figure 2.2-3: Site Boundary TLD Locations (ODCM 07.01 Figure 3)

Figure 2.2-4 below illustrates the control sample locations.

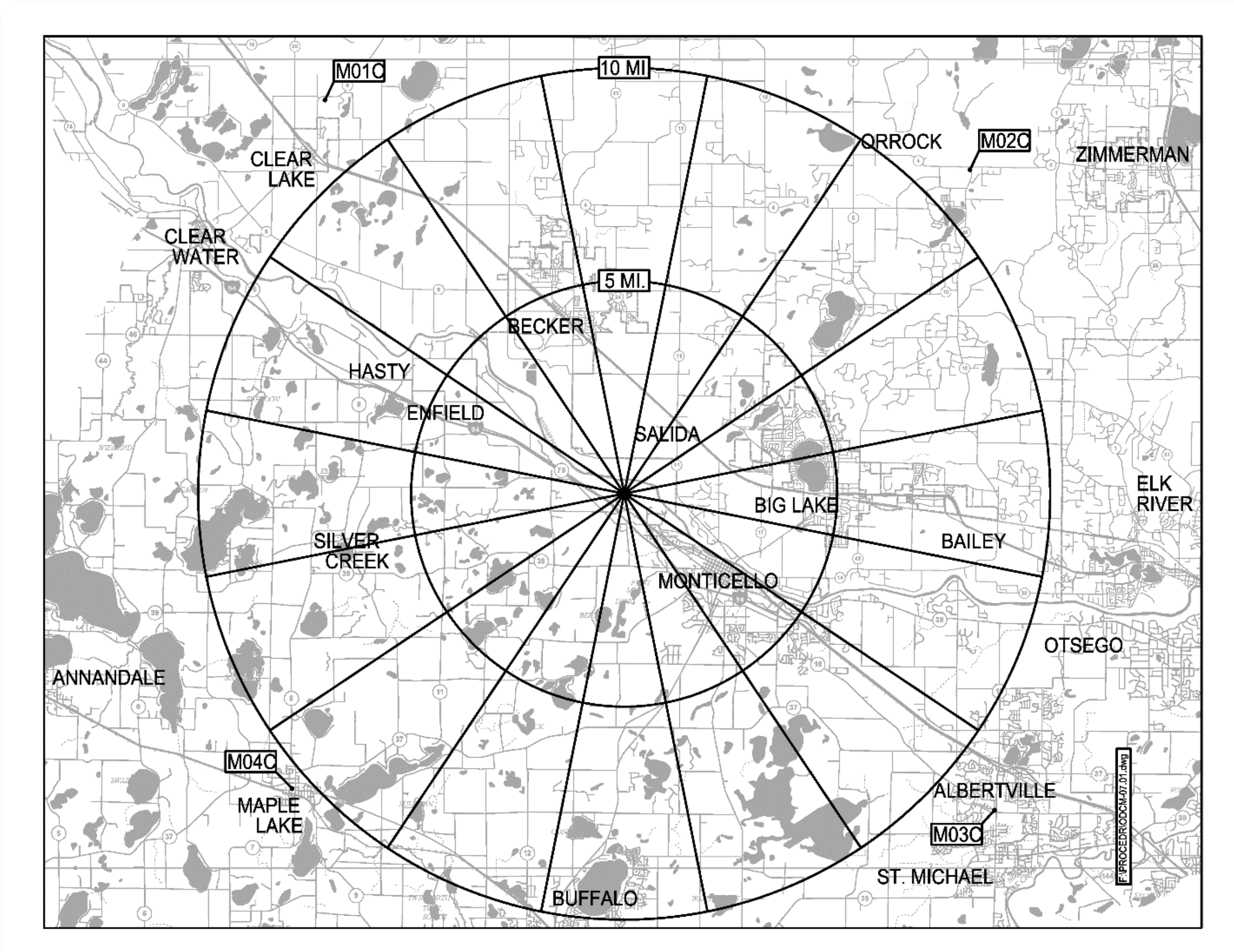

Figure 2.2-4: Control Locations (ODCM 07.01 Figure 4)

Figure 2.2-5 illustrates the ISFSI TLD locations.

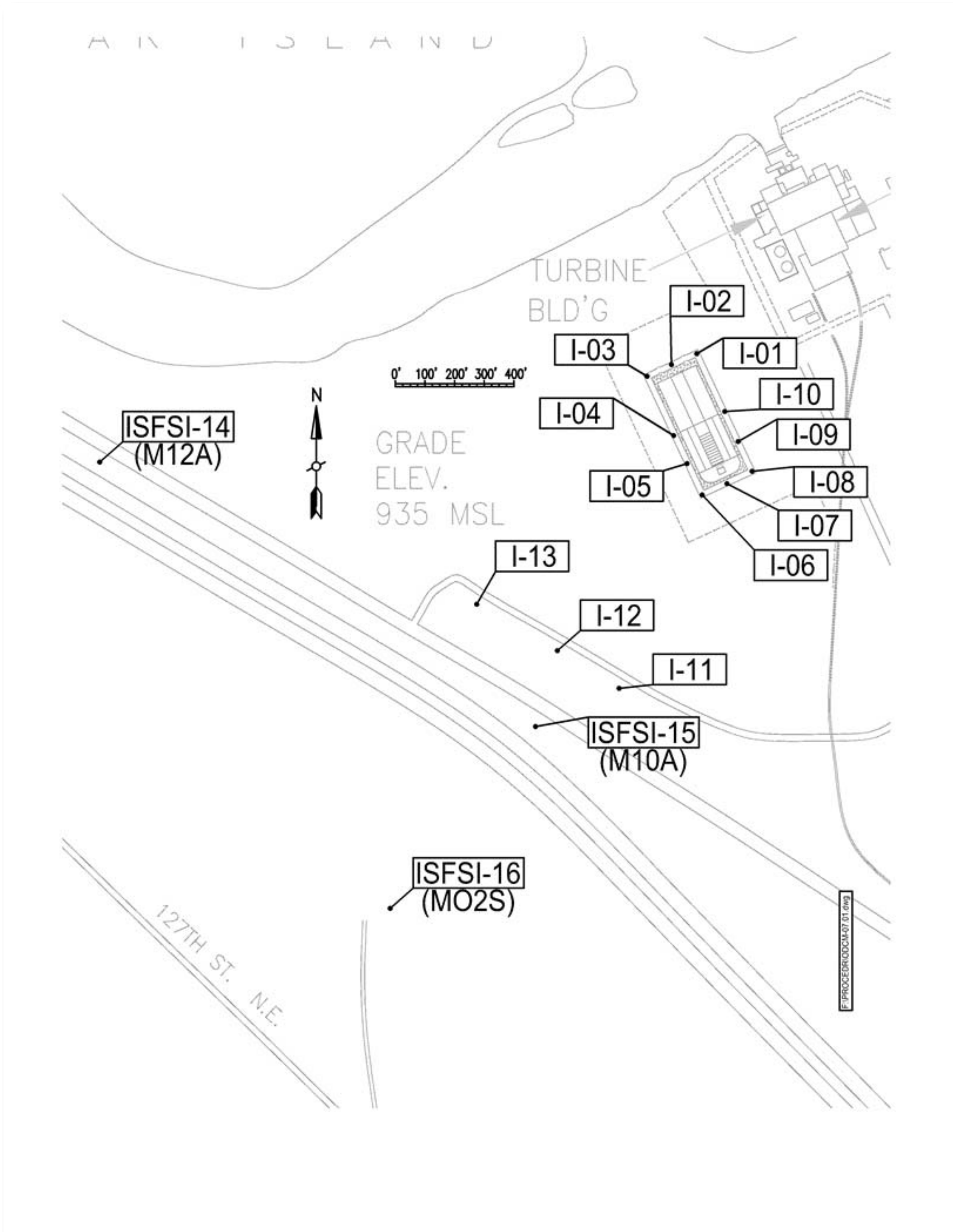

Figure 2.2-5: ISFSI TLD Locations (ODCM 07.01 Figure 5)

3 STATISTICAL AND CALCULATIONAL METHODOLOGY

3.1 Trend Identification

The REMP is not only intended to determine levels of radionuclides in the environment associated with MNGP's operations, but to evaluate trends in those levels over a period of time. If the data indicate a trend in the concentration of a radionuclide in an environmental medium, it could indicate that reactor operations are causing that particular radionuclide to fluctuate in the environment. Understanding effluent releases from MNGP is necessary to identify and interpret trends (or lack of trends) based on environmental data. Factors that may affect environmental levels of radionuclides include prevailing weather conditions (*e.g.*, periods of drought, solar cycles, and extreme precipitation events) and construction activities in close proximity to MNGP of a given sampling location.[10] Some of these factors may be obvious, such as, the increase of airborne particulate beryllium-7 concentration due to atmospheric mixing or increase of surface water tritium due to atmospheric deposition from heavy precipitation events, while others are sometimes unknown.

3.2 Estimation of the Mean Value

A widely used statistical calculation was performed on the raw data collected under the sample analysis program. The calculation involved determining the mean value for the indicator and control samples for each sample medium. The mean value was used in the reduction of the data generated by the sampling and analysis of the various media in the REMP. "Net activity (or concentration)" is the activity (or concentration) determined to be present in the sample. No "minimum detectable activity (or concentration)," "lower limit of detection," "less than level," or negative activities or concentrations are included in the calculation of the mean. Equation 1 below was used to calculate the estimated mean. The estimated mean is equal to the sum of all the individual sample values, beginning with the first sample, divided by the total number of samples.

$$\overline{x} = \frac{\sum_{i=1}^{N} x_i}{N}$$

(Equation 1)

Where:

$\overline{x}$ = estimate of the mean
i = individual sample
N = total number of samples with a net activity (or concentration)
x_i = net activity (or concentration) for sample i

When mean values are proceeded by a "±" value in the text, the ± value represents the standard deviation of the individual values used to estimate the mean.

[10] Additionally, from time to time, the trends may be affected by statistical additions or exclusions of known sources of radioactive material. For instance, there is a measurable amount of radioactivity attributable to the 1986 Chernobyl accident and the 2011 Japan earthquake and tsunami, which triggered the Fukushima Dai-ichi Nuclear Power Plant incident. It is important to note whether these factors are being accounted for, as they affect radiological environmental measurements, even though they are not attributable to MNGP.

3.3 Lower Limit of Detection and Minimum Detectable Concentration

The lower limit of detection (LLD) and minimum detectable concentration (MDC) are used throughout the REMP and are defined as follows.

- LLD is defined in the ODCM as the smallest concentration of radioactive material in a sample that will yield a net count above the system background that will be detected with 95 percent probability; *i.e.*, only a 5 percent probability of falsely concluding that a blank observation represents a “real” signal. The LLD is an *a priori* (*i.e.,* before the fact) measurement. The actual LLD is dependent upon the standard deviation of the background-counting rate, the counting efficiency, the sample size (mass or volume), the radiochemical yield, and the radioactive decay of the sample between sample collection and counting. The required LLDs for each sample medium and selected radionuclides are provided in the ODCM and listed in Table 3.4-2.
- MDC is the net counting rate (sample after subtraction of background) that must be surpassed before a sample is considered to contain a scientifically measurable amount of a radioactive material exceeding background amounts. The MDC is calculated using a sample background and may be thought of as an "actual" LLD for a particular sample measurement.

Certain gross counting measurements display a calculated negative value, indicating background is greater than sample activity. In these instances, it does not mean that radioactivity is removed from the environment. Instead, the measurement errors associated with the radiochemical analysis have fluctuated causing the background count rate to be greater than the sample count rate.

3.4 Reporting Levels and Lower Limits of Detection for Radioactivity

Reporting levels and LLDs for activity found in environmental samples are listed in Table 3.4-1 and Table 3.4-2. Required REMP sample analyses and their frequencies are listed in Table 3.4-3.

Table 3.4-1: Reporting Levels for Radioactivity Concentration in Environmental Samples

Analysis	Water (pCi/L)	Airborne Particulate or Gas (pCi/m^3)	Fish (pCi/kg, wet)	Milk (pCi/L)	Vegetables (pCi/kg, wet)
Tritium (H-3)	20,000[a]				
Manganese-54 (Mn-54)	1,000		30,000		
Iron-59 (Fe-59)	400		10,000		
Cobalt-58 (Co-58)	1,000		30,000		
Cobalt-60 (Co-60)	300		10,000		
Zinc-65 (Zn-65)	300		20,000		
Zirconium-95 and Niobium-95 (Zr-Nb-95)	400[b]				
Iodine-131 (I-131)	2[c]	0.9		3	100
Cesium-134 (Cs-134)	30	10	1,000	60	1,000
Cesium-137 (Cs-137)	50	20	2,000	70	2,000
Barium-140 and Lanthanum-140 (Ba-La-140)	200[b]			300[b]	

Notes:

[a] For drinking water samples. This is a 40 CFR Part 141 value. If no drinking water pathway exists, a value of 30,000 pCi/L may be used.

[b] Total for parent and daughter product.

[c] If no drinking water pathways exist, a value of 20 pCi/L may be used.

Table 3.4-2: Maximum Values for the Lower Limits of Detection (LLD)

Analysis	Water (pCi/l)	Airborne Particulate or Gas (pCi/m^3)	Fish (pCi/kg, wet)	Milk (pCi/L)	Food Products (pCi/kg, wet)	Sediment (pCi/kg, dry)
Gross beta	4	0.01				
Tritium (H-3)	2000[a]					
Manganese-54 (Mn-54)	15		130			
Iron-59 (Fe-59)	30		260			
Cobalt-58 and Cobalt-60 (Co-58, 60)	15		130			
Zinc-65 (Zn-65)	30		260			
Zirconium-95 and Niobium-95 (Zr-Nb-95)	15[b]					
Iodine-131 (I-131)	1[c]	0.07		1	60	
Cesium-134 (Cs-134)	15	0.05	130	15	60	150
Cesium-137 (Cs-137)	18	0.06	150	18	80	180
Barium-140 and Lanthanum-140 (Ba-La-140)	15[b]			15[b]		

<u>Notes:</u>

[a] If no drinking water pathway exists, a value of 3000 pCi/L may be used.

[b] The specified LLD applies to the daughter nuclide of an equilibrium mixture of the parent and daughter nuclides. Per the Radiological Assessment Branch Technical Position, the following values may be used for individual nuclide LLDs when equilibrium conditions are not met: 30 pCi/L for zirconium-95, 15 pCi/L for niobium-95, 60 pCi/L for barium-140, and 15 pCi/L for lanthanum-140.

[c] If no drinking water pathway exists, a value of 15 pCi/L may be used.

Table 3.4-3: Analysis and Frequency of Samples

Pathway	Sample Location	Type	I-131	Gross Beta	Gamma Isotopic	Tritium	Gamma Dose
Airborne Particulate and Radioiodine	M-1 Air Station M-1	Control	W	W	Q[1]		
	M-2 Air Station M-2		W	W	Q[1]		
	M-3 Air Station M-3		W	W	Q[1]		
	M-4 Air Station M-4		W	W	Q[1]		
	M-5 Air Station M-5		W	W	Q[1]		
Direct Radiation	M01C to M04C	Control					Q
	M01A to M14A						Q
	M01B to M16B						Q
	M01S to M06S						Q
	I-11 to 1-13						Q
Waterborne: River Water	M-8c Upstream of MNGP	Control			M[1]	Q[1]	
	M-9 Downstream of MNGP				M[1]	Q[1]	
Waterborne: Groundwater	M-43c Imholte Farm	Control			Q	Q	
	M-11 City of Monticello				Q	Q	
	M-12 Plant Well No. 11				Q	Q	
	M-55 Hasbrouck Residence				Q	Q	
Waterborne: Drinking Water	M-14 City of Minneapolis		BW[1,2]	M[1]	M[1]	Q[1]	
Waterborne: Sediment	M-8c Upstream of Plant	Control			SA		
	M-9 Downstream of Plant				SA		
	M-15 Montissippi Park				SA		
Ingestion: Milk	-		M/BW[3,4]		M/BW[3,4]		
Ingestion: Vegetation	M-43c Imholte Farm	Control	M[5]		M[5]		
	M-41 Training Center		M[5]		M[5]		
	M-42 Biology Station Road		M[5]		M[5]		
Ingestion: Fish	M-8c Upstream of Plant	Control			SA		
	M-9 Downstream of Plant				SA		
Ingestion: Food Products	-				A[3]		

Notes for Table 3.4-3:

[1] Composite of weekly samples.

[2] Iodine-131 analysis included on each bi-weekly composite when the dose from the consumption of the water is greater than 1 mrem/year. (ODCM Revision 26)

[3] This pathway is currently unavailable at MNGP.

[4] Every two weeks when animals are on pasture; monthly at other times.

[5] During growing season when milk samples are unavailable.

W = weekly

BW = every two weeks

M = monthly

Q = quarterly

SA = semi-annually

A = annually

4 INTERPRETATION OF RESULTS

4.1 Airborne Radioiodine and Particulates

The average annual gross beta[11] concentrations in airborne particulates were similar at the indicator (0.040 ± 0.013 pCi/m^3 for 2020) and control locations (0.039 ± 0.013 pCi/m^3 for 2020). These 2020 results are comparable to levels observed from 2009 through 2019. The results are graphed below in Figure 4.1-1.

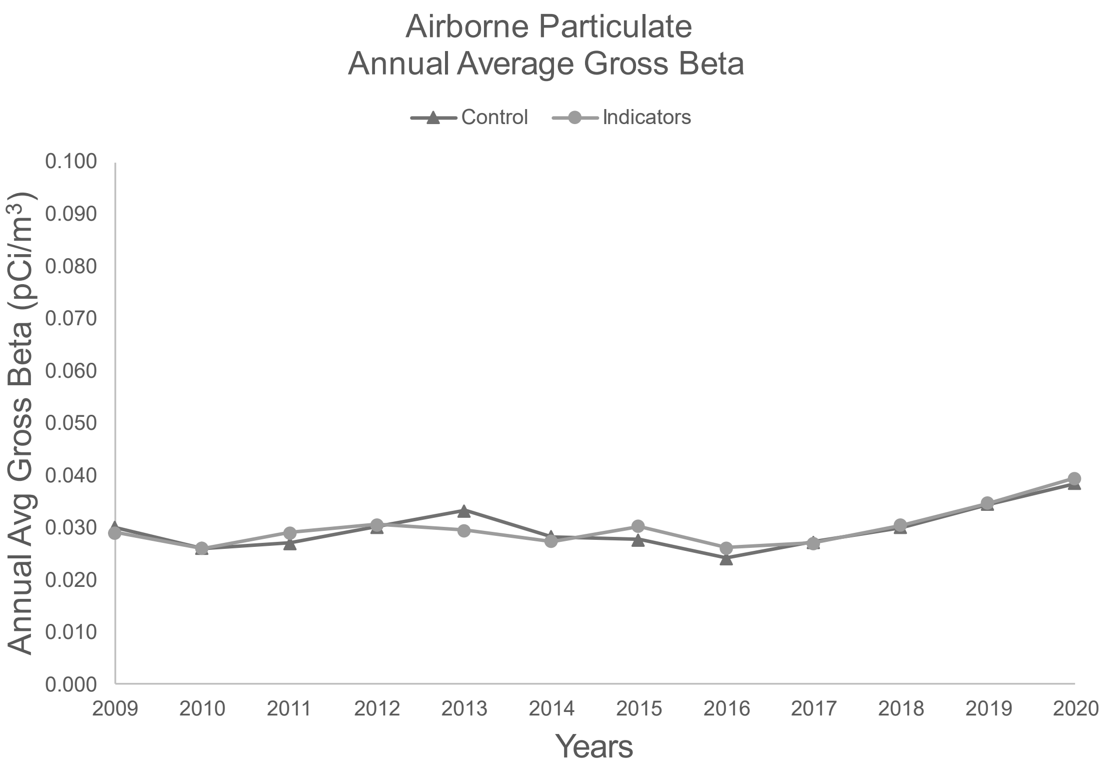

Figure 4.1-1: Graph of Historical Airborne Particulate Gross Beta

[11] Gross beta is a measurement of all beta activity present, regardless of specific radionuclide source. Beta particles are physically identical to electrons, but are differentiated by their source (beta particles are created in the nucleus during certain types of nuclear transformations, whereas electrons come from the electron cloud surrounding the nucleus). Beta particles can have various states of energy.

Figure 4.1-2 shows the average indicator gross beta from the four indicator locations (Air Station locations M-2, M-3, M-4, M-5) versus the control location (Air Station M-1) in 2020. The error bar represents the statistical uncertainty, as 1.96 sigma (σ) (95% confidence), associated with each measurement for a given sample collection date. Despite the variability of gross beta activity in airborne particulates, the average results from the indicator locations were similar to the results from the control location.

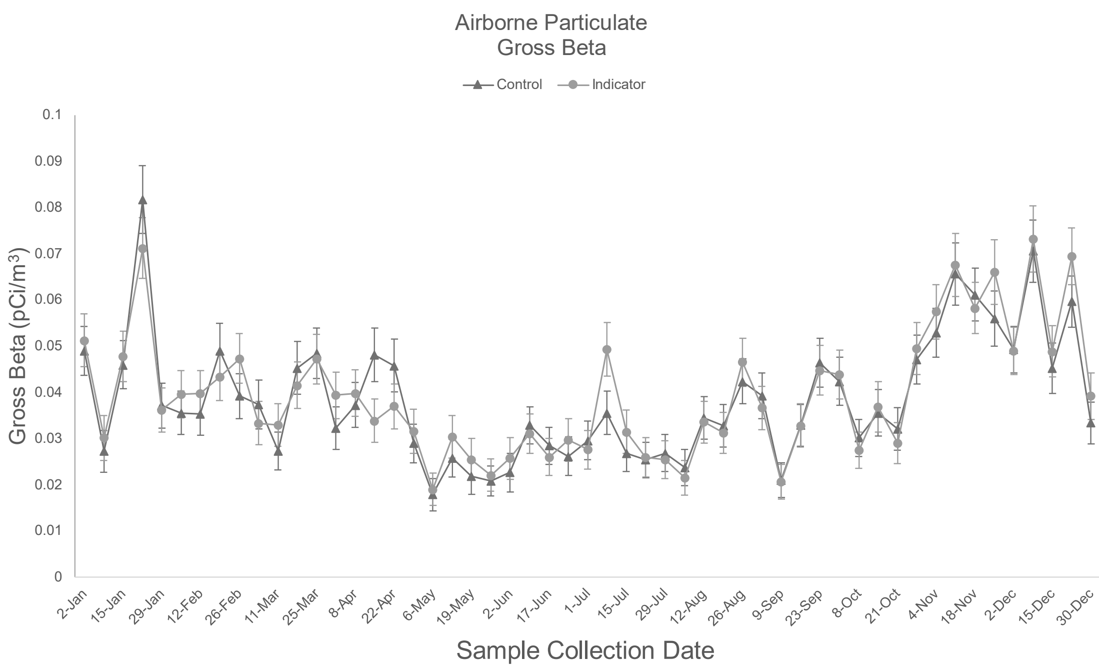

Figure 4.1-2: Graph of 2020 Average Airborne Particulate Gross Beta for Indicator and Control Locations

Mixing of the upper and lower atmospheres can transport suspended particles and beryllium-7[12] from the upper atmosphere to the lower atmosphere, which can increase the airborne particulate gross beta in the lower atmosphere. Gamma spectroscopic analysis of quarterly composites of air particulate filters yielded similar results for indicator and control locations. Beryllium-7 was detected in all samples, with an average activity of 0.075 ± 0.011 pCi/m^3 for the control locations, and 0.078 ± 0.015 pCi/m^3 for the indicator locations. All other gamma-emitting isotopes were below their respective LLD limits.

The weekly levels of airborne radioiodine-131 were below the LLD for the airborne radioiodine cartridge samples analyzed. There was no indication of an emission of radioiodine from MNGP.

[12] Beryllium-7 can be created in the upper atmosphere by cosmic radiation and solar flares (Arnold & Al-Salih, 1955).

4.2 Drinking Water

Tritium activity was measured below the detection limit for all samples. Gamma isotopic results were all below detection limits. Gross beta results were all below detection limits. Gross beta averages are shown on Figure 4.2-1. There was no indication of an effect from MNGP.

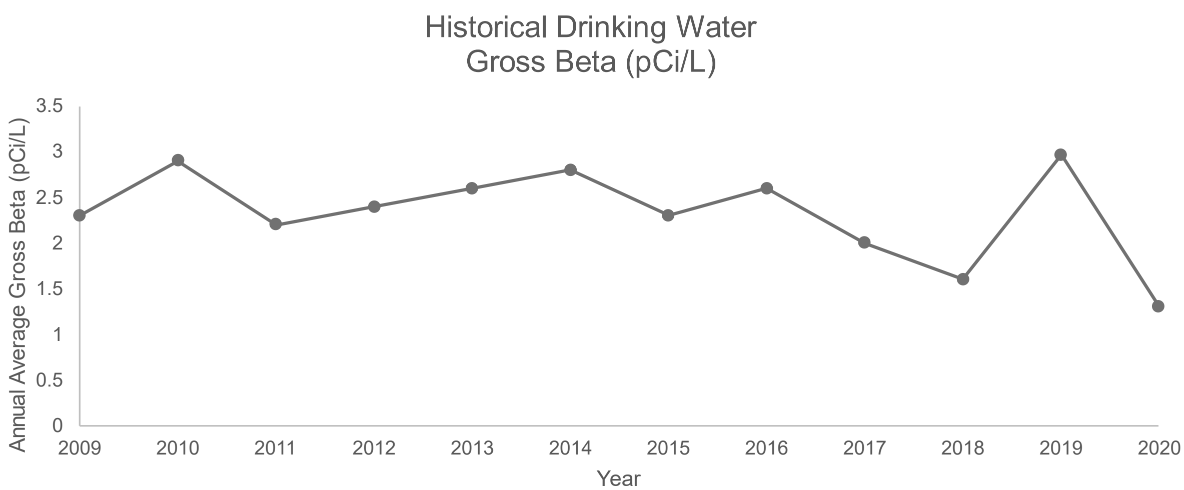

Figure 4.2-1: Graph of Historical Gross Beta for Drinking Water Sample

4.3 River Water

River water was analyzed from samples both upstream and downstream of MNGP. Tritium activity was measured below the detection limit for all samples. The gamma isotopic results were all below detection limits.

4.4 Groundwater

Tritium and gamma isotopic results were below the detection limit for all samples taken. The data for 2020 were consistent with the previous years' results and no MNGP operational effects were indicated.

4.5 Broadleaf Vegetation

Vegetation samples were collected during the growing season of June, July, August, and September 2020. Gamma isotopic and iodine-131 concentrations were measured below the detection limit in all samples. These samples are required when milk samples are not available.

4.6 Food Products

Corn and potato samples were not required for 2020. There were no crops within five miles of MNGP irrigated using water from the Mississippi River, and MNGP did not discharge radioactive liquid effluents.

4.7 Fish

Eight fish were analyzed in 2020, including two fish collected from upstream locations and two collected from downstream locations in May and then again in September. Two species of fish, shorthead redhorse and smallmouth bass, were collected from each location. Gamma spectroscopy was performed on the edible portion of the fish. Only potassium-40, which is a common radioisotope found in nature and would not be associated with MNGP activities, was found with an average of 3.23 ± 0.06 pCi/g wet weight for four upstream samples and 3.17 ± 0.08 pCi/g wet weight for the four downstream samples. These results are consistent with historical results. Other gamma-emitting isotopes remained below detection limits. There were no gamma emitting radionuclides attributable to MNGP operations identified in any of the 2020 fish samples.

Photo Credit: Darin Jensen, Senior Design Engineer, MNGP

Canada Goose and Goslings Crossing Near an MNGP Radiological Environmental Sampling Point

4.8 Shoreline Sediment

Shoreline sediments were collected from three locations: upstream, downstream, and downstream-recreational. Cesium-137 was detected in May at the upstream sample (M-8), with a concentration of 0.035 ± 0.023 pCi/g dry weight. Similar levels of activity have been observed since 1996 (see Figure 4.8-1) and are indicative of the influence of fallout deposition from above ground nuclear weapons testing. Levels of cesium-137 in sediments are observed to fluctuate as silt distributions shift due to natural erosion and transport processes. Naturally occurring beryllium-7 and potassium-40 were also detected. There was no indication of a MNGP effect.

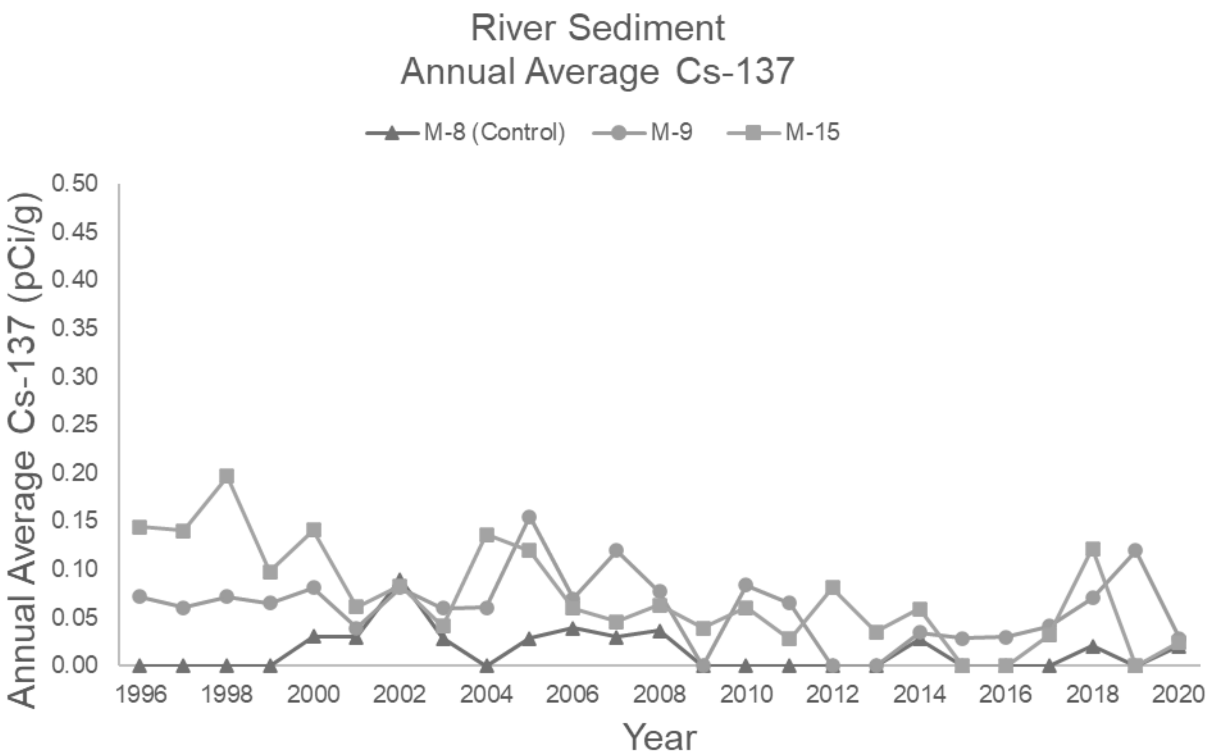

Figure 4.8-1: Graph of Historical Cesium-137 in River Sediment

4.9 Direct Gamma Radiation

4.9.1 Environmental TLD

Ambient radiation was measured in the general area of the Site boundary, at the inner ring, at an outer ring 4 to 5 miles (mi) from the Plant, at special interest areas, and at four control locations. On average, the quarterly TLD measurements (where one standard [std] quarter is a 91-day period) were similar for both inner and outer rings, at 14.3 and 13.9 millirem (mrem)/std quarter, respectively. The mean for special interest locations was 14.2 mrem/std quarter and the mean for the control locations was 13.2 mrem/std quarter. Figure 4.9.1-1 shows the average measured dose from each std quarter. The error bars represent the statistical uncertainty associated with each average measurement.

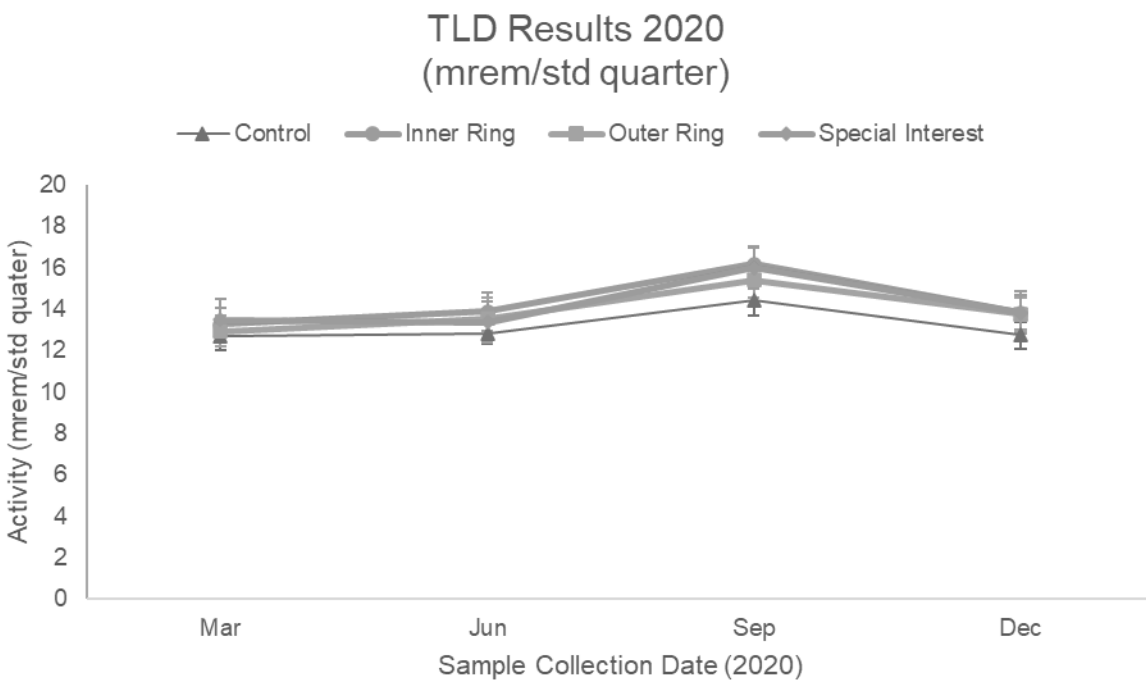

Figure 4.9.1-1: Graph of Direct Gamma Radiation Measurements

Dose rates measured at the inner and outer ring locations in 2020 were similar to those observed from 1999 through 2019 and are shown in Figure 4.9.1-2. No MNGP effect on ambient gamma radiation is indicated.

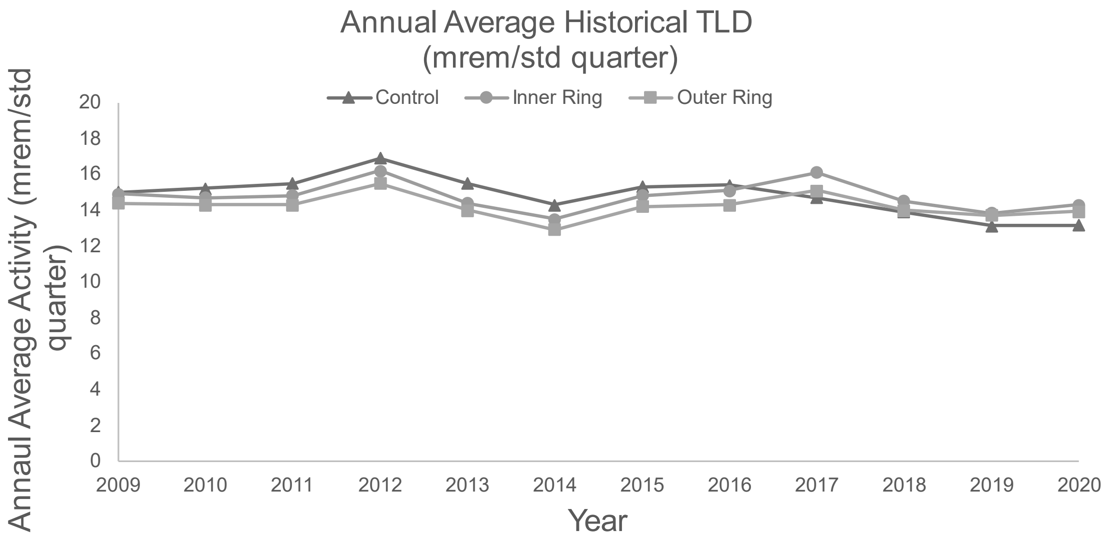

Figure 4.9.1-2: Graph of Historical Direct Gamma Measurements

4.9.2 ISFSI TLD

Gamma and Neutron TLDs are located around the Independent Spent Fuel Storage Installation (ISFSI) to monitor direct radiation from stored fuel for trending purposes. The ISFSI TLDs are not considered true REMP TLDs and are not representative of the dose to members of the public. Results for monitoring are included in Section 10.

No additional spent fuel casks were moved to the ISFSI in 2020. Annual data trends at and in the vicinity of the ISFSI are consistent with expectations. There were no detectable dose rate increases observed at the Site boundary TLDs in 2020.

5 LAND USE CENSUS

5.1 Purpose

The Land Use Census identifies the pathways (or routes) by which radioactive material may reach the general populations near commercial nuclear generating stations. This is accomplished by completing studies each year that identify how the surrounding lands are used by the population. A comprehensive census of the use of the land within a five-mile distance of the Plant is completed during the growing season each year. This information is used for dose assessment and to identify changes to the stations sampled and the type of samples. Therefore, the purpose of the Land Use Census is to ensure the REMP is current based on human activity near MNGP, as well as to provide data for the calculation of estimated radiation exposure.

Woodchuck Near an MNGP Radiological Environmental Sampling Point.

The pathways evaluated are:

- Ingestion Pathway - Results from eating food crops that may have radioactive materials deposited on them or may have taken up radioactive materials from the soil or atmosphere. Another potential pathway is through drinking milk or eating cheese from local cows or goats. The vegetation used to feed these animals may include radioactive material due to deposition or uptake from soil and the radioactivity transferred to the milk. If milk animals are not present, vegetation is collected in lieu of milk.
- Direct Radiation Exposure Pathway - Results from deposition of radioactive materials on the ground or from passage of these radioactive materials in the air.
- Inhalation Pathway - Results from breathing radioactive materials transported in the air.

5.2 Methodology

The following must be identified within a five-mile radius of the Plant for each of the sixteen meteorological sectors (*i.e.*, compass heading) for potential wind direction; for example, North-Northeast (NNE):

- The nearest resident
- The nearest garden of greater than 500 square feet (ft^2) producing broadleaf vegetables ("Garden")
- The nearest animal used for meat consumption ("Meat")
- The nearest milk-producing animal ("Milk")

The 2020 survey was performed using door-to-door surveys and visual observations while driving; additionally, inputs from the 2019 field data forms were used to evaluate changes to the land use. Google Earth Pro satellite imagery and the Homeland Security Emergency Management Monticello Basemap were used in determining changes in land use. Data were collected using a combination of the Spyglass App and Google Earth Pro, using a universal serial bus (USB) global positioning system (GPS) receiver. Google Earth Pro was used to determine receptor location distances and sectors; these results were used in determining dispersion parameters for dose calculations. 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.

5.3 2020 Land Use Census

The 2020 Land Use Census was conducted between August 13 and August 20, 2020, by the REMP Coordinator in accordance with MNGP's Chemistry Manual, Procedure I.05.41, "Annual Land Use Census and Critical Receptor Identification."

There were no sectors that had an increase in the nearest garden deposition coefficient (D/Q) of greater than 20 percent compared to 2019. The highest D/Q garden for 2020 remains in sector SSE at 1.20 miles from MNGP.

Deer Near an MNGP Radiological Environmental Sampling Point.

There were three sectors where the highest D/Q value for the combined Meat and Garden increased by greater than 20 percent. The increase was due to finding these combined receptor pathways in 2020 that were not observed in 2019 (S, SW, and WNW). In addition, the combined pathways were not present in the three sectors (N, NE, and SSW) in which they were observed in 2019. The highest D/Q Meat location is in the WSW sector, 1.78 miles from the Plant. The highest D/Q combined Meat/Garden location is in the W sector, 1.82 miles from the Plant.

There were no sectors in which the highest D/Q values for the nearest resident increased by more than 20 percent in 2020. The highest D/Q resident remains at 0.99 miles from the Plant in the SSE sector.

In 2019 a new Milk location was located 3.25 miles in the NNE sector. The animal is infrequently milked and only provides enough for the family usage. Due to the relativity low deposition, the calculated dose at this location is lower than the vegetation sample locations. Milk samples are required for three locations within 3 miles or three locations where doses are calculated to be greater than 1 mrem/year (ODCM 07.01). The identified Milk animal is greater than 3 miles from the site, and the dose from all pathways at that location is 0.022 mrem/year to the infant thyroid. Thus, vegetation sampling was performed in lieu of milk sampling.

There are no crops being irrigated from the Mississippi River within five miles downstream of the Plant, based upon the most recent Water Use Resources Permit Index Report from the Minnesota Department of Natural Resources. 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 UFSAR.

Table 5.3-1 summarizes the locations showing greater than a 20 percent increase in D/Q as identified in the Land Use Census from 2019 to 2020. The locations identified in Table 5.3-1 do not necessarily represent the locations with the highest D/Q for a given pathway; rather, these are the locations with a greater than 20 percent increase in the D/Q of a pathway within a specific sector. The highest D/Q location for each pathway is described in Table 5.3-2.

Table 5.3-1: Changes in Land Use Census from 2019 to 2020

Sector	Pathway	2019 Distance (mi)	2020 Distance (mi)	2019 D/Q	2020 D/Q
S	Meat + Garden	-	4.40	-	1.9E-10
SW	Meat + Garden	-	3.40	-	2.30E-10
WNW	Meat + Garden	-	3.40	-	2.80E-10
N	Meat + Garden	3.79	-	5.30E-10	-
NE	Meat + Garden	3.44	-	1.40E-10	-
SSW	Meat + Garden	2.77	-	4.10E-10	-

Table 5.3-2: Summary of Highest Location for Each Pathway in 2020

Pathway	Sector	Distance (mi)	D/Q
Resident	SSE	0.99	1.40E-08
Meat	WSW	1.78	9.60E-10
Meat + Garden	W	1.82	6.90E-10
Garden	SSE	1.21	6.70E-09
Milk[1]	NNE	3.24	3.90E-10
Crops	-	-	-

Notes:

[1] Vegetation performed in lieu of Milk sampling

Doses due to ground plane, inhalation, and ingestion of vegetables and meat, were calculated for the highest D/Q Resident, Meat, Garden, and combined Meat and Garden locations identified in the 2020 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 2019 Annual Effluent Data report source term as input. This resulted in identifying the same sector, distance, and pathway as compared to last year's critical receptor. The location, comprising a residence with a garden, is 1.20 miles away from the Plant located in the SSE sector (designated GH). The pathway identified is the combination of ground plane, inhalation, and vegetable ingestion. For the purposes of compliance with 10 CFR 50 Appendix I, the critical receptor is defined as a child at this location with dose calculated to the thyroid. The dose for this receptor is estimated at 0.0335 mrem/year.

6 QUALITY ASSURANCE

6.1 Sample Collection

MNGP personnel performed the environmental sample collections as specified by approved sample collection procedures.

6.2 Sample Analysis

General Engineering Laboratories, LLC (GEL) performed the environmental sample analyses as specified by approved analysis procedures. GEL is located in Charleston, South Carolina.

6.3 Dosimetry Analysis

Environmental Dosimetry Company (EDC) works in conjunction with Stanford Dosimetry to perform the environmental dosimetry measurements as specified by approved dosimetry analysis procedures. The Environmental TLD program at the EDC provides Panasonic TLD badges containing calcium sulfate ($CaSO_4$) phosphor elements for posting in the field. The raw TLD results are corrected for individual element sensitivity and reader sensitivity as determined by the quality control results. Control dosimeters are used to determine the background radiation exposure during the shipment and serve to evaluate transit exposures. The transit exposures are subtracted from the field dosimeters. Since the measured signal fades from the time of exposure to analysis, the fade of the thermoluminescent response is corrected.

6.4 Laboratory Equipment Quality Assurance

6.4.1 Daily Quality Control

GEL has an internal QA program which monitors each type of instrumentation for reliability and accuracy. Daily quality control checks ensure that instruments are in proper working order, and these checks are used to monitor instrument performance.

6.4.2 Calibration Verification

National Institute of Standards and Technology (NIST) standards that represent counting geometries are analyzed as unknowns at various frequencies, ranging from weekly to annually, to verify that efficiency calibrations are valid. The frequency is dependent upon instrument use and performance. Investigations are performed and documented should calibration verification data fall outside of the acceptable limits.

6.5 General Engineering Laboratory, LLC

GEL participated in various QA programs for inter-laboratory, intra-laboratory, third party cross check programs, and a number of proficiency testing programs during 2020. A summary of the GEL QA program results for the sample media types sent to GEL during 2020 is documented in Appendix A.

6.6 Environmental Dosimetry Company

EDC participates in an internal performance acceptance criteria and a quarterly independent testing TLD intercomparison program. In 2020, 100 percent of the individual dosimeters passed the performance criteria. A summary of the 2020 EDC Annual Quality Assurance Status Report is documented in Appendix B.

7 ENVIRONMENTAL SAMPLING MODIFICATIONS

7.1 Program Modifications

There were no programmatic changes to environmental sampling; however, the configuration of each of the REMP Air Sampling Units was modified following the September 2020 collection events. The existing sample holders were augmented with goosenecks to orient the sample heads toward the potential activity source to be more consistent with industry best practice. The modified Air Sampling Units were placed into service in conjunction with quarterly calibration in October 2020.

7.2 Change of Sampling Procedures

There were no changes to sampling procedures in 2020.

7.3 Change of Analysis Procedures

In 2018, samples were analyzed by Environmental, Inc. Midwest Laboratory. In 2019, the samples were analyzed by GEL. While the laboratory change did not impact the required LLDs, the actual MDC for some analytes, such as tritium and gross beta, could be different due to variations in natural background and analytical equipment.

In 2019, weekly drinking water and surface water samples were composited by GEL. In 2020, the weekly water samples were composited onsite and shipped to GEL monthly. While the compositing change did not impact the required LLDs, the actual MDC for some analytes, such as barium-140/lathanium-140, could be different due to changes in the sample times.

ODCM Revision 26 revised the drinking water sample requirement to make iodine-131 sampling consistent with NUREG-1302. This revision requires iodine-131 analysis to be performed when the dose calculated for the consumption of water is greater than 1 mrem per year. Otherwise, only a monthly drinking water composite analyzed for gross beta and gamma isotopic and a quarterly composite analyzed for tritium should be collected. As a result of this change, drinking water iodine-131 sampling ceased on February 27, 2020.

The standard operating procedures used by GEL are approved methods. Copies of GEL's accreditations and certifications are available on their website, www.gel.com.

7.4 Sample Deviations and Unavailable Analyses

Table 7.4-1 lists the deviations from the required REMP sample collection in 2020. Despite these sample deviations, 99.6 percent of the required samples were successfully obtained and analyzed.

Table 7.4-1: Sample Deviations and Unavailable Analyses

Sample Type	Analysis	Location	Collection Date or Period	Reason for not conducting REMP as required	Corrective Action	Condition Report
Surface Water	Gamma Isotopic	M-8C	Composite - Gamma: Jan, Feb, Mar 2020 and Tritium: 1st quarter[1]	Unsafe condition for sampling due to river surface being frozen	Sample obtained when water thawed	501000036207
	Tritium					
TLD	Direct Radiation	M-12A	Quarter 4 2020 (Oct through Dec 2020)	TLD located along CR 75 – West Sector was missing from its assigned TLD holder	TLD for 1Q2021 placed in TLD holder and cap covers were reaffixed	501000047634

Notes:

[1] January and February samples could not be collected, but samples were collected in March. The quarterly composite for tritium therefore only includes March. Although condition report 501000036207 references the January event, subsequent events for which this condition applied were tracked under Management of Change (MOC) 603000004249.

7.5 Analytical Deviations

The ODCM 07.01 Table 3 LLD values for the parent-daughter isotopic pair barium-140/lanthanum-140 are 60 pCi/L and 15 pCi/L, respectively (*see* Table 3.4-2). Of the 50 groundwater, surface water, and drinking water samples collected in 2020, the LLD was not satisfied in two of the barium-140/lanthanum-140 samples (4%). In each sample, the MDC was higher than the LLD. The cause of the deviation was largely due to the time period between sample analysis and sample collection. GEL's Laboratory Information System (LIMS) outage at the end of June, coupled with short radiochemical half-life, caused the deviations. Since barium-140 and lanthanum-140 half-lives of 12.75 days and 1.68 days, respectively, are shorter than the delay due to the outage, the required LLDs could not be met. *See* Table 7.5-1 for more details.

Table 7.5-1: Analytical Deviations

Location	Collect Date/Time	Analysis Date/Time	Isotope	Result (pCi/L)	ODCM 07.01 Table 3 Required LLD (pCi/L)	Minimum Detectible Concentration (MDC) (pCi/L)	Cause
M-8 Upstream of Plant	5/27/2020 08:10	7/14/2020 09:27	La-140	-0.028 U	15	42.7	A
			Ba-140	-36.8 U	60	177	A
M-9 Downstream of Plant	5/27/2020 08:25	7/14/2020 10:47	La-140	-13.7 U	15	47.2	A
			Ba-140	-33.3 U	60	132	A

Cause Codes:

A = GEL's LIMS outage

8 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM – SUMMARY OF RESULTS

This section presents a summary of MNGP's REMP sampling and monitoring results for the 2020 period for airborne particulates, airborne radioiodine, direct radiation, and measurable radioactivity in milk, broadleaf vegetation, river water, aquatic invertebrates, shoreline sediments, groundwater, drinking water, and fish. In all, there were no reported non-routine measurements.

8.1 Radiological Environmental Monitoring Program Data Summary

Table 8.1-1 below presents the summary of MNGP's REMP sampling and monitoring results for the 2020 period.

Table 8.1-1: 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 2020

Medium or Pathway Sampled (Units)	Type, Total Number of Analyses performed (e.g. I-131, 400)	ODCM Table 3 Lower Limit of Detection (LLD)	Indicator Mean[1]; (f)[2] Range[1]	Location with Highest Annual Mean: Name / Distance and Direction	Location with Highest Annual Mean: Mean[1] (f)[2] Range[1]	Control Mean[1] (f)[2] Range[1]	Number of Nonroutine Reported Measurements
Airborne Particulates (pCi/m³)	Gross Beta (265)	0.01	0.040 (212/212) 0.012 - 0.085	M-3, Air Station 0.6 m @ 104/ESE	0.040 (53/53) 0.021 - 0.085	0.039 (53/53) 0.018 - 0.082	0
	Gamma (20)						0
	Be-7 [3]	-	0.078 (16/16) 0.056 – 0.104	M-3, Air Station 0.6 m @ 104/ESE	0.083 (4/4) 0.062 – 0.104	0.075 (4/4) 0.063 – 0.089	
	Mn-54	-	<LLD	-	-	<LLD	
	Co-58	-	<LLD	-	-	<LLD	
	Co-60	-	<LLD	-	-	<LLD	
	Zn-65	-	<LLD	-	-	<LLD	
	Zr-Nb-95	-	<LLD	-	-	<LLD	
	Ru-103	-	<LLD	-	-	<LLD	
	Ru-106	-	<LLD	-	-	<LLD	
	Cs-134	0.05	<LLD	-	-	<LLD	
	Cs-137	0.06	<LLD	-	-	<LLD	
	Ba-La-140	-	<LLD	-	-	<LLD	
	Ce-141	-	<LLD	-	-	<LLD	
	Ce-144	-	<LLD	-	-	<LLD	
Airborne Radioiodine (pCi/m³)	I-131 (265)	0.07	<LLD	-	-	<LLD	0
Broadleaf Vegetation (pCi/kg-wet)	Gamma (9)						0
	Mn-54	-	<LLD	-	-	<LLD	
	Fe-59	-	<LLD	-	-	<LLD	
	Co-58	-	<LLD	-	-	<LLD	
	Co-60	-	<LLD	-	-	<LLD	
	Zn-65	-	<LLD	-	-	<LLD	
	Zr-Nb-95	-	<LLD	-	-	<LLD	
	I-131	60	<LLD	-	-	<LLD	
	Cs-134	60	<LLD	-	-	<LLD	
	Cs-137	80	<LLD	-	-	<LLD	
Milk (pCi/L)	I-131 (0)	1	N/A	N/A	N/A	N/A	0
	Gamma (0)	N/A	N/A	N/A	N/A	N/A	0

Medium or Pathway Sampled (Units)	Type, Total Number of Analyses performed (e.g. I-131, 400)	ODCM Table 3 Lower Limit of Detection (LLD)	Indicator Mean[1]; (f)[2] Range[1]	Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean[1] (f)[2] Range[1]	Control Mean[1] (f)[2] Range[1]	Number of Nonroutine Reported Measurements
Fish (pCi/kg-wet)	Gamma (8)						0
	K-40[3]	-	3173 (4/4) 3030 - 3230	M-9 Downstream of Plant	3215 (4/4) 3210 - 3220	3225 (4/4) 3140 – 3300	
	Mn-54	130	<LLD	-	-	<LLD	
	Fe-59	260	<LLD	-	-	<LLD	
	Co-58	130	<LLD	-	-	<LLD	
	Co-60	130	<LLD	-	-	<LLD	
	Zn-65	260	<LLD	-	-	<LLD	
	Zr-Nb-95	-	<LLD	-	-	<LLD	
	Cs-134	130	<LLD	-	-	<LLD	
	Cs-137	150	<LLD	-	-	<LLD	
	Ba-La-140	-	<LLD	-	-	<LLD	
	Ce-144	-	<LLD	-	-	<LLD	
Shoreline Sediments (pCi/kg-dry)	Gamma (6)						0
	Be-7[3]	-	492 (3/4) 320 - 699	M-9, Downstream of Plant	699 (1/2) 699 - 699	<LLD	
	K-40[3]	-	12000 (4/4) 11000 - 12700	M-15 Montissippi Park	12600 (2/2) 12500 - 12700	10850 (2/2) 10600 - 11100	
	Mn-54	-	<LLD	-	-	<LLD	
	Fe-59	-	<LLD	-	-	<LLD	
	Co-58	-	<LLD	-	-	<LLD	
	Co-60	-	<LLD	-	-	<LLD	
	Zn-65	-	<LLD	-	-	<LLD	
	Zr-Nb-95	-	<LLD	-	-	<LLD	
	Cs-134	150	<LLD	-	-	<LLD	
	Cs-137	180	<LLD	-	-	34.8 (1/2) 34.8 - 34.8	
	Ba-La-140	-	<LLD	-	-	<LLD	
	Ce-144	-	<LLD	-	-	<LLD	
Drinking Water (pCi/L)	Gross Beta (12)	4	<LLD	-	-	None	0
	Gamma (12)						0
	Mn-54	15	<LLD	-	-	None	
	Fe-59	30	<LLD	-	-	None	
	Co-58	15	<LLD	-	-	None	
	Co-60	15	<LLD	-	-	None	
	Zn-65	30	<LLD	-	-	None	
	Zr-Nb-95	15[4]	<LLD	-	-	None	
	Cs-134	15	<LLD	-	-	None	
	Cs-137	18	<LLD	-	-	None	
	Ba-La-140	15[4]	<LLD [6]	-	<LLD [6]	None	
	Ce-144	-	<LLD	-	-	None	

Medium or Pathway Sampled (Units)	Type, Total Number of Analyses performed (e.g. I-131, 400)	ODCM Table 3 Lower Limit of Detection (LLD)	Indicator Mean[1]; (f)[2] Range[1]	Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean[1] (f)[2] Range[1]	Control Mean[1] (f)[2] Range[1]	Number of Nonroutine Reported Measurements
Drinking Water (pCi/L)	I-131 (7)	1	<LLD	-	-	None	0
	Tritium (4)	2000	<LLD	-	-	None	0
Groundwater (pCi/L)	Gamma (16)						0
	Mn-54	15	<LLD	-	-	<LLD	
	Fe-59	30	<LLD	-	-	<LLD	
	Co-58	15	<LLD	-	-	<LLD	
	Co-60	15	<LLD	-	-	<LLD	
	Zn-65	30	<LLD	-	-	<LLD	
	Zr-Nb-95	15[4]	<LLD	-	-	<LLD	
	Cs-134	15	<LLD	-	-	<LLD	
	Cs-137	18	<LLD	-	-	<LLD	
	Ba-La-140	15[4]	<LLD	-	-	<LLD	
	Ce-144	-	<LLD	-	-	<LLD	
	I-131[7] (4)	1[5]	<LLD	-	-	<LLD	0
	Tritium (16)	2000	<LLD	-	-	<LLD	0
River Water (pCi/L)	Gamma (20)						0
	Mn-54	15	<LLD	-	<LLD	<LLD	
	Fe-59	30	<LLD	-	<LLD	<LLD	
	Co-58	15	<LLD	-	<LLD	<LLD	
	Co-60	15	<LLD	-	<LLD	<LLD	
	Zn-65	30	<LLD	-	<LLD	<LLD	
	Zr-Nb-95	15[4]	<LLD	-	<LLD	<LLD	
	Cs-134	15	<LLD	-	<LLD	<LLD	
	Cs-137	18	<LLD	-	<LLD	<LLD	
	Ba-La-140	15[4]	<LLD [6]	-	<LLD [6]	<LLD [6]	
	Ce-144	-	<LLD	-	<LLD	<LLD	
	Tritium (7)	2000	<LLD	-	-	<LLD	0
Direct Radiation: Control (10 to 12 miles distant) (mrem/91 days)	Gamma (16)	-	N/A	M03C 11.6 mi @ 130/SE	14.2 (4/4) (13.3 - 15.9)	13.2 (16/16) (11.8 - 15.9)	0
Direct Radiation: Inner Ring (General Area at Site Boundary) (mrem/91 days)	Gamma (55)	-	14.3 (55/55) (11.9 - 17.2)	M11A, 0.4 mi @ 237/WSW	15.2 (4/4) (14.2 -17.2)		0
Direct Radiation: Outer Ring (4-5 mi. distant) (mrem/91 days)	Gamma (64)	-	13.9 (64/64) (10.8 - 17.1)	M14B, 4.3 mi @ 289/WNW	15.4 (4/4) (14.4 - 17.1)		0

Medium or Pathway Sampled (Units)	Type, Total Number of Analyses performed (e.g. I-131, 400)	ODCM Table 3 Lower Limit of Detection (LLD)	Indicator Mean[1]; (f)[2] Range[1]	Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean[1] (f)[2] Range[1]	Control Mean[1] (f)[2] Range[1]	Number of Nonroutine Reported Measurements
Direct Radiation: Special Interest Areas (mrem/91 days)	Gamma (36)	-	14.2 (36/36) (11 – 17.4)	M06S, 2.6 mi @134/SE	15.4 (4/4) (14.3 - 17.4)		0

Notes:

[1] Mean and range are based upon detectible measurements only.
[2] (f) Fraction of detectible measurements at a specific location
[3] Natural and not due to Plant influence
[4] The specified LLD applies to the daughter nuclide of an equilibrium mixture of the parent and daughter nuclides. Per the Radiological Assessment Branch Technical Position, the following values may be used for individual nuclide LLDs when equilibrium conditions are not met: 30 pCi/L for zirconium-95, 15 pCi/L for niobium-95, 60 pCi/L for barium-140, and 15 pCi/L for lanthanum-140.
[5] If no drinking water pathway exists, a value of 15 pCi/L may be used.
[6] Positive barium-140 results were due to analytical deviations rather than actual detection of Plant related material. Lanthanum-140 was not detected in any of the water samples. In some cases, the required LLD was not met for barium-140/lanthanum-140. See Section 7.5 for further details.
[7] Not required

9 ERRATA TO PREVIOUS REPORTS

9.1 Errata to the MNGP AREOR

There are no errata for previous reports from 2020.

10 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM RESULTS

This section provides tabulated REMP monitoring results. Data below were analyzed by GEL. The results reported relate only to the items tested and to the samples as received by the laboratory. Copies of GEL's accreditations and certificates can be found at www.gel.com. The table notes, matrix abbreviations, and laboratory qualifiers common to each of the GEL analytical results tables are provided below.

Notes

1. LLDs are a priori values.
2. MDCs are calculated a posteriori value.
3. Gamma spectroscopy analysis results are calculated from a measurement using only one gamma energy line.
4. Results with either no qualifier, an M, or an L are considered positive results. While a U, UI, or ND are negative.

Matrix Abbreviations

AC	Airborne Cartridge
AP	Airborne Particulate
SE	Sediment
TA	Aquatic Tissue
TP	Plant Tissue
WG	Groundwater
WP	Drinking Water
WS	Surface Water

Qualifiers

L	Analyte present. Reported value may be biased low. Actual value is expected to be higher
M	M if above MDC and less than LLD
M	REMP Result >MDC/CL and <RDL
ND	Analyte concentration is not detected above the limits as defined as the “U” qualifier
U	Analyte was analyzed for, but not detected above the MDL, MDA, MDC, or LOD
UI	Gamma Spectroscopy – uncertain identification; these results were evaluated and found to be false positives, unless otherwise noted
X	Lab specific qualifier – see notes from data tables for details.

10.1 Detection of activity

It is often not possible to say for certain when net radioactivity is present in samples at environmental background levels due to natural variations in counting instrument backgrounds and other factors. The data below is reported as determined by the lab with uncertainties and all data has been included (even results with negative numbers). Results with U, UI, or ND qualifiers are considered “not detected” and results with L, M, or blank qualifiers are considered to be “detected.”

AIRBORNE CARTRIDGE: RADIOIODINE

Sample Date	Air Station M-1 (pCi/m³)	Air Station M-2 (pCi/m³)	Air Station M-3 (pCi/m³)	Air Station M-4 (pCi/m³)	Air Station M-5 (pCi/m³)
1/2/2020	-5.59E-04 ± 5.56E-03 U	-6.17E-03 ± 6.22E-03 U	7.53E-04 ± 4.71E-03 U	-3.84E-03 ± 9.10E-03 U	1.96E-03 ± 6.42E-03 U
1/8/2020	2.64E-03 ± 7.44E-03 U	-2.34E-03 ± 7.32E-03 U	9.59E-05 ± 7.12E-03 U	6.31E-03 ± 7.63E-03 U	-3.17E-03 ± 7.12E-03 U
1/15/2020	2.36E-03 ± 5.26E-03 U	-4.62E-03 ± 5.33E-03 U	-3.52E-03 ± 6.24E-03 U	2.54E-03 ± 7.10E-03 U	-2.61E-03 ± 7.58E-03 U
1/22/2020	-4.02E-03 ± 5.69E-03 U	-3.69E-03 ± 8.26E-03 U	3.07E-03 ± 7.42E-03 U	-1.09E-03 ± 6.08E-03 U	5.39E-03 ± 6.10E-03 U
1/29/2020	-1.86E-04 ± 5.87E-03 U	5.68E-03 ± 7.81E-03 U	-6.07E-03 ± 6.29E-03 U	2.62E-03 ± 8.46E-03 U	-5.10E-03 ± 5.38E-03 U
2/5/2020	-6.44E-03 ± 9.09E-03 U	-1.40E-03 ± 7.84E-03 U	1.33E-03 ± 6.39E-03 U	-3.29E-03 ± 7.66E-03 U	3.28E-03 ± 6.17E-03 U
2/12/2020	-7.65E-03 ± 9.69E-03 U	3.17E-03 ± 5.23E-03 U	2.14E-03 ± 5.08E-03 U	8.29E-04 ± 6.87E-03 U	3.09E-03 ± 6.22E-03 U
2/19/2020	-3.60E-03 ± 8.46E-03 U	-1.66E-03 ± 5.20E-03 U	2.77E-03 ± 6.57E-03 U	5.57E-03 ± 7.76E-03 U	2.55E-03 ± 4.15E-03 U
2/26/2020	7.85E-04 ± 6.00E-03 U	3.14E-03 ± 4.94E-03 U	2.11E-03 ± 6.20E-03 U	-4.18E-03 ± 6.98E-03 U	6.68E-03 ± 7.28E-03 U
3/4/2020	-1.18E-03 ± 1.07E-02 U	-3.36E-03 ± 9.48E-03 U	-2.39E-03 ± 6.43E-03 U	-9.01E-04 ± 7.51E-03 U	6.92E-04 ± 9.33E-03 U
3/11/2020	1.09E-03 ± 5.45E-03 U	-1.40E-03 ± 5.69E-03 U	4.87E-03 ± 8.41E-03 U	-2.38E-03 ± 5.48E-03 U	3.80E-03 ± 5.31E-03 U
3/18/2020	4.04E-03 ± 7.00E-03 U	-7.62E-05 ± 5.71E-03 U	-1.65E-03 ± 5.86E-03 U	-1.78E-03 ± 5.50E-03 U	4.59E-03 ± 6.26E-03 U
3/25/2020	-1.66E-02 ± 1.64E-02 U	6.18E-04 ± 1.61E-02 U	-5.40E-03 ± 1.17E-02 U	-4.00E-03 ± 1.57E-02 U	1.73E-03 ± 1.20E-02 U
4/1/2020	7.02E-03 ± 6.13E-03 U	1.46E-03 ± 5.34E-03 U	-3.78E-03 ± 8.15E-03 U	-2.71E-03 ± 6.41E-03 U	-1.07E-03 ± 4.50E-03 U
4/8/2020	2.14E-03 ± 5.90E-03 U	-1.07E-03 ± 5.73E-03 U	-5.29E-03 ± 6.56E-03 U	-2.12E-03 ± 5.83E-03 U	-4.43E-03 ± 5.47E-03 U
4/15/2020	-2.17E-03 ± 6.88E-03 U	3.01E-03 ± 7.16E-03 U	-2.88E-03 ± 8.23E-03 U	2.66E-03 ± 7.04E-03 U	2.67E-03 ± 6.08E-03 U
4/22/2020	3.83E-04 ± 9.15E-03 U	4.77E-03 ± 5.66E-03 U	4.88E-04 ± 6.08E-03 U	-2.29E-03 ± 7.20E-03 U	-1.58E-03 ± 6.65E-03 U
4/29/2020	-9.04E-05 ± 7.18E-03 U	2.33E-04 ± 6.82E-03 U	4.26E-03 ± 8.59E-03 U	1.45E-03 ± 8.47E-03 U	4.64E-03 ± 7.55E-03 U
5/6/2020	9.94E-03 ± 9.74E-03 UI	-8.37E-04 ± 4.54E-03 U	1.47E-03 ± 6.61E-03 U	6.20E-04 ± 6.85E-03 U	1.07E-02 ± 9.88E-03 UI
5/13/2020	-3.74E-03 ± 7.04E-03 U	1.65E-03 ± 6.72E-03 U	-1.13E-03 ± 6.53E-03 U	2.44E-03 ± 6.06E-03 U	-2.39E-03 ± 6.57E-03 U
5/20/2020	-3.12E-03 ± 5.78E-03 U	2.83E-03 ± 7.50E-03 U	-9.02E-04 ± 5.06E-03 U	-2.85E-03 ± 5.49E-03 U	7.96E-03 ± 7.10E-03 U
5/27/2020	-1.26E-03 ± 5.62E-03 U	1.02E-03 ± 5.25E-03 U	-4.76E-03 ± 4.96E-03 U	1.27E-03 ± 4.69E-03 U	-3.52E-03 ± 6.11E-03 U
6/3/2020	9.22E-04 ± 7.63E-03 U	1.06E-04 ± 8.32E-03 U	3.24E-03 ± 9.54E-03 U	2.43E-03 ± 1.53E-02 U	-5.26E-03 ± 7.03E-03 U
6/10/2020	5.60E-03 ± 6.09E-03 U	2.30E-03 ± 5.61E-03 U	-4.01E-03 ± 8.57E-03 U	-2.19E-03 ± 4.95E-03 U	-1.61E-03 ± 6.92E-03 U
6/17/2020	1.44E-03 ± 6.72E-03 U	-6.27E-03 ± 7.46E-03 U	5.13E-03 ± 7.86E-03 U	2.47E-03 ± 7.83E-03 U	1.17E-03 ± 1.26E-02 U
6/24/2020	-1.04E-03 ± 7.37E-03 U	4.62E-03 ± 6.81E-03 U	-5.37E-03 ± 8.46E-03 U	8.59E-04 ± 9.85E-03 U	-5.67E-03 ± 7.62E-03 U
7/1/2020	-5.97E-03 ± 7.46E-03 U	-2.33E-03 ± 5.60E-03 U	7.70E-03 ± 1.29E-02 U	-4.05E-03 ± 8.06E-03 U	3.23E-03 ± 6.08E-03 U
7/8/2020	1.65E-04 ± 8.04E-03 U	4.59E-03 ± 9.07E-03 U	3.93E-03 ± 9.81E-03 U	-7.13E-03 ± 1.00E-02 U	4.20E-03 ± 1.36E-02 U

Sample Date	Air Station M-1 (pCi/m^3)	Air Station M-2 (pCi/m^3)	Air Station M-3 (pCi/m^3)	Air Station M-4 (pCi/m^3)	Air Station M-5 (pCi/m^3)
7/15/2020	2.45E-03 ± 5.90E-03 U	4.26E-03 ± 6.70E-03 U	2.23E-03 ± 6.52E-03 U	1.68E-03 ± 9.45E-03 U	-2.41E-03 ± 9.33E-03 U
7/22/2020	1.35E-03 ± 8.95E-03 U	4.01E-03 ± 9.92E-03 U	7.75E-04 ± 9.60E-03 U	-3.29E-03 ± 1.14E-02 U	5.67E-05 ± 7.60E-03 U
7/29/2020	-4.05E-03 ± 1.25E-02 U	4.51E-03 ± 9.09E-03 U	-2.45E-03 ± 1.17E-02 U	-2.84E-03 ± 8.71E-03 U	5.86E-03 ± 1.22E-02 U
8/5/2020	3.09E-04 ± 7.21E-03 U	-2.20E-03 ± 6.71E-03 U	4.70E-04 ± 7.79E-03 U	-9.73E-04 ± 6.24E-03 U	3.21E-03 ± 6.06E-03 U
8/12/2020	-1.59E-03 ± 6.93E-03 U	-3.59E-03 ± 9.09E-03 U	8.96E-05 ± 8.52E-03 U	-5.80E-05 ± 8.50E-03 U	-2.11E-03 ± 7.76E-03 U
8/19/2020	1.45E-03 ± 6.14E-03 U	-9.53E-04 ± 9.53E-03 U	-1.02E-03 ± 1.18E-02 U	-2.04E-04 ± 9.02E-03 U	5.65E-04 ± 5.61E-03 U
8/26/2020	5.49E-03 ± 7.19E-03 U	1.36E-04 ± 5.64E-03 U	4.50E-03 ± 8.68E-03 U	1.16E-03 ± 7.35E-03 U	-3.05E-03 ± 6.19E-03 U
9/2/2020	8.76E-05 ± 6.76E-03 U	1.01E-03 ± 6.80E-03 U	3.16E-03 ± 5.85E-03 U	5.76E-03 ± 7.57E-03 U	3.66E-03 ± 8.03E-03 U
9/9/2020	1.16E-03 ± 6.77E-03 U	2.50E-03 ± 6.67E-03 U	4.13E-03 ± 7.02E-03 U	-1.47E-03 ± 6.65E-03 U	5.31E-04 ± 7.39E-03 U
9/16/2020	2.71E-03 ± 7.19E-03 U	1.19E-03 ± 7.51E-03 U	-2.44E-03 ± 5.58E-03 U	-4.18E-04 ± 5.63E-03 U	-5.79E-04 ± 6.45E-03 U
9/23/2020	6.84E-04 ± 5.67E-03 U	2.40E-03 ± 6.38E-03 U	-4.29E-03 ± 7.67E-03 U	1.40E-02 ± 9.29E-03 UI	2.20E-03 ± 6.71E-03 U
9/30/2020	-6.37E-04 ± 7.55E-03 U	-2.16E-03 ± 6.78E-03 U	2.60E-03 ± 1.05E-02 U	3.23E-03 ± 8.46E-03 U	-7.15E-04 ± 6.36E-03 U
10/7/2020	-4.85E-03 ± 6.98E-03 U	-1.57E-03 ± 9.16E-03 U	-9.02E-03 ± 6.80E-03 U	7.84E-03 ± 6.90E-03 U	1.21E-03 ± 5.80E-03 U
10/14/2020	-2.47E-03 ± 9.51E-03 U	1.60E-03 ± 1.13E-02 U	-3.36E-03 ± 8.94E-03 U	-4.26E-03 ± 1.13E-02 U	2.16E-03 ± 8.47E-03 U
10/21/2020	7.23E-04 ± 7.98E-03 U	1.11E-04 ± 9.73E-03 U	6.25E-03 ± 7.38E-03 U	-5.92E-03 ± 9.48E-03 U	-4.17E-03 ± 8.48E-03 U
10/28/2020	-4.50E-03 ± 8.78E-03 U	3.48E-03 ± 1.18E-02 U	-1.07E-03 ± 7.69E-03 U	-1.10E-02 ± 1.25E-02 U	6.83E-04 ± 9.91E-03 U
11/4/2020	-5.03E-04 ± 6.82E-03 U	4.47E-03 ± 1.34E-02 U	-3.04E-03 ± 8.93E-03 U	1.22E-02 ± 1.44E-02 U	-5.94E-03 ± 6.40E-03 U
11/11/2020	-1.15E-03 ± 5.37E-03 U	3.68E-03 ± 8.56E-03 U	-4.24E-03 ± 6.06E-03 U	3.17E-03 ± 5.50E-03 U	5.60E-04 ± 5.38E-03 U
11/18/2020	-1.93E-03 ± 5.83E-03 U	1.92E-03 ± 5.50E-03 U	3.45E-03 ± 4.90E-03 U	-5.45E-03 ± 5.26E-03 U	1.83E-03 ± 5.93E-03 U
11/25/2020	-2.49E-03 ± 8.00E-03 U	6.46E-03 ± 8.18E-03 U	-3.34E-03 ± 1.19E-02 U	2.50E-03 ± 8.90E-03 U	-1.38E-03 ± 9.89E-03 U
12/2/2020	-1.78E-03 ± 6.57E-03 U	4.81E-03 ± 6.76E-03 U	-2.59E-04 ± 6.69E-03 U	-1.99E-03 ± 7.42E-03 U	-6.82E-03 ± 7.07E-03 U
12/9/2020	4.15E-03 ± 7.00E-03 U	-1.70E-03 ± 6.82E-03 U	-4.02E-03 ± 7.17E-03 U	-6.20E-04 ± 7.44E-03 U	3.90E-03 ± 5.98E-03 U
12/16/2020	-5.02E-03 ± 7.85E-03 U	1.44E-02 ± 9.02E-03 UI	2.57E-03 ± 8.37E-03 U	5.32E-03 ± 5.59E-03 U	-5.76E-04 ± 5.39E-03 U
12/23/2020	2.67E-03 ± 7.54E-03 U	2.75E-03 ± 1.13E-02 U	-2.36E-03 ± 1.76E-02 U	-6.82E-04 ± 8.48E-03 U	-1.08E-02 ± 1.58E-02 U
12/30/2020	8.26E-03 ± 8.08E-03 U	7.60E-04 ± 8.18E-03 U	1.23E-02 ± 9.71E-03 U	-1.64E-03 ± 8.39E-03 U	-5.61E-04 ± 8.80E-03 U

AIRBORNE PARTICULATES: GROSS BETA

Sample Date	Air Station M-1 (pCi/m³)	Air Station M-2 (pCi/m³)	Air Station M-3 (pCi/m³)	Air Station M-4 (pCi/m³)	Air Station M-5 (pCi/m³)
1/2/2020	0.049 ± 0.005	0.046 ± 0.005	0.046 ± 0.005	0.060 ± 0.007	0.053 ± 0.006
1/8/2020	0.027 ± 0.005	0.026 ± 0.004	0.029 ± 0.005	0.036 ± 0.006	0.030 ± 0.005
1/15/2020	0.046 ± 0.005	0.041 ± 0.005	0.048 ± 0.006	0.057 ± 0.006	0.045 ± 0.005
1/22/2020	0.082 ± 0.007	0.068 ± 0.006	0.073 ± 0.007	0.068 ± 0.006	0.075 ± 0.007
1/29/2020	0.037 ± 0.005	0.033 ± 0.004	0.036 ± 0.005	0.041 ± 0.005	0.034 ± 0.005
2/5/2020	0.036 ± 0.005	0.044 ± 0.006	0.035 ± 0.005	0.037 ± 0.005	0.042 ± 0.005
2/12/2020	0.035 ± 0.005	0.037 ± 0.005	0.049 ± 0.006	0.037 ± 0.005	0.036 ± 0.005
2/19/2020	0.049 ± 0.006	0.045 ± 0.005	0.043 ± 0.005	0.039 ± 0.005	0.047 ± 0.006
2/26/2020	0.039 ± 0.005	0.047 ± 0.005	0.046 ± 0.005	0.054 ± 0.006	0.042 ± 0.005
3/4/2020	0.037 ± 0.005	0.034 ± 0.005	0.030 ± 0.004	0.033 ± 0.004	0.036 ± 0.005
3/11/2020	0.027 ± 0.004	0.025 ± 0.004	0.040 ± 0.006	0.037 ± 0.005	0.029 ± 0.004
3/18/2020	0.045 ± 0.006	0.039 ± 0.005	0.044 ± 0.005	0.041 ± 0.005	0.043 ± 0.005
3/25/2020	0.048 ± 0.005	0.042 ± 0.005	0.052 ± 0.006	0.056 ± 0.006	0.039 ± 0.005
4/1/2020	0.032 ± 0.005	0.038 ± 0.005	0.040 ± 0.005	0.043 ± 0.005	0.036 ± 0.005
4/8/2020	0.037 ± 0.005	0.043 ± 0.005	0.040 ± 0.005	0.037 ± 0.005	0.039 ± 0.005
4/15/2020	0.048 ± 0.006	0.033 ± 0.005	0.031 ± 0.004	0.033 ± 0.004	0.039 ± 0.005
4/22/2020	0.046 ± 0.006	0.036 ± 0.005	0.032 ± 0.004	0.036 ± 0.005	0.043 ± 0.006
4/29/2020	0.029 ± 0.004	0.026 ± 0.004	0.042 ± 0.006	0.028 ± 0.005	0.030 ± 0.004
5/6/2020	0.018 ± 0.004	0.012 ± 0.002	0.021 ± 0.004	0.027 ± 0.005	0.016 ± 0.004
5/13/2020	0.026 ± 0.004	0.026 ± 0.004	0.029 ± 0.005	0.038 ± 0.006	0.028 ± 0.004
5/20/2020	0.022 ± 0.004	0.024 ± 0.004	0.029 ± 0.005	0.023 ± 0.004	0.025 ± 0.004
5/27/2020	0.021 ± 0.003	0.022 ± 0.004	0.023 ± 0.004	0.020 ± 0.003	0.024 ± 0.004
6/3/2020	0.023 ± 0.004	0.026 ± 0.004	0.022 ± 0.004	0.029 ± 0.005	0.027 ± 0.005
6/10/2020	0.033 ± 0.004	0.029 ± 0.004	0.032 ± 0.004	0.027 ± 0.004	0.035 ± 0.005
6/17/2020	0.028 ± 0.004	0.026 ± 0.004	0.030 ± 0.004	0.025 ± 0.004	0.024 ± 0.004
6/24/2020	0.026 ± 0.004	0.032 ± 0.005	0.026 ± 0.004	0.030 ± 0.005	0.030 ± 0.005
7/1/2020	0.030 ± 0.004	0.026 ± 0.004	0.028 ± 0.004	0.029 ± 0.005	0.027 ± 0.004
7/8/2020	0.036 ± 0.005	0.047 ± 0.006	0.046 ± 0.006	0.051 ± 0.006	0.054 ± 0.006
7/15/2020	0.027 ± 0.004	0.031 ± 0.004	0.030 ± 0.005	0.031 ± 0.005	0.034 ± 0.005
7/22/2020	0.025 ± 0.004	0.025 ± 0.004	0.029 ± 0.005	0.027 ± 0.004	0.023 ± 0.004
7/29/2020	0.027 ± 0.004	0.025 ± 0.004	0.028 ± 0.004	0.022 ± 0.004	0.027 ± 0.004
8/5/2020	0.024 ± 0.004	0.023 ± 0.004	0.022 ± 0.004	0.021 ± 0.004	0.020 ± 0.004
8/12/2020	0.034 ± 0.005	0.032 ± 0.004	0.035 ± 0.005	0.033 ± 0.005	0.034 ± 0.005
8/19/2020	0.033 ± 0.005	0.029 ± 0.005	0.034 ± 0.005	0.030 ± 0.004	0.031 ± 0.004

Sample Date	Air Station M-1 (pCi/m³)	Air Station M-2 (pCi/m³)	Air Station M-3 (pCi/m³)	Air Station M-4 (pCi/m³)	Air Station M-5 (pCi/m³)
8/26/2020	0.042 ± 0.005	0.049 ± 0.006	0.050 ± 0.006	0.044 ± 0.005	0.043 ± 0.005
9/2/2020	0.039 ± 0.005	0.039 ± 0.005	0.037 ± 0.005	0.040 ± 0.005	0.031 ± 0.004
9/9/2020	0.021 ± 0.004	0.022 ± 0.004	0.021 ± 0.004	0.019 ± 0.004	0.021 ± 0.004
9/16/2020	0.033 ± 0.005	0.027 ± 0.004	0.040 ± 0.005	0.029 ± 0.004	0.035 ± 0.005
9/23/2020	0.046 ± 0.005	0.048 ± 0.006	0.051 ± 0.006	0.039 ± 0.005	0.041 ± 0.005
9/30/2020	0.042 ± 0.005	0.042 ± 0.005	0.046 ± 0.006	0.044 ± 0.005	0.044 ± 0.005
10/7/2020	0.030 ± 0.004	0.028 ± 0.004	0.026 ± 0.004	0.028 ± 0.004	0.028 ± 0.004
10/14/2020	0.036 ± 0.005	0.043 ± 0.006	0.032 ± 0.005	0.034 ± 0.005	0.038 ± 0.005
10/21/2020	0.032 ± 0.005	0.031 ± 0.005	0.032 ± 0.005	0.028 ± 0.004	0.025 ± 0.004
10/28/2020	0.047 ± 0.005	0.046 ± 0.006	0.054 ± 0.006	0.047 ± 0.005	0.050 ± 0.006
11/4/2020	0.053 ± 0.005	0.063 ± 0.007	0.053 ± 0.005	0.059 ± 0.006	0.055 ± 0.006
11/11/2020	0.066 ± 0.007	0.066 ± 0.007	0.066 ± 0.007	0.065 ± 0.006	0.072 ± 0.007
11/18/2020	0.061 ± 0.006	0.059 ± 0.006	0.059 ± 0.005	0.055 ± 0.005	0.061 ± 0.006
11/25/2020	0.056 ± 0.006	0.065 ± 0.007	0.064 ± 0.007	0.068 ± 0.007	0.067 ± 0.007
12/2/2020	0.049 ± 0.005	0.048 ± 0.005	0.048 ± 0.005	0.043 ± 0.005	0.057 ± 0.006
12/9/2020	0.071 ± 0.007	0.066 ± 0.007	0.085 ± 0.008	0.072 ± 0.007	0.070 ± 0.007
12/16/2020	0.045 ± 0.005	0.047 ± 0.006	0.050 ± 0.006	0.050 ± 0.005	0.048 ± 0.006
12/23/2020	0.060 ± 0.006	0.068 ± 0.006	0.067 ± 0.006	0.068 ± 0.006	0.075 ± 0.007
12/30/2020	0.033 ± 0.005	0.039 ± 0.005	0.034 ± 0.005	0.046 ± 0.005	0.038 ± 0.005

AIRBORNE PARTICULATES: GAMMA ISOTOPIC

Air Station M-1	Qtr 1 (pCi/m³)	Qtr 2 (pCi/m³)	Qtr 3 (pCi/m³)	Qtr 4 (pCi/m³)
Barium-140	7.28E-04 ± 2.50E-03 U	7.88E-04 ± 2.18E-03 U	2.57E-04 ± 1.98E-03 U	1.31E-03 ± 1.54E-03 U
Beryllium-7	6.34E-02 ± 8.61E-03	8.94E-02 ± 8.95E-03	8.21E-02 ± 8.63E-03	6.50E-02 ± 6.34E-03
Cerium-141	2.25E-04 ± 3.21E-04 U	2.57E-04 ± 3.37E-04 U	-1.54E-04 ± 3.15E-04 U	-8.99E-05 ± 2.07E-04 U
Cerium-144	8.50E-04 ± 1.06E-03 U	2.24E-04 ± 9.35E-04 U	2.16E-04 ± 9.45E-04 U	-8.45E-04 ± 6.53E-04 U
Cesium-134	-1.47E-04 ± 2.74E-04 U	-1.21E-04 ± 2.29E-04 U	1.84E-04 ± 2.73E-04 U	1.71E-04 ± 2.27E-04 U
Cesium-137	5.91E-05 ± 2.50E-04 U	-1.00E-04 ± 2.20E-04 U	-1.44E-05 ± 2.20E-04 U	1.94E-04 ± 4.07E-04 U
Cobalt-58	-1.09E-04 ± 2.85E-04 U	6.81E-05 ± 2.23E-04 U	1.53E-05 ± 2.35E-04 U	2.25E-04 ± 2.56E-04 U
Cobalt-60	2.65E-05 ± 2.33E-04 U	-3.10E-04 ± 2.69E-04 U	5.18E-05 ± 2.89E-04 U	-9.13E-05 ± 2.29E-04 U
Lanthanum-140	-1.67E-04 ± 1.04E-03 U	-1.44E-04 ± 9.17E-04 U	4.57E-04 ± 7.85E-04 U	1.85E-04 ± 2.94E-04 U

Air Station M-1	Qtr 1 (pCi/m³)	Qtr 2 (pCi/m³)	Qtr 3 (pCi/m³)	Qtr 4 (pCi/m³)
Manganese-54	-1.36E-04 ± 2.55E-04 **U**	1.35E-04 ± 3.44E-04 **U**	2.49E-04 ± 2.45E-04 **U**	1.90E-04 ± 2.56E-04 **U**
Niobium-95	-7.20E-05 ± 3.90E-04 **U**	1.01E-04 ± 3.22E-04 **U**	-1.80E-04 ± 2.37E-04 **U**	-2.26E-05 ± 2.55E-04 **U**
Ruthenium-103	-2.64E-05 ± 2.82E-04 **U**	-1.41E-04 ± 2.10E-04 **U**	-3.07E-05 ± 2.59E-04 **U**	-6.28E-05 ± 2.20E-04 **U**
Ruthenium-106	4.49E-04 ± 1.90E-03 **U**	1.51E-03 ± 2.19E-03 **U**	-7.62E-04 ± 1.76E-03 **U**	1.77E-03 ± 3.59E-03 **U**
Zinc-65	8.78E-04 ± 4.97E-04 **U**	-2.43E-04 ± 4.40E-04 **U**	-3.61E-05 ± 5.46E-04 **U**	2.22E-04 ± 4.82E-04 **U**
Zirconium-95	1.46E-04 ± 4.82E-04 **U**	-1.67E-04 ± 4.80E-04 **U**	4.73E-04 ± 5.45E-04 **U**	-7.80E-05 ± 4.52E-04 **U**

Air Station M-2	Qtr 1 (pCi/m³)	Qtr 2 (pCi/m³)	Qtr 3 (pCi/m³)	Qtr 4 (pCi/m³)
Barium-140	5.00E-04 ± 3.28E-03 **U**	-9.54E-04 ± 1.91E-03 **U**	4.88E-04 ± 2.05E-03 **U**	-1.15E-03 ± 2.16E-03 **U**
Beryllium-7	5.60E-02 ± 1.23E-02	8.80E-02 ± 7.94E-03	8.45E-02 ± 7.96E-03	6.64E-02 ± 9.20E-03
Cerium-141	-2.27E-04 ± 5.09E-04 **U**	-1.79E-04 ± 3.43E-04 **U**	-6.87E-06 ± 3.04E-04 **U**	-1.49E-04 ± 3.24E-04 **U**
Cerium-144	7.91E-04 ± 1.39E-03 **U**	-7.00E-04 ± 7.48E-04 **U**	-9.49E-05 ± 8.66E-04 **U**	-2.79E-04 ± 1.02E-03 **U**
Cesium-134	-1.62E-04 ± 3.43E-04 **U**	1.78E-04 ± 2.43E-04 **U**	-5.08E-05 ± 2.26E-04 **U**	1.75E-04 ± 3.34E-04 **U**
Cesium-137	1.48E-04 ± 4.99E-04 **U**	-1.60E-05 ± 2.00E-04 **U**	-9.78E-05 ± 2.40E-04 **U**	-6.32E-05 ± 2.99E-04 **U**
Cobalt-58	-6.92E-05 ± 3.96E-04 **U**	-1.95E-04 ± 1.85E-04 **U**	1.41E-04 ± 2.52E-04 **U**	1.49E-04 ± 3.13E-04 **U**
Cobalt-60	-2.87E-04 ± 4.00E-04 **U**	3.61E-04 ± 2.55E-04 **U**	-1.06E-04 ± 2.44E-04 **U**	-7.24E-05 ± 3.08E-04 **U**
Lanthanum-140	3.75E-05 ± 1.23E-03 **U**	1.18E-04 ± 5.86E-04 **U**	-5.77E-04 ± 8.73E-04 **U**	6.98E-04 ± 7.24E-04 **U**
Manganese-54	1.47E-04 ± 2.97E-04 **U**	-4.57E-05 ± 1.78E-04 **U**	-2.66E-05 ± 1.74E-04 **U**	1.03E-04 ± 3.13E-04 **U**
Niobium-95	1.85E-04 ± 3.61E-04 **U**	-1.17E-05 ± 2.53E-04 **U**	9.87E-07 ± 2.72E-04 **U**	3.35E-04 ± 3.59E-04 **U**
Ruthenium-103	-2.35E-04 ± 3.93E-04 **U**	-9.65E-05 ± 2.40E-04 **U**	6.62E-05 ± 2.63E-04 **U**	-5.85E-05 ± 2.35E-04 **U**
Ruthenium-106	4.75E-04 ± 2.19E-03 **U**	1.59E-03 ± 1.49E-03 **U**	1.90E-03 ± 2.11E-03 **U**	-1.30E-03 ± 2.81E-03 **U**
Zinc-65	-5.10E-04 ± 1.04E-03 **U**	-1.55E-04 ± 4.45E-04 **U**	1.74E-05 ± 5.50E-04 **U**	1.10E-05 ± 6.78E-04 **U**
Zirconium-95	-3.22E-06 ± 8.15E-04 **U**	2.07E-04 ± 3.29E-04 **U**	-1.67E-04 ± 4.47E-04 **U**	-4.12E-04 ± 5.08E-04 **U**

Air Station M-3	Qtr 1 (pCi/m³)	Qtr 2 (pCi/m³)	Qtr 3 (pCi/m³)	Qtr 4 (pCi/m³)
Barium-140	4.31E-04 ± 1.89E-03 U	2.93E-04 ± 2.35E-03 U	2.00E-04 ± 2.08E-03 U	6.09E-04 ± 1.31E-03 U
Beryllium-7	7.30E-02 ± 8.79E-03	1.04E-01 ± 1.06E-02	9.44E-02 ± 8.57E-03	6.23E-02 ± 7.35E-03
Cerium-141	-2.96E-04 ± 3.19E-04 U	-5.46E-04 ± 4.75E-04 U	2.85E-05 ± 3.30E-04 U	2.94E-05 ± 3.33E-04 U
Cerium-144	1.02E-04 ± 8.94E-04 U	-1.11E-04 ± 1.06E-03 U	4.44E-04 ± 1.05E-03 U	5.62E-04 ± 1.07E-03 U
Cesium-134	6.19E-05 ± 2.04E-04 U	-5.20E-05 ± 3.49E-04 U	-1.97E-04 ± 2.50E-04 U	-4.57E-05 ± 2.28E-04 U
Cesium-137	-5.49E-05 ± 2.07E-04 U	1.46E-04 ± 2.71E-04 U	1.47E-04 ± 2.20E-04 U	-4.50E-05 ± 2.35E-04 U
Cobalt-58	-1.78E-04 ± 2.71E-04 U	1.99E-05 ± 2.79E-04 U	-5.11E-05 ± 2.56E-04 U	5.11E-05 ± 2.99E-04 U
Cobalt-60	5.45E-05 ± 2.59E-04 U	-6.17E-05 ± 3.51E-04 U	-7.23E-05 ± 2.78E-04 U	-1.53E-04 ± 2.26E-04 U
Lanthanum-140	1.40E-05 ± 6.38E-04 U	1.24E-04 ± 1.55E-03 U	2.70E-04 ± 9.83E-04 U	9.70E-05 ± 6.51E-04 U
Manganese-54	-6.44E-05 ± 2.37E-04 U	1.89E-04 ± 2.56E-04 U	1.51E-04 ± 2.22E-04 U	9.74E-05 ± 2.40E-04 U
Niobium-95	1.04E-04 ± 2.48E-04 U	-1.62E-04 ± 3.19E-04 U	-2.14E-04 ± 3.32E-04 U	-6.32E-05 ± 3.26E-04 U
Ruthenium-103	-6.78E-05 ± 2.80E-04 U	-1.09E-04 ± 2.77E-04 U	3.81E-04 ± 4.03E-04 U	-2.10E-05 ± 2.49E-04 U
Ruthenium-106	-2.78E-04 ± 1.75E-03 U	1.34E-03 ± 2.45E-03 U	3.28E-03 ± 4.17E-03 UI	-4.38E-04 ± 2.12E-03 U
Zinc-65	-5.79E-05 ± 5.65E-04 U	3.53E-04 ± 6.59E-04 U	-3.98E-05 ± 5.13E-04 U	-2.04E-04 ± 4.96E-04 U
Zirconium-95	-4.73E-05 ± 3.79E-04 U	-9.80E-06 ± 6.03E-04 U	2.17E-04 ± 3.91E-04 U	6.97E-05 ± 4.04E-04 U

Air Station M-4	**Qtr 1** **(pCi/m³)**	**Qtr 2** **(pCi/m³)**	**Qtr 3** **(pCi/m³)**	**Qtr 4** **(pCi/m³)**
Barium-140	-5.06E-04 ± 2.33E-03 **U**	6.71E-04 ± 2.17E-03 **U**	6.91E-04 ± 1.92E-03 **U**	2.34E-03 ± 3.00E-03 **U**
Beryllium-7	6.96E-02 ± 8.48E-03	1.02E-01 ± 9.91E-03	7.39E-02 ± 7.69E-03	6.79E-02 ± 1.14E-02
Cerium-141	-2.17E-04 ± 4.39E-04 **U**	-2.38E-04 ± 4.09E-04 **U**	3.20E-04 ± 3.81E-04 **U**	-6.01E-04 ± 5.01E-04 **U**
Cerium-144	-7.48E-05 ± 1.11E-03 **U**	-2.87E-04 ± 1.06E-03 **U**	4.69E-04 ± 1.01E-03 **U**	-9.35E-04 ± 1.66E-03 **U**
Cesium-134	-1.09E-04 ± 2.53E-04 **U**	9.30E-05 ± 2.48E-04 **U**	2.94E-05 ± 2.03E-04 **U**	4.67E-04 ± 4.86E-04 **U**
Cesium-137	4.12E-05 ± 2.70E-04 **U**	-6.45E-05 ± 2.58E-04 **U**	2.25E-04 ± 1.60E-04 **U**	5.61E-05 ± 4.77E-04 **U**
Cobalt-58	-1.30E-05 ± 2.61E-04 **U**	1.07E-05 ± 2.63E-04 **U**	7.58E-05 ± 2.02E-04 **U**	6.13E-04 ± 5.24E-04 **U**
Cobalt-60	3.21E-05 ± 3.18E-04 **U**	1.12E-04 ± 2.84E-04 **U**	-1.77E-05 ± 2.49E-04 **U**	1.14E-04 ± 4.97E-04 **U**
Lanthanum-140	-3.73E-04 ± 9.97E-04 **U**	-3.12E-04 ± 8.07E-04 **U**	-8.57E-05 ± 7.10E-04 **U**	5.71E-05 ± 1.11E-03 **U**
Manganese-54	-4.82E-05 ± 2.81E-04 **U**	3.30E-04 ± 2.53E-04 **U**	-1.89E-05 ± 2.69E-04 **U**	-8.82E-05 ± 4.40E-04 **U**
Niobium-95	3.41E-05 ± 3.97E-04 **U**	1.13E-04 ± 2.30E-04 **U**	-1.21E-05 ± 2.21E-04 **U**	-2.78E-04 ± 5.08E-04 **U**
Ruthenium-103	-2.65E-05 ± 3.27E-04 **U**	1.19E-04 ± 2.86E-04 **U**	-9.09E-07 ± 2.14E-04 **U**	-2.67E-04 ± 4.05E-04 **U**
Ruthenium-106	2.93E-04 ± 2.48E-03 **U**	1.27E-03 ± 2.13E-03 **U**	1.29E-03 ± 1.89E-03 **U**	5.86E-04 ± 2.76E-03 **U**
Zinc-65	-2.54E-04 ± 6.22E-04 **U**	-1.89E-04 ± 4.42E-04 **U**	-2.24E-04 ± 5.67E-04 **U**	-2.55E-04 ± 1.14E-03 **U**
Zirconium-95	-2.94E-04 ± 4.89E-04 **U**	1.58E-04 ± 4.81E-04 **U**	1.11E-04 ± 4.53E-04 **U**	-1.98E-04 ± 8.47E-04 **U**

Air Station M-5	Qtr 1 (pCi/m³)	Qtr 2 (pCi/m³)	Qtr 3 (pCi/m³)	Qtr 4 (pCi/m³)
Barium-140	-1.53E-03 ± 2.25E-03 U	-5.80E-04 ± 2.57E-03 U	5.54E-04 ± 2.37E-03 U	3.87E-04 ± 1.87E-03 U
Beryllium-7	6.34E-02 ± 7.51E-03	9.93E-02 ± 9.92E-03	8.15E-02 ± 8.75E-03	6.72E-02 ± 8.23E-03
Cerium-141	-4.54E-04 ± 4.60E-04 U	-3.07E-04 ± 4.97E-04 U	-7.40E-04 ± 4.46E-04 U	4.06E-05 ± 4.38E-04 U
Cerium-144	5.54E-06 ± 1.08E-03 U	1.01E-03 ± 1.85E-03 U	4.65E-04 ± 1.09E-03 U	4.41E-04 ± 1.15E-03 U
Cesium-134	-4.00E-05 ± 2.73E-04 U	2.03E-04 ± 2.77E-04 U	1.16E-04 ± 2.64E-04 U	-2.39E-04 ± 3.01E-04 U
Cesium-137	6.29E-05 ± 2.38E-04 U	1.85E-04 ± 2.44E-04 U	2.98E-05 ± 2.35E-04 U	-1.88E-06 ± 2.63E-04 U
Cobalt-58	-1.36E-04 ± 2.82E-04 U	5.44E-05 ± 3.00E-04 U	4.17E-05 ± 2.88E-04 U	5.70E-05 ± 2.60E-04 U
Cobalt-60	-1.46E-05 ± 2.41E-04 U	7.59E-05 ± 2.50E-04 U	4.65E-06 ± 2.75E-04 U	-1.75E-04 ± 2.63E-04 U
Lanthanum-140	-6.90E-04 ± 8.45E-04 U	3.78E-04 ± 1.13E-03 U	3.00E-04 ± 6.78E-04 U	9.26E-06 ± 8.75E-04 U
Manganese-54	1.18E-04 ± 2.20E-04 U	-9.32E-05 ± 2.71E-04 U	6.09E-05 ± 2.12E-04 U	2.26E-04 ± 2.46E-04 U
Niobium-95	2.61E-05 ± 3.16E-04 U	-6.21E-05 ± 3.22E-04 U	4.78E-05 ± 3.19E-04 U	-1.57E-04 ± 3.04E-04 U
Ruthenium-103	-1.23E-04 ± 2.75E-04 U	1.51E-04 ± 3.05E-04 U	-1.30E-04 ± 2.32E-04 U	2.06E-06 ± 3.38E-04 U
Ruthenium-106	1.56E-04 ± 2.11E-03 U	2.20E-03 ± 2.46E-03 U	-1.73E-03 ± 1.87E-03 U	-5.83E-04 ± 2.45E-03 U
Zinc-65	5.43E-05 ± 4.47E-04 U	1.55E-04 ± 6.03E-04 U	-2.91E-04 ± 6.00E-04 U	1.52E-04 ± 5.33E-04 U
Zirconium-95	8.74E-05 ± 5.38E-04 U	-2.97E-04 ± 6.24E-04 U	1.98E-04 ± 5.17E-04 U	7.14E-05 ± 3.98E-04 U

SEDIMENT: GAMMA ISOTOPIC

M-8c Upstream of Plant	Qtr 2 (pCi/Kg, dry)	Qtr 4 (pCi/Kg, dry)		M-9 Downstream of Plant	Qtr 2 (pCi/Kg, dry)	Qtr 4 (pCi/Kg, dry)
Barium-140	-53.9 ± 55.0 U	33.7 ± 87.7 U		Barium-140	4.3 ± 93.2 U	-15.0 ± 98.3 U
Beryllium-7	117.0 ± 97.5 U	178.0 ± 276.0 U		Beryllium-7	234.0 ± 270.0 UI	699.0 ± 342.0
Cerium-144	20.4 ± 64.9 U	-55.9 ± 91.2 U		Cerium-144	61.5 ± 62.6 U	44.2 ± 116.0 U
Cesium-134	8.2 ± 16.3 U	25.6 ± 24.8 U		Cesium-134	14.0 ± 17.6 U	-14.1 ± 24.0 U
Cesium-137	34.8 ± 23.4 M	6.9 ± 16.3 U		Cesium-137	20.9 ± 25.2 U	36.2 ± 27.5 U
Cobalt-58	-4.2 ± 12.9 U	10.3 ± 14.4 U		Cobalt-58	-7.0 ± 17.7 U	20.3 ± 16.8 U
Cobalt-60	4.1 ± 15.3 U	-10.1 ± 20.1 U		Cobalt-60	0.3 ± 16.4 U	-0.5 ± 26.2 U
Iron-59	-24.9 ± 39.8 U	9.2 ± 35.7 U		Iron-59	-22.8 ± 33.2 U	-11.8 ± 44.3 U
Lanthanum-140	-16.6 ± 17.0 U	4.1 ± 25.4 U		Lanthanum-140	-21.6 ± 28.4 U	-10.3 ± 35.3 U
Manganese-54	3.8 ± 13.8 U	6.1 ± 16.2 U		Manganese-54	15.4 ± 19.1 U	-6.5 ± 21.0 U
Niobium-95	3.1 ± 13.1 U	-4.3 ± 16.2 U		Niobium-95	11.6 ± 17.0 U	-0.8 ± 25.9 U
Potassium-40	10600.0 ± 750.0	11100.0 ± 837.0		Potassium-40	11000.0 ± 805.0	11800.0 ± 1070.0
Ruthenium-103	-0.4 ± 11.2 U	2.3 ± 13.7 U		Ruthenium-103	-8.0 ± 11.9 U	-1.5 ± 20.5 U
Ruthenium-106	80.1 ± 99.1 U	4.0 ± 136.0 U		Ruthenium-106	11.6 ± 140.0 U	20.5 ± 184.0 U
Zinc-65	6.5 ± 36.5 U	9.4 ± 38.9 U		Zinc-65	1.6 ± 37.8 U	25.5 ± 45.7 U
Zirconium-95	13.6 ± 25.0 U	6.2 ± 30.7 U		Zirconium-95	-21.6 ± 30.2 U	-9.0 ± 42.4 U

M-15 Montissippi Park	Qtr 2 (pCi/Kg, dry)	Qtr 4 (pCi/Kg, dry)
Barium-140	40.0 ± 46.8 **U**	-68.8 ± 94.8 **U**
Beryllium-7	320.0 ± 200.0	456.0 ± 262.0
Cerium-144	15.0 ± 68.1 **U**	-19.7 ± 90.9 **U**
Cesium-134	22.0 ± 23.9 **U**	24.6 ± 28.7 **U**
Cesium-137	22.6 ± 26.1 **UI**	27.2 ± 21.9 **U**
Cobalt-58	5.7 ± 12.5 **U**	9.8 ± 16.5 **U**
Cobalt-60	-1.2 ± 13.8 **U**	8.4 ± 18.6 **U**
Iron-59	21.1 ± 28.7 **U**	3.7 ± 42.4 **U**
Lanthanum-140	1.9 ± 12.1 **U**	4.0 ± 28.1 **U**
Manganese-54	25.9 ± 20.3 **UI**	6.0 ± 17.4 **U**
Niobium-95	-4.2 ± 15.4 **U**	-0.4 ± 18.9 **U**
Potassium-40	12500.0 ± 700.0	12700.0 ± 963.0
Ruthenium-103	-6.8 ± 10.8 **U**	3.4 ± 18.1 **U**
Ruthenium-106	-23.1 ± 108.0 **U**	2.3 ± 153.0 **U**
Zinc-65	15.1 ± 35.7 **U**	2.9 ± 48.5 **U**
Zirconium-95	3.0 ± 26.8 **U**	21.0 ± 31.0 **U**

TISSUE – FISH: GAMMA ISOTOPIC

(pCi/Kg, wet)	M-8c Upstream of Plant				M-9 Downstream of Plant			
	May		Sep		May		Sep	
	Fish 1	Fish 2	Fish 1	Fish 2	Fish 1	Fish 2	Fish 1	Fish 2
Barium-140	9.6 ± 18.5 **U**	8.4 ± 15.8 **U**	-1.2 ± 30.0 **U**	22.0 ± 36.6 **U**	14.2 ± 19.3 **U**	12.5 ± 34.5 **U**	9.0 ± 26.2 **U**	19.0 ± 36.0 **U**
Cerium-144	-21.5 ± 21.4 **U**	-7.7 ± 18.4 **U**	-28.9 ± 44.7 **U**	3.1 ± 43.3 **U**	-13.5 ± 16.0 **U**	0.7 ± 16.7 **U**	-21.8 ± 28.3 **U**	3.4 ± 45.1 **U**
Cesium-134	3.1 ± 3.9 **U**	-6.6 ± 4.2 **U**	0.7 ± 8.4 **U**	3.9 ± 11.4 **U**	3.7 ± 3.9 **U**	2.1 ± 5.4 **U**	0.1 ± 7.1 **U**	0.7 ± 9.0 **U**
Cesium-137	1.5 ± 3.6 **U**	5.3 ± 3.5 **U**	-0.6 ± 7.5 **U**	2.2 ± 10.1 **U**	1.8 ± 3.6 **U**	5.1 ± 4.9 **U**	2.1 ± 5.3 **U**	7.1 ± 9.4 **U**
Cobalt-58	2.0 ± 3.4 **U**	-0.2 ± 3.2 **U**	4.4 ± 8.8 **U**	0.2 ± 10.9 **U**	2.9 ± 3.1 **U**	0.0 ± 3.0 **U**	1.1 ± 6.1 **U**	-2.0 ± 8.1 **U**
Cobalt-60	1.0 ± 4.3 **U**	-2.6 ± 3.7 **U**	-1.1 ± 10.7 **U**	4.1 ± 9.3 **U**	-0.6 ± 4.0 **U**	-0.3 ± 3.5 **U**	-3.0 ± 5.9 **U**	2.1 ± 10.4 **U**
Iron-59	-2.1 ± 8.1 **U**	8.5 ± 7.8 **U**	-12.0 ± 19.5 **U**	22.6 ± 21.8 **U**	3.7 ± 7.7 **U**	3.2 ± 8.0 **U**	-0.3 ± 14.7 **U**	-2.8 ± 16.9 **U**
Lanthanum-140	5.4 ± 4.9 **U**	-3.6 ± 4.9 **U**	-8.6 ± 12.8 **U**	-6.2 ± 8.6 **U**	3.4 ± 4.7 **U**	-5.2 ± 4.3 **U**	0.1 ± 9.0 **U**	4.0 ± 12.1 **U**
Manganese-54	0.3 ± 3.5 **U**	0.3 ± 3.0 **U**	5.2 ± 8.2 **U**	0.5 ± 9.3 **U**	1.4 ± 3.3 **U**	-3.9 ± 3.2 **U**	0.9 ± 5.9 **U**	4.8 ± 8.1 **U**
Niobium-95	1.4 ± 3.2 **U**	1.6 ± 3.1 **U**	1.9 ± 9.5 **U**	3.9 ± 8.2 **U**	-0.4 ± 3.9 **U**	0.2 ± 3.4 **U**	1.7 ± 5.9 **U**	0.4 ± 8.5 **U**
Potassium-40	3260.0 ± 201.0	3200.0 ± 194.0	3140.0 ± 448.0	3300.0 ± 459.0	3210.0 ± 201.0	3030.0 ± 193.0	3220.0 ± 379.0	3230.0 ± 470.0
Zinc-65	-3.1 ± 8.5 **U**	1.6 ± 9.6 **U**	3.8 ± 15.5 **U**	19.4 ± 29.1 **U**	7.7 ± 10.0 **U**	0.2 ± 9.3 **U**	2.1 ± 14.7 **U**	10.8 ± 22.7 **U**
Zirconium-95	-1.6 ± 5.9 **U**	1.1 ± 6.0 **U**	-5.3 ± 11.7 **U**	-3.4 ± 14.2 **U**	2.5 ± 5.7 **U**	2.0 ± 5.8 **U**	2.4 ± 9.2 **U**	32.5 ± 22.5 **UI**

TISSUE – PLANT: GAMMA ISOTOPIC

pCi/Kg	M-41 Training Center				M-42 Biology Station Road			
	Jun	Jul	Aug	Sep	Jun	Jul	Aug	Sep
Cesium-134	-4.1 ± 9.4 U	4.3 ± 11.3 U	-1.2 ± 9.4 U	4.6 ± 9.5 U	2.3 ± 11.9 U	-0.5 ± 13.0 U	-1.8 ± 9.0 U	4.1 ± 17.0 U
Cesium-137	-3.9 ± 7.6 U	3.7 ± 10.6 U	3.4 ± 7.6 U	25.5 ± 20.3 UI	-3.9 ± 11.3 U	7.7 ± 12.1 U	-2.9 ± 7.0 U	-9.5 ± 20.7 U
Cobalt-58	-8.6 ± 10.8 U	-4.2 ± 10.2 U	4.4 ± 8.7 U	-5.1 ± 8.7 U	0.3 ± 11.5 U	4.5 ± 10.5 U	2.8 ± 8.0 U	9.0 ± 13.7 U
Cobalt-60	1.5 ± 9.5 U	-3.6 ± 14.9 U	-2.5 ± 10.2 U	-4.3 ± 9.4 U	5.8 ± 20.1 U	-2.5 ± 17.7 U	-1.6 ± 10.6 U	-2.0 ± 12.2 U
Iodine-131	9.1 ± 16.5 U	-11.0 ± 15.3 U	-2.9 ± 12.8 U	-2.3 ± 16.2 U	26.0 ± 19.3 U	11.2 ± 21.0 U	-7.6 ± 10.8 U	20.9 ± 23.2 U
Iron-59	-16.6 ± 24.8 U	-19.6 ± 23.7 U	0.3 ± 17.7 U	-2.7 ± 22.3 U	4.6 ± 26.7 U	-21.3 ± 29.8 U	-8.7 ± 17.6 U	-12.5 ± 28.3 U
Manganese-54	-5.7 ± 8.8 U	-0.6 ± 7.7 U	6.8 ± 8.9 U	-0.4 ± 8.4 U	-8.9 ± 12.2 U	4.5 ± 12.7 U	-0.3 ± 8.0 U	-12.1 ± 14.7 U
Niobium-95	5.5 ± 9.0 U	5.0 ± 9.6 U	4.0 ± 9.0 U	-0.2 ± 8.6 U	-4.2 ± 11.0 U	1.7 ± 12.4 U	4.2 ± 8.5 U	6.3 ± 15.2 U
Zinc-65	0.9 ± 21.4 U	2.7 ± 18.3 U	17.9 ± 38.7 U	0.0 ± 20.9 U	-18.4 ± 30.4 U	-16.6 ± 29.2 U	-5.7 ± 18.4 U	4.8 ± 28.9 U

pCi/Kg	M-43 Imholte Farm			
	Jun	Jul	Aug	Sep
Cesium-134	-2.0 ± 9.8 U	20.4 ± 17.7 U	-2.3 ± 17.9 U	1.7 ± 13.4 U
Cesium-137	-4.1 ± 7.5 U	2.0 ± 17.0 U	1.6 ± 14.5 U	0.2 ± 11.9 U
Cobalt-58	1.8 ± 7.9 U	-3.1 ± 14.6 U	6.1 ± 13.8 U	0.1 ± 11.4 U
Cobalt-60	-4.3 ± 9.0 U	-8.2 ± 14.6 U	4.2 ± 16.9 U	7.6 ± 12.4 U
Iodine-131	3.3 ± 15.8 U	2.6 ± 25.4 U	6.2 ± 22.3 U	19.9 ± 21.2 U
Iron-59	-28.2 ± 24.4 U	-0.7 ± 35.6 U	0.3 ± 33.9 U	-15.2 ± 23.1 U
Manganese-54	1.9 ± 9.1 U	-7.7 ± 13.7 U	-1.4 ± 13.0 U	6.1 ± 11.6 U
Niobium-95	11.9 ± 9.1 U	7.0 ± 14.7 U	2.4 ± 14.7 U	-3.5 ± 14.4 U
Zinc-65	10.5 ± 24.0 U	3.7 ± 37.2 U	14.0 ± 38.5 U	20.3 ± 29.9 U

WATER: TRITIUM

pCi/L	Qtr 1	Qtr 2	Qtr 3	Qtr 4
M-11 City of Monticello	-57.0 ± 249.0 **U**	108.0 ± 181.0 **U**	63.4 ± 275.0 **U**	24.2 ± 133.0 **U**
M-12 Plant Well #11	35.0 ± 254.0 **U**	159.0 ± 189.0 **U**	15.6 ± 272.0 **U**	-26.4 ± 131.0 **U**
M-14 City of Minneapolis[1]	142.0 ± 278.0 **U**	176.0 ± 136.0 **U**	56.6 ± 112.0 **U**	65.4 ± 171.0 **U**
M-43 Imholte Farm	-23.4 ± 248.0 **U**	-47.3 ± 169.0 **U**	42.8 ± 265.0 **U**	-0.2 ± 136.0 **U**
M-55 Hasbrouck Residence	-109.0 ± 246.0 **U**	94.2 ± 180.0 **U**	252.0 ± 280.0 **U**	37.4 ± 142.0 **U**
M-8 Upstream of Plant	-8.4 ± 154.0 **U**	-236.0 ± 259.0 **U**	115.0 ± 254.0 **U**	151.0 ± 219.0 **U**
M-9 Downstream of Plant	-17.6 ± 143.0 **U**	-154.0 ± 266.0 **U**	-155.0 ± 232.0 **U**	19.1 ± 220.0 **U**

[1]Q4 2020 composite sample collection continued into January 4, 2021.

WATER – DRINKING: GROSS BETA

M-14 City of Minneapolis	Gross Beta (pCi/L)
Jan	1.570 ± 2.240 **U**
Feb	2.110 ± 2.330 **U**
Mar	1.620 ± 1.820 **U**
Apr	1.590 ± 2.180 **U**
May	1.870 ± 2.130 **U**
Jun	1.290 ± 1.510 **U**
Jul	0.174 ± 1.940 **U**
Aug[1]	0.717 ± 2.110 **U**
Sep	1.550 ± 2.040 **U**
Oct[1]	0.051 ± 1.540 **U**
Nov[1]	1.010 ± 2.030 **U**
Dec[1]	1.780 ± 1.990 **U**

[1]Monthly composite samples collected in August, October, November, and December continued into the first few days of each subsequent respective month.

WATER – DRINKING: IODINE-131

M-14 City of Minneapolis	Iodine-131 (pCi/L)
1/2/2020	-1.15E-01 ± 2.71E-01 **U**
1/8/2020	2.57E-01 ± 3.33E-01 **U**
1/15/2020	-4.81E-01 ± 5.38E-01 **U**
1/22/2020	3.47E-01 ± 5.60E-01 **U**
1/29/2020	-2.52E-01 ± 5.07E-01 **U**
2/5/2020	-3.28E-01 ± 4.61E-01 **U**
2/12/2020	3.20E-01 ± 5.35E-01 **U**

Iodine-131 analysis completed on each bi-weekly sample when the dose from the consumption of the water is greater than 1 mrem/year (ODCM Revision 26)

WATER – GROUNDWATER: GAMMA ISOTOPIC

M-11 City of Monticello	**Qtr 1** **(pCi/L)**	**Qtr 2** **(pCi/L)**	**Qtr 3** **(pCi/L)**	**Qtr 4** **(pCi/L)**
Barium-140	-3.92E+00 ± 6.37E+00 **U**	1.83E+00 ± 4.52E+00 **U**	3.83E+00 ± 1.62E+01 **U**	-1.86E+00 ± 1.36E+01 **U**
Cerium-144	-1.13E+00 ± 6.17E+00 **U**	-3.76E-01 ± 5.95E+00 **U**	-3.47E+00 ± 2.03E+01 **U**	4.45E+00 ± 1.73E+01 **U**
Cesium-134	-9.66E-02 ± 9.73E-01 **U**	3.74E-01 ± 9.58E-01 **U**	2.31E+00 ± 3.01E+00 **U**	-3.71E-01 ± 2.31E+00 **U**
Cesium-137	-2.40E-01 ± 8.63E-01 **U**	8.22E-01 ± 2.35E+00 **U**	2.96E+00 ± 2.78E+00 **U**	-8.83E-01 ± 2.16E+00 **U**
Cobalt-58	-4.18E-01 ± 1.03E+00 **U**	-5.34E-01 ± 8.83E-01 **U**	-6.55E-01 ± 3.92E+00 **U**	1.08E+00 ± 2.11E+00 **U**
Cobalt-60	-7.76E-01 ± 1.03E+00 **U**	-5.54E-01 ± 9.96E-01 **U**	-1.57E+00 ± 3.80E+00 **U**	-1.57E+00 ± 2.59E+00 **U**
Iron-59	2.14E+00 ± 2.17E+00 **U**	8.75E-01 ± 1.77E+00 **U**	-3.11E+00 ± 5.33E+00 **U**	-1.58E+00 ± 4.12E+00 **U**
Lanthanum-140	4.80E-01 ± 8.83E-01 **U**	-4.34E-02 ± 9.15E-01 **U**	-8.94E-01 ± 3.34E+00 **U**	-4.66E-01 ± 1.75E+00 **U**
Manganese-54	6.76E-03 ± 9.95E-01 **U**	4.55E-01 ± 1.08E+00 **U**	-7.20E-01 ± 3.03E+00 **U**	-6.98E-01 ± 2.50E+00 **U**
Niobium-95	-2.27E+00 ± 2.81E+00 **U**	-9.69E-01 ± 2.05E+00 **U**	-7.07E+00 ± 6.45E+00 **U**	1.12E+00 ± 4.36E+00 **U**
Zinc-65	2.27E-01 ± 1.83E+00 **U**	-1.79E-01 ± 1.48E+00 **U**	-1.95E+00 ± 6.01E+00 **U**	-1.45E+00 ± 3.76E+00 **U**
Zirconium-95	-3.92E+00 ± 6.37E+00 **U**	1.83E+00 ± 4.52E+00 **U**	3.83E+00 ± 1.62E+01 **U**	-1.86E+00 ± 1.36E+01 **U**

M-12 Plant Well #11	**Qtr 1** **(pCi/L)**	**Qtr 2** **(pCi/L)**	**Qtr 3** **(pCi/L)**	**Qtr 4** **(pCi/L)**
Barium-140	3.34E+00 ± 5.64E+00 **U**	7.65E-01 ± 4.52E+00 **U**	1.10E+00 ± 1.24E+01 **U**	8.79E+00 ± 1.97E+01 **U**
Cerium-144	3.33E-01 ± 5.30E+00 **U**	5.29E-01 ± 5.78E+00 **U**	-6.21E+00 ± 1.66E+01 **U**	9.09E+00 ± 1.87E+01 **U**
Cesium-134	5.37E-01 ± 8.94E-01 **U**	-3.83E-01 ± 8.15E-01 **U**	1.75E+00 ± 2.89E+00 **U**	-3.24E-01 ± 2.44E+00 **U**
Cesium-137	-3.06E-01 ± 1.78E+00 **U**	3.88E-01 ± 8.99E-01 **U**	1.04E+00 ± 2.74E+00 **U**	1.60E+00 ± 2.49E+00 **U**
Cobalt-58	1.83E+00 ± 1.42E+00 **UI**	-5.67E-02 ± 8.66E-01 **U**	-7.42E-01 ± 2.98E+00 **U**	-1.22E-01 ± 2.71E+00 **U**
Cobalt-60	9.38E-01 ± 7.87E-01 **U**	3.40E-01 ± 8.96E-01 **U**	-1.56E+00 ± 3.61E+00 **U**	-7.49E-01 ± 2.87E+00 **U**
Iron-59	-2.14E+00 ± 2.03E+00 **U**	3.63E-01 ± 1.79E+00 **U**	5.70E-01 ± 4.67E+00 **U**	-6.68E-02 ± 5.60E+00 **U**
Lanthanum-140	-1.72E+00 ± 1.95E+00 **U**	6.86E-01 ± 1.58E+00 **U**	-4.66E+00 ± 3.78E+00 **U**	1.21E+00 ± 7.02E+00 **U**
Manganese-54	4.93E-01 ± 8.35E-01 **U**	-6.26E-01 ± 8.05E-01 **U**	-4.22E-01 ± 2.36E+00 **U**	3.90E+00 ± 2.87E+00 **UI**
Niobium-95	-3.90E-03 ± 9.23E-01 **U**	6.66E-01 ± 9.36E-01 **U**	-3.09E-02 ± 3.05E+00 **U**	-2.08E+00 ± 2.53E+00 **U**
Zinc-65	3.26E+00 ± 1.82E+00 **U**	8.95E-01 ± 1.85E+00 **U**	-1.47E+00 ± 5.32E+00 **U**	1.31E+00 ± 5.71E+00 **U**
Zirconium-95	9.31E-02 ± 1.65E+00 **U**	-5.69E-01 ± 1.63E+00 **U**	1.56E+00 ± 4.78E+00 **U**	2.96E+00 ± 5.45E+00 **U**

M-43 Imholte Farm	**Qtr 1** **(pCi/L)**	**Qtr 2** **(pCi/L)**	**Qtr 3** **(pCi/L)**	**Qtr 4** **(pCi/L)**
Barium-140	-7.43E+00 ± 7.59E+00 **U**	3.56E-01 ± 5.64E+00 **U**	-2.47E+00 ± 8.51E+00 **U**	5.78E+00 ± 1.23E+01 **U**
Cerium-144	-8.51E+00 ± 8.05E+00 **U**	-3.90E+00 ± 1.03E+01 **U**	1.13E+00 ± 1.17E+01 **U**	7.64E+00 ± 1.21E+01 **U**
Cesium-134	3.32E-01 ± 1.18E+00 **U**	1.18E+00 ± 1.28E+00 **U**	4.43E-01 ± 2.01E+00 **U**	-1.17E+00 ± 2.04E+00 **U**
Cesium-137	7.43E-01 ± 1.08E+00 **U**	4.11E-01 ± 1.12E+00 **U**	-9.45E-01 ± 1.86E+00 **U**	-1.32E+00 ± 1.77E+00 **U**
Cobalt-58	-1.91E-01 ± 1.09E+00 **U**	-1.25E+00 ± 1.71E+00 **U**	9.42E-01 ± 1.79E+00 **U**	-3.71E-01 ± 1.79E+00 **U**
Cobalt-60	-9.78E-01 ± 1.42E+00 **U**	-2.91E-01 ± 1.01E+00 **U**	-3.33E-01 ± 2.37E+00 **U**	-4.09E-01 ± 1.57E+00 **U**
Iron-59	-2.21E-01 ± 2.37E+00 **U**	9.20E-01 ± 2.47E+00 **U**	-1.38E-01 ± 3.35E+00 **U**	2.07E+00 ± 5.10E+00 **U**
Lanthanum-140	-1.15E+00 ± 2.59E+00 **U**	1.12E+00 ± 2.13E+00 **U**	-8.89E-01 ± 2.92E+00 **U**	2.49E+00 ± 4.86E+00 **U**
Manganese-54	1.91E-01 ± 1.02E+00 **U**	-1.12E-01 ± 1.12E+00 **U**	6.47E-01 ± 1.69E+00 **U**	1.98E+00 ± 1.80E+00 **U**
Niobium-95	-5.88E-01 ± 1.23E+00 **U**	-6.60E-01 ± 1.60E+00 **U**	-5.17E-02 ± 1.91E+00 **U**	-5.20E-02 ± 2.32E+00 **U**
Zinc-65	1.40E+00 ± 2.54E+00 **U**	2.28E+00 ± 2.23E+00 **U**	-1.11E+00 ± 4.50E+00 **U**	-7.97E-01 ± 4.26E+00 **U**
Zirconium-95	-5.32E-01 ± 2.03E+00 **U**	1.21E+00 ± 1.75E+00 **U**	6.05E-01 ± 2.70E+00 **U**	-4.46E-01 ± 2.78E+00 **U**

M-55 Hasbrouck Residence	**Qtr 1** **(pCi/L)**	**Qtr 2** **(pCi/L)**	**Qtr 3** **(pCi/L)**	**Qtr 4** **(pCi/L)**
Barium-140	-8.29E-01 ± 7.69E+00 **U**	1.82E+00 ± 4.74E+00 **U**	2.46E-01 ± 1.04E+01 **U**	-4.10E+00 ± 1.34E+01 **U**
Cerium-144	2.17E+00 ± 5.58E+00 **U**	1.69E+00 ± 5.81E+00 **U**	4.24E+00 ± 1.44E+01 **U**	8.68E+00 ± 1.23E+01 **U**
Cesium-134	3.00E-01 ± 9.47E-01 **U**	6.50E-01 ± 9.29E-01 **U**	1.98E+00 ± 2.53E+00 **U**	1.48E+00 ± 2.27E+00 **U**
Cesium-137	-4.63E-01 ± 8.97E-01 **U**	-5.99E-01 ± 1.04E+00 **U**	-1.55E+00 ± 2.23E+00 **U**	-5.21E-01 ± 1.78E+00 **U**
Cobalt-58	-7.53E-01 ± 8.71E-01 **U**	3.01E-01 ± 8.67E-01 **U**	1.00E+00 ± 2.42E+00 **U**	5.99E-01 ± 1.77E+00 **U**
Cobalt-60	-2.46E-01 ± 8.68E-01 **U**	1.97E-01 ± 8.31E-01 **U**	-1.11E-02 ± 2.40E+00 **U**	3.24E-01 ± 1.35E+00 **U**
Iron-59	-8.98E-01 ± 1.92E+00 **U**	-7.99E-01 ± 1.88E+00 **U**	1.76E+00 ± 4.04E+00 **U**	-3.34E+00 ± 4.23E+00 **U**
Lanthanum-140	-7.62E-01 ± 1.82E+00 **U**	-8.29E-01 ± 1.72E+00 **U**	-5.18E-02 ± 3.49E+00 **U**	-1.22E+00 ± 4.67E+00 **U**
Manganese-54	6.04E-01 ± 7.83E-01 **U**	7.75E-01 ± 1.25E+00 **U**	-1.67E+00 ± 2.32E+00 **U**	-5.45E-01 ± 1.87E+00 **U**
Niobium-95	-1.29E+00 ± 1.96E+00 **U**	-2.01E-02 ± 1.43E+00 **U**	1.16E+00 ± 2.23E+00 **U**	-2.57E-02 ± 2.19E+00 **U**
Zinc-65	3.09E-01 ± 1.95E+00 **U**	-5.21E-01 ± 2.11E+00 **U**	3.21E-01 ± 4.49E+00 **U**	3.36E+00 ± 2.49E+00 **U**
Zirconium-95	-1.33E+00 ± 1.48E+00 **U**	6.99E-01 ± 1.57E+00 **U**	-1.36E+00 ± 3.38E+00 **U**	-5.60E-02 ± 3.36E+00 **U**

WATER – DRINKING: GAMMA ISOTOPIC

M-14 City of Minneapolis

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Barium-140	-8.100 ± 13.500 **U**	14.900 ± 13.400 **U**	-14.300 ± 16.100 **U**	-3.730 ± 10.300 **U**	2.410 ± 9.100 **U**	-2.520 ± 21.800 **U**	-4.710 ± 17.700 **U**	6.920 ± 14.000 **U**	1.470 ± 8.480 **U**	0.958 ± 6.390 **U**	-9.110 ± 7.090 **U**	2.050 ± 7.920 **U**
Cerium-144	2.600 ± 6.390 **U**	-1.530 ± 5.540 **U**	0.287 ± 6.410 **U**	8.910 ± 8.930 **U**	14.000 ± 10.700 **U**	5.410 ± 15.100 **U**	-8.570 ± 17.200 **U**	-1.520 ± 13.100 **U**	0.352 ± 9.420 **U**	-1.480 ± 7.350 **U**	-2.180 ± 7.320 **U**	0.710 ± 11.000 **U**
Cesium-134	0.042 ± 0.876 **U**	-0.293 ± 0.844 **U**	0.427 ± 0.947 **U**	-0.639 ± 1.310 **U**	0.696 ± 1.740 **U**	-0.488 ± 2.410 **U**	-1.290 ± 3.130 **U**	0.297 ± 2.200 **U**	-0.696 ± 1.450 **U**	0.126 ± 1.120 **U**	0.532 ± 1.180 **U**	-0.546 ± 1.720 **U**
Cesium-137	0.825 ± 0.971 **U**	-0.026 ± 0.787 **U**	0.349 ± 0.931 **U**	-0.114 ± 1.240 **U**	-0.534 ± 1.580 **U**	-0.255 ± 2.290 **U**	2.020 ± 3.210 **U**	1.170 ± 2.060 **U**	-0.073 ± 1.460 **U**	0.106 ± 1.170 **U**	0.797 ± 1.250 **U**	-0.170 ± 1.620 **U**
Cobalt-58	0.100 ± 1.050 **U**	-0.028 ± 0.900 **U**	0.208 ± 1.140 **U**	0.186 ± 1.340 **U**	-0.148 ± 1.600 **U**	1.180 ± 2.450 **U**	0.573 ± 3.190 **U**	-0.770 ± 1.780 **U**	-0.918 ± 1.480 **U**	0.635 ± 1.090 **U**	-0.090 ± 1.020 **U**	-0.115 ± 1.320 **U**
Cobalt-60	-0.399 ± 0.956 **U**	0.155 ± 0.764 **U**	0.041 ± 1.070 **U**	0.246 ± 1.300 **U**	-0.767 ± 1.780 **U**	1.520 ± 1.920 **U**	1.100 ± 2.930 **U**	-0.464 ± 1.920 **U**	-0.623 ± 1.740 **U**	-0.112 ± 1.290 **U**	-0.263 ± 1.040 **U**	0.916 ± 1.780 **U**
Iron-59	-2.030 ± 2.550 **U**	-0.312 ± 2.080 **U**	1.400 ± 2.350 **U**	-2.220 ± 3.650 **U**	0.699 ± 3.320 **U**	-2.550 ± 5.860 **U**	0.701 ± 6.080 **U**	0.520 ± 4.610 **U**	-0.075 ± 2.900 **U**	1.830 ± 2.520 **U**	-0.059 ± 2.280 **U**	-0.489 ± 2.960 **U**
Lanthanum-140	-6.510 ± 4.580 **U**	-4.580 ± 4.330 **U**	-1.280 ± 3.670 **U**	-1.810 ± 3.760 **U**	-3.200 ± 3.890 **U**	-0.259 ± 8.510 **U**	0.907 ± 6.960 **U**	-3.400 ± 5.320 **U**	-2.420 ± 2.660 **U**	4.440 ± 5.400 **UI**	2.180 ± 1.360 **U**	-1.760 ± 2.660 **U**
Manganese-54	-0.992 ± 0.893 **U**	-0.322 ± 0.778 **U**	0.262 ± 0.956 **U**	0.542 ± 1.470 **U**	-0.608 ± 1.520 **U**	-0.556 ± 2.630 **U**	0.724 ± 3.540 **U**	0.594 ± 2.070 **U**	-0.231 ± 1.230 **U**	0.300 ± 1.110 **U**	0.452 ± 0.939 **U**	-0.355 ± 1.580 **U**
Niobium-95	0.458 ± 1.110 **U**	2.990 ± 1.750 **UI**	-1.970 ± 2.250 **U**	-1.490 ± 2.000 **U**	0.763 ± 1.580 **U**	0.970 ± 2.540 **U**	-0.370 ± 3.430 **U**	-0.652 ± 2.460 **U**	0.268 ± 1.380 **U**	0.614 ± 1.180 **U**	0.937 ± 1.260 **U**	1.570 ± 2.410 **U**
Zinc-65	0.232 ± 2.260 **U**	1.220 ± 1.720 **U**	0.104 ± 2.100 **U**	0.293 ± 3.040 **U**	0.900 ± 3.460 **U**	1.620 ± 4.000 **U**	-2.440 ± 6.760 **U**	0.000 ± 3.480 **U**	3.830 ± 3.540 **U**	0.934 ± 2.310 **U**	-0.002 ± 1.930 **U**	-0.963 ± 2.800 **U**
Zirconium-95	2.010 ± 3.300 **U**	-0.253 ± 1.780 **U**	0.684 ± 3.360 **U**	0.226 ± 2.630 **U**	-1.380 ± 2.740 **U**	-0.703 ± 3.800 **U**	-0.900 ± 5.520 **U**	-2.300 ± 3.870 **U**	-0.572 ± 3.140 **U**	1.330 ± 2.290 **U**	2.140 ± 1.980 **U**	-0.524 ± 2.500 **U**

[1]Monthly composite samples collected in August, October, November, and December continued into the first few days of each subsequent respective month.

WATER – SURFACE: GAMMA ISOTOPIC

M-8 Upstream of Plant

pCi/L	Jan[1]	Feb[1]	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Barium-140	-	-	-1.020 ± 7.780 U	-1.230 ± 12.400 U	-36.800 ± 111.000[2] U	-0.804 ± 8.920 U	5.490 ± 10.100 U	8.250 ± 21.800 U	2.760 ± 10.200 U	17.100 ± 27.200 U	-0.284 ± 7.960 U	10.300 ± 20.600 U
Cerium-144	-	-	-0.159 ± 4.500 U	0.275 ± 7.100 U	-8.640 ± 15.900 U	-2.570 ± 5.710 U	-4.250 ± 6.380 U	2.180 ± 15.100 U	4.440 ± 11.300 U	2.830 ± 9.010 U	3.170 ± 5.910 U	-3.440 ± 9.090 U
Cesium-134	-	-	-0.387 ± 0.939 U	0.604 ± 1.100 U	0.822 ± 2.360 U	0.468 ± 0.764 U	-0.187 ± 1.000 U	0.808 ± 2.000 U	1.050 ± 1.900 U	-0.400 ± 1.520 U	-0.495 ± 0.822 U	-0.999 ± 1.470 U
Cesium-137	-	-	-0.344 ± 0.781 U	0.005 ± 1.360 U	-0.735 ± 2.660 U	0.127 ± 0.784 U	0.615 ± 0.963 U	1.800 ± 1.990 U	4.950 ± 2.980 UI	0.522 ± 1.300 U	0.089 ± 0.820 U	-0.240 ± 1.570 U
Cobalt-58	-	-	-0.385 ± 0.927 U	0.013 ± 1.100 U	-0.420 ± 2.830 U	-0.538 ± 0.841 U	-0.519 ± 1.040 U	-0.365 ± 2.460 U	-0.062 ± 1.760 U	-1.850 ± 1.680 U	-0.190 ± 0.787 U	-0.904 ± 1.770 U
Cobalt-60	-	-	0.018 ± 0.766 U	0.201 ± 1.030 U	2.180 ± 2.870 U	0.212 ± 0.846 U	0.348 ± 0.978 U	0.563 ± 1.950 U	0.167 ± 1.670 U	-0.194 ± 1.560 U	-0.062 ± 0.802 U	0.383 ± 1.270 U
Iron-59	-	-	-0.182 ± 1.890 U	-1.150 ± 2.520 U	7.250 ± 9.250 U	1.660 ± 2.120 U	-1.040 ± 2.550 U	-4.650 ± 6.070 U	-0.121 ± 3.640 U	-2.030 ± 4.190 U	0.536 ± 1.680 U	0.195 ± 4.580 U
Lanthanum-140	-	-	2.360 ± 2.970 U	-1.880 ± 3.710 U	-0.028 ± 25.400[2] U	-2.760 ± 2.830 U	1.380 ± 3.890 U	1.820 ± 7.130 U	-1.700 ± 3.460 U	-3.230 ± 9.110 U	-2.470 ± 2.580 U	-0.411 ± 8.370 U
Manganese-54	-	-	-0.112 ± 0.919 U	0.467 ± 1.190 U	-0.933 ± 2.260 U	0.200 ± 0.771 U	-0.050 ± 0.936 U	-0.296 ± 2.050 U	1.700 ± 1.740 U	0.518 ± 1.300 U	0.442 ± 0.716 U	2.170 ± 1.460 UI
Niobium-95	-	-	0.760 ± 0.976 U	0.624 ± 1.180 U	0.660 ± 3.280 U	0.282 ± 0.915 U	0.564 ± 1.090 U	-0.836 ± 2.690 U	-1.610 ± 1.890 U	-1.120 ± 1.840 U	-0.181 ± 0.884 U	0.473 ± 1.830 U
Zinc-65	-	-	-0.785 ± 1.800 U	0.158 ± 2.480 U	6.990 ± 4.130 U	0.143 ± 1.560 U	-0.761 ± 1.920 U	-2.260 ± 4.070 U	-3.670 ± 4.260 U	0.296 ± 2.990 U	0.755 ± 1.570 U	-0.746 ± 3.250 U
Zirconium-95	-	-	1.400 ± 1.590 U	1.170 ± 2.180 U	0.531 ± 4.680 U	-0.822 ± 1.620 U	1.000 ± 1.960 U	0.211 ± 3.690 U	1.250 ± 3.300 U	0.985 ± 3.160 U	1.070 ± 1.550 U	0.887 ± 3.600 U

Notes:

[1] Sample unavailable due to unsafe condition for sampling resulting from frozen river surface.

[2] Positive barium-140 results were due to analytical deviations rather than actual detection of MNGP related material. Lanthanum-140 was not detected in any of the water samples. In some cases, the required LLD was not met for barium-140/lanthanum-140. See Section 7.5 for further details.

M-9 Downstream of Plant

pCi/L	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Barium-140	-6.520 ± 21.700 U	-19.200 ± 21.100 U	-3.610 ± 8.020 U	-5.650 ± 19.400 U	-33.300 ± 84.900[1] U	0.309 ± 8.880 U	-2.750 ± 9.350 U	8.620 ± 21.700 U	6.740 ± 11.700 U	-4.640 ± 23.600 U	-0.563 ± 10.200 U	0.517 ± 16.300 U
Cerium-144	-3.440 ± 6.800 U	2.850 ± 4.320 U	-6.700 ± 5.710 U	0.027 ± 11.000 U	-4.600 ± 16.000 U	1.770 ± 5.490 U	-7.830 ± 7.610 U	2.220 ± 13.300 U	4.240 ± 12.800 U	9.260 ± 11.300 U	-0.907 ± 7.320 U	-8.080 ± 11.100 U
Cesium-134	1.010 ± 0.936 U	0.714 ± 0.689 U	0.392 ± 0.798 U	0.076 ± 2.010 U	0.093 ± 2.140 U	0.591 ± 0.746 U	-0.286 ± 1.420 U	2.650 ± 2.770 U	-0.570 ± 1.920 U	-0.347 ± 1.190 U	0.201 ± 0.937 U	-0.758 ± 1.950 U
Cesium-137	0.502 ± 0.869 U	0.416 ± 0.673 U	0.569 ± 0.820 U	-1.980 ± 1.610 U	0.234 ± 2.760 U	-0.264 ± 0.779 U	-0.246 ± 0.796 U	-2.020 ± 2.100 U	0.305 ± 1.750 U	0.154 ± 1.100 U	-0.883 ± 1.030 U	-0.460 ± 1.880 U
Cobalt-58	-0.525 ± 1.100 U	0.172 ± 0.764 U	-0.494 ± 0.813 U	-0.776 ± 1.880 U	0.820 ± 3.300 U	-0.174 ± 0.825 U	-0.151 ± 0.856 U	2.090 ± 3.950 U	-1.810 ± 2.390 U	0.742 ± 1.270 U	-0.303 ± 1.090 U	-1.280 ± 2.040 U
Cobalt-60	0.090 ± 0.864 U	0.145 ± 0.677 U	0.383 ± 0.834 U	-0.361 ± 1.790 U	-2.020 ± 2.550 U	-0.185 ± 1.190 U	0.945 ± 0.844 U	3.120 ± 2.940 U	0.720 ± 1.930 U	0.329 ± 0.960 U	-0.134 ± 1.020 U	0.341 ± 1.760 U
Iron-59	-2.680 ± 3.000 U	-1.480 ± 2.180 U	-0.194 ± 1.950 U	-1.550 ± 4.110 U	-6.210 ± 8.680 U	-0.042 ± 1.910 U	0.835 ± 1.980 U	-2.350 ± 6.680 U	0.113 ± 3.680 U	2.100 ± 3.670 U	-1.290 ± 2.310 U	1.700 ± 4.660 U
Lanthanum-140	-1.430 ± 5.440 U	-2.430 ± 3.870 U	-3.880 ± 3.220 U	1.090 ± 6.920 U	-13.700 ± 33.000[1] U	-1.100 ± 3.300 U	-2.900 ± 3.280 U	-5.620 ± 7.700 U	0.408 ± 3.690 U	1.970 ± 6.780 U	-2.780 ± 3.530 U	6.850 ± 6.080 U
Manganese-54	-1.210 ± 0.906 U	-0.221 ± 0.661 U	1.190 ± 0.993 U	-0.303 ± 1.780 U	-1.960 ± 2.650 U	0.168 ± 1.580 U	-0.339 ± 0.794 U	-0.001 ± 2.190 U	0.852 ± 1.830 U	-0.243 ± 1.190 U	0.646 ± 0.965 U	-0.728 ± 1.670 U
Niobium-95	0.968 ± 1.990 U	-0.199 ± 0.881 U	0.191 ± 1.480 U	-1.530 ± 1.880 U	-0.927 ± 3.600 U	0.346 ± 1.170 U	0.149 ± 0.991 U	0.527 ± 2.380 U	0.741 ± 1.710 U	0.278 ± 1.290 U	0.713 ± 1.070 U	-0.201 ± 2.080 U
Zinc-65	-3.380 ± 3.440 U	0.262 ± 1.510 U	0.631 ± 1.670 U	-2.060 ± 2.920 U	7.070 ± 7.690 UI	0.169 ± 1.780 U	-0.280 ± 1.810 U	-0.963 ± 4.090 U	-0.593 ± 3.880 U	-0.031 ± 2.130 U	-0.541 ± 2.420 U	-0.602 ± 3.390 U
Zirconium-95	-0.915 ± 1.890 U	-0.813 ± 1.560 U	0.344 ± 1.550 U	0.712 ± 3.500 U	5.590 ± 6.170 U	-1.200 ± 1.560 U	0.125 ± 1.720 U	3.450 ± 4.390 U	1.740 ± 3.450 U	0.003 ± 2.240 U	-0.889 ± 2.060 U	-0.301 ± 4.000 U

[1] Positive barium-140 results were due to analytical deviations rather than actual detection of MNGP related material. Lanthanum-140 was not detected in any of the water samples. In some cases, the required LLD was not met for barium-140/lanthanum-140. See Section 7.5 for further details.

Data below were analyzed EDC. The results reported relate only to the items tested and to the sample as received by the laboratory. The raw TLD results are corrected for individual element sensitivity and reader sensitivity and determined by QC results. Transit exposures are subtracted and the fade of the thermoluminescent response is compensated. The abbreviations common to each of the EDC analytical results tables are provided below.

Abbreviations

ISFSI	Independent Spent Fuel Storage Installation
TLD	Thermoluminescent Dosimeter
mR/Std. Qtr	Millirem per standard quarter (91 days)

DIRECT RADIATION – TLD: GAMMA

mrem/91 day	Qtr 1	Qtr 2	Qtr 3	Qtr 4
Control				
M01C Kirchenbauer Farm	11.8 ± 0.7	12.9 ± 0.6	13.8 ± 0.8	12.4 ± 0.7
M02C Cty Rd 4 & 15	12.4 ± 0.7	12.1 ± 0.5	13.8 ± 0.9	12.4 ± 0.8
M03C Cty Rd 19 & Jason Ave	13.5 ± 0.6	14.2 ± 0.5	15.9 ± 1.3	13.3 ± 0.5
M04C Maple Lake Water Tower	13.0 ± 0.6	12.1 ± 0.4	14.2 ± 1.1	12.9 ± 0.5
Inner				
M01A Sherburne Ave. So.	12.9 ± 0.8	14.7 ± 1.1	15.7 ± 1.0	14.1 ± 0.9
M02A Sherburne Ave. So.	13.3 ± 0.6	13.9 ± 0.9	15.4 ± 1.1	13.7 ± 0.8
M03A Sherburne Ave. So.	11.9 ± 0.5	13.6 ± 0.8	15.2 ± 1.1	13.2 ± 0.6
M04A Biology Station Rd.	12.9 ± 0.7	12.9 ± 0.6	15.8 ± 0.9	12.8 ± 0.8
M05A Biology Station Rd.	12.9 ± 0.6	13.4 ± 0.7	16.1 ± 0.8	13.2 ± 0.6
M06A Biology Station Rd.	13.5 ± 0.6	13.7 ± 0.8	16.9 ± 1.2	14.1 ± 0.5
M07A Parking Lot H	13.5 ± 0.7	14.0 ± 0.6	16.9 ± 0.9	14.0 ± 0.8
M08A Parking Lot F	13.2 ± 0.8	13.9 ± 0.9	17.1 ± 0.9	14.1 ± 0.8
M09A County Road 75	13.7 ± 0.6	13.5 ± 0.5	16.9 ± 1.1	13.3 ± 0.6
M10A County Road 75	12.8 ± 0.6	13.5 ± 0.8	15.7 ± 1.0	14.1 ± 0.8
M11A County Road 75	14.2 ± 0.8	14.7 ± 0.7	17.2 ± 0.9	14.9 ± 0.9
M12A County Road 75	13.7 ± 0.6	14.2 ± 0.7	16.4 ± 0.8	(*see* note 1)
M13A North Boundary Rd.	13.5 ± 0.7	13.8 ± 0.8	15.0 ± 1.2	14.0 ± 0.6
M14A North Boundary Rd.	13.6 ± 0.8	14.6 ± 1.1	16.1 ± 1.0	14.3 ± 0.5
Outer				
M01B 117th Street	12.7 ± 0.8	13.2 ± 0.6	14.8 ± 0.8	13.0 ± 0.4
M02B County Road 11	13.4 ± 0.6	14.2 ± 0.5	15.1 ± 0.9	13.1 ± 0.6
M03B County Rd. 73 & 81	10.8 ± 0.7	11.3 ± 0.4	13.6 ± 0.8	11.8 ± 0.8
M04B County Rd. 73 (196th Street)	12.6 ± 0.8	13.1 ± 0.5	14.7 ± 1.1	12.7 ± 0.6
M05B City of Big Lake	13.2 ± 0.9	13.5 ± 0.6	14.9 ± 0.9	13.9 ± 0.5
M06B County Rd 14 & 196th Street	11.7 ± 0.8	13.4 ± 0.8	15.2 ± 0.8	14.0 ± 0.6
M07B Monticello Industrial Dr.	14.0 ± 0.7	13.5 ± 0.6	15.2 ± 0.9	14.3 ± 1.0
M08B Residence Hwy 25 & Davidson Ave	13.3 ± 0.9	12.8 ± 0.4	14.5 ± 0.8	13.5 ± 0.7
M09B Weinand Farm	13.0 ± 0.6	14.7 ± 1.0	16.3 ± 0.9	14.7 ± 0.9
M10B Reisewitz Farm - Acacia Ave	12.9 ± 0.8	13.7 ± 0.8	15.7 ± 0.9	13.7 ± 0.8
M11B Vanlith Farm - 97th Ave	12.9 ± 0.7	14.6 ± 0.6	16.3 ± 1.0	14.0 ± 0.5

mrem/91 day	Qtr 1	Qtr 2	Qtr 3	Qtr 4
M12B Lake Maria St. Park	13.0 ± 0.7	13.9 ± 0.7	16.1 ± 0.9	14.3 ± 0.7
M13B Bridgewater Sta.	13.6 ± 0.7	13.6 ± 0.7	16.4 ± 1.1	14.5 ± 0.8
M14B Anderson Res. - Cty Rd 111	14.4 ± 0.7	14.8 ± 0.6	17.1 ± 0.8	15.3 ± 0.5
M15B Red Oak Wild Bird Farm	12.6 ± 0.6	13.4 ± 0.7	15.7 ± 0.9	14.4 ± 0.7
M16B University Ave and Hancock St, Becker	12.7 ± 0.5	13.0 ± 0.7	15.0 ± 1.1	13.0 ± 0.8
Special Interest				
I-11 OCA Fence South, on exit road	13.8 ± 0.7	13.6 ± 0.5	17.0 ± 0.7	14.2 ± 0.5
I-12 OCA Fence Middle, on exit road	13.8 ± 0.6	13.8 ± 0.7	16.3 ± 0.8	13.9 ± 1.3
I-13 OCA Fence North, on exit road	14.5 ± 0.9	14.6 ± 0.8	16.7 ± 0.9	14.8 ± 0.8
M01S 127th St. NE	11.5 ± 0.8	11.0 ± 0.4	14.1 ± 0.8	12.0 ± 0.5
M02S Krone Residence	11.9 ± 0.8	11.9 ± 0.7	14.7 ± 0.9	12.4 ± 0.7
M03S Big Oaks Park	13.2 ± 0.8	14.0 ± 0.7	15.7 ± 0.8	14.1 ± 0.5
M04S Pinewood School	14.1 ± 0.8	14.0 ± 0.8	16.3 ± 0.8	14.9 ± 0.7
M05S 20500 Co. Rd 11, Big Lake	13.3 ± 0.6	13.1 ± 0.6	15.8 ± 1.0	13.4 ± 0.7
M06S Monticello Public Works	15.1 ± 0.5	14.3 ± 0.8	17.4 ± 0.8	14.8 ± 0.5

Notes:

[1] Location could not be sampled due to missing TLD (Condition Report 501000047634)

DIRECT RADIATION – ISFSI: GAMMA

mrem/91 day	Type	Qtr1	Qtr2	Qtr3	Qtr4
I-01 NE corner of ISFSI	Gamma	42.9 ± 2.9	40.1 ± 1.7	45.3 ± 4.0	41.2 ± 1.7
I-02 North side of ISFSI, center	Gamma	37.0 ± 1.9	34.7 ± 1.8	40.1 ± 2.0	37.4 ± 2.1
I-03 NW corner of ISFSI	Gamma	33.3 ± 1.9	30.3 ± 2.4	36.8 ± 1.6	35.0 ± 2.1
I-04 West side of ISFSI, middle	Gamma	102.3 ± 14.3	81.0 ± 4.4	84.0 ± 5.5	80.5 ± 2.5
I-05 West side of ISFSI, at center of array	Gamma	57.9 ± 4.2	52.0 ± 4.0	57.7 ± 3.8	55.9 ± 3.2
I-06 SW corner of ISFSI	Gamma	29.0 ± 2.0	29.7 ± 3.1	31.8 ± 1.5	32.6 ± 2.3
I-07 South side of ISFSI, center	Gamma	34.4 ± 3.1	31.5 ± 3.2	37.9 ± 5.1	32.3 ± 2.3
I-08 SE corner of ISFSI	Gamma	37.4 ± 4.6	32.3 ± 4.0	37.3 ± 4.5	33.7 ± 4.4
I-09 East side of ISFSI, at center of array	Gamma	72.0 ± 6.7	71.1 ± 7.2	64.8 ± 5.7	64.4 ± 5.4
I-10 East side of ISFSI, middle	Gamma	83.4 ± 4.4	73.9 ± 5.4	103.8 ± 9.8	85.6 ± 3.6

Design & Consultancy for natural and built assets