2807 West County Road 75
Monticello, MN 55362

May 14, 2024

L-MT-24-013
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

2023 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 following enclosures:

- Annual Radiological Environmental Operating Report, under MNGP's "Radiological Environmental Monitoring Program," for year 2023. (Enclosure 1)
- 2022 Annual Radiological Environmental Operating Report Update. (Enclosure 2)

Summary of Commitments

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

Gregory D. Brown
Plant Manager, Monticello Nuclear Generating Plant
Northern States Power Company – Minnesota

Enclosures (2)

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

ENCLOSURE 1

RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
JANUARY 1 – DECEMBER 31, 2023

160 Pages Follow

2023 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT (AREOR)

Monticello Nuclear Generating Plant

Last Updated: 5/3/2024

2023 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

Monticello Nuclear Generating Plant

Prepared for:
Xcel Energy, Inc.

Prepared by:
Arcadis US, Inc.
630 Plaza Drive
Suite 200
Highlands Ranch
Colorado 80129

Our Ref.:
30078625

Date: 5/3/2024

Michael Hay, PhD
Principal Scientist
Senior Technical Advisor

Josh Myers, PG
Project Manager
Quality Assurance Reviewer

Brooke Thompson

Brooke Thompson
Environmental Engineer
Quality Assurance Reviewer

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/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
LOD	limit of detection
MDA	minimum detectable activity
MDC	minimum detectable concentration
MDL	minimum detection limit
mi	mile
MNGP	Monticello Nuclear Generating Plant
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
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.

Barnett, F., P. Carson, T. Linscome-Hatfield, and H. Brittingham. ProUCL 5.2. U.S. Environmental Protection Agency, Washington, DC, 2022.

Code of Federal Regulations (CFR), 10 CFR Appendix I to Part 50 – Numerical Guides for Design Objectives and Limiting Conditions for Operation To Meet the Criterion "As Low as is Reasonably Achievable" for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents, January 2002.

Code of Federal Regulations (CFR), 40 CFR Part 141- National Primary Drinking Water Regulations, December 1975.

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

Nuclear Regulatory Commission (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 27.

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

EXECUTIVE SUMMARY

This 2023 Annual Radiological Environmental Operating Report (AREOR) describes the Monticello Nuclear Generating Plant (MNGP) Radiological Environmental Monitoring Program (REMP) and program results for the 2023 calendar year.[1] MNGP is operated by Northern States Power Company, a Minnesota corporation, doing business as 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, as applicable


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, 818 samples were analyzed, yielding 1,849 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 2023 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 which correspond to Quarter 4 and December 2022 extended to January 3rd, 2023. These data were provided in the 2022 AREOR and are not discussed in this 2023 AREOR.

1 INTRODUCTION

Photo Credit: Daniel Thurston, Chemistry Supervisor, MNGP

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 (CFR, 2002).

This 2023 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 2023 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 which correspond to Quarter 4 and December 2022 extended to January 3rd 2023. These data were provided in the 2022 AREOR and are not discussed in this 2023 AREOR.

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.

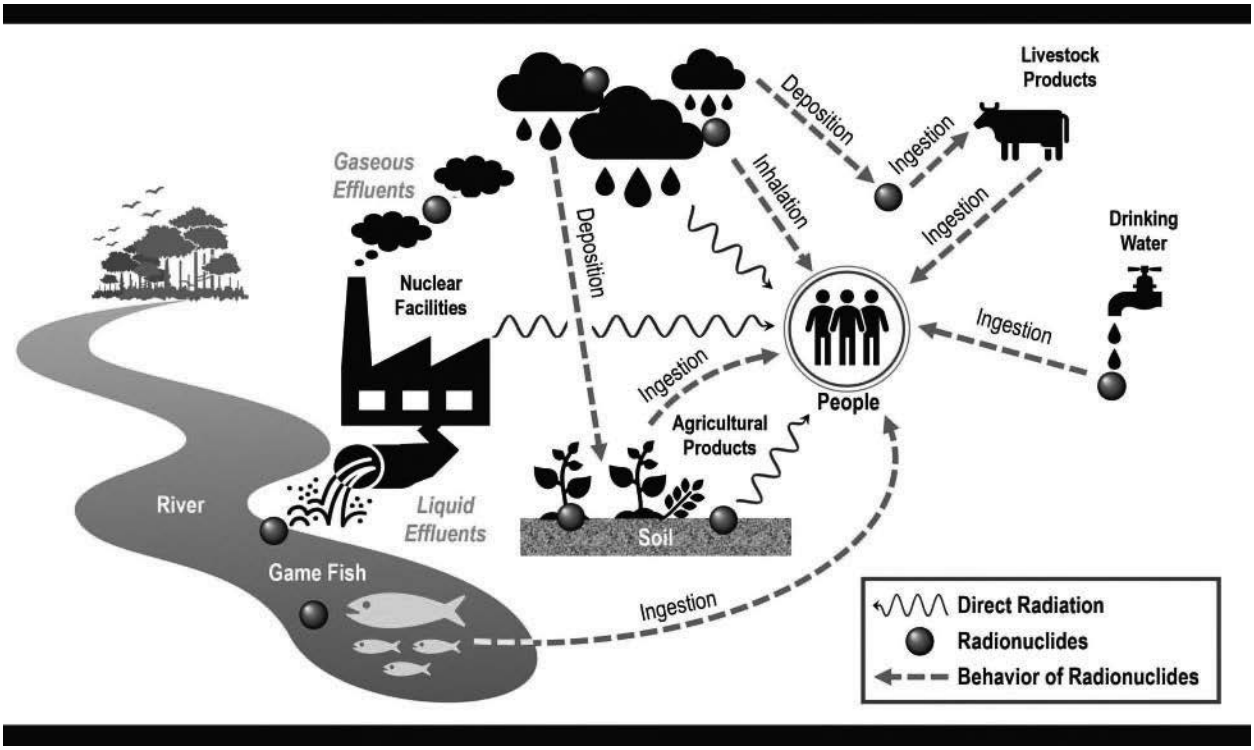


Figure 1.0-1: Monitored Potential Exposure Pathways

---

[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 approximately 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 Thermoluminescent Dosimeter (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 Part 50 (CFR, 2002). 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 (CFR, 2002) and Regulatory Guide 4.15 “Quality Assurance for Radiological Environmental Monitoring Programs" (Regulatory, 1979). Appendix A of this 2023 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 locations listed in Tables 2.1-1 through 2.1-5. 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 based on Deposition Coefficients (D/Qs), 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:

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

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

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)

			Location		
Type of Sample	**Code**	**Collection Site**	**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, as determined by Section 2.1 of the ODCM 07.01.

Code letters are defined below:

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)

			Location		
Type of Sample	Code	Collection Site	Distance Miles	Compass Heading	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	Barton Ave NW	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)

			Location		
Type of Sample	Code	Collection Site	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:

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, sediment, well water, air, and vegetation.

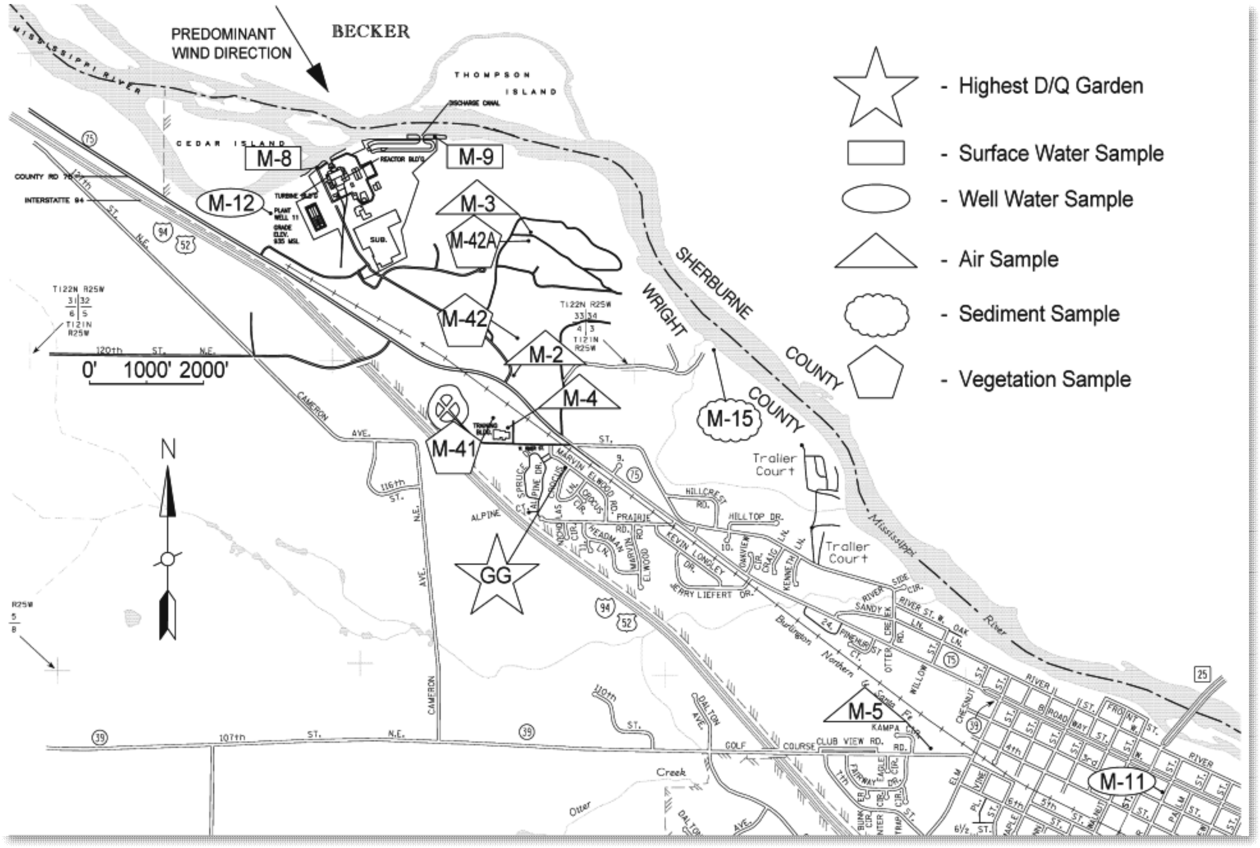


Figure 2.2-1: Radiation Environmental Monitoring Program (ODCM 07.01 Figure 1)

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

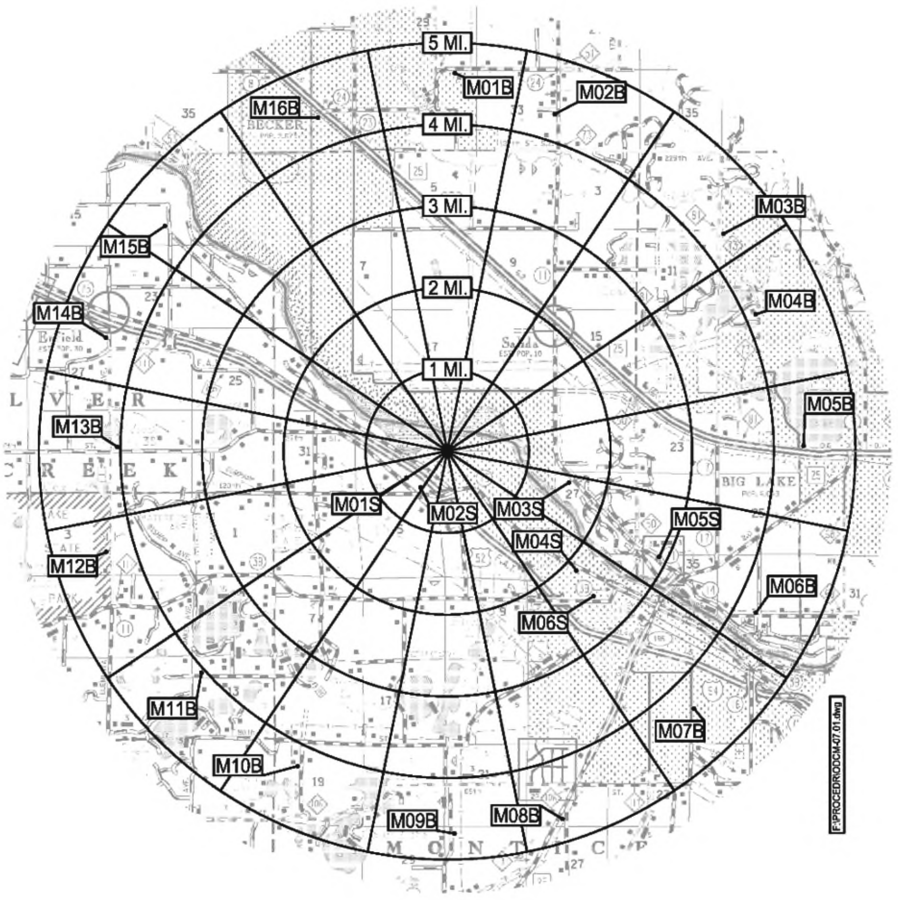


Figure 2.2-2: 4 - 5 Mile Ring and Special Interest TLD Locations (ODCM 07.01 Figure 2)

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

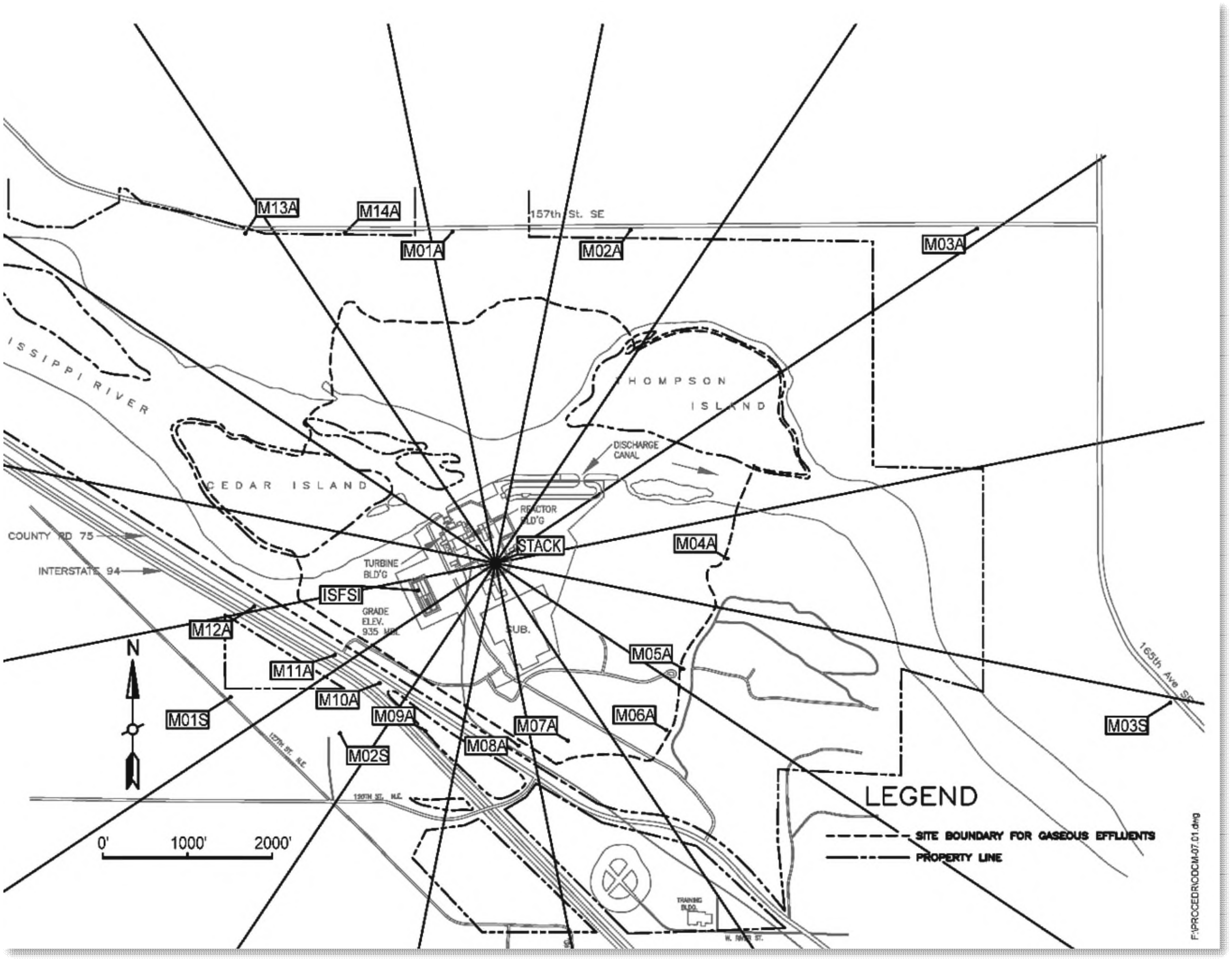


Figure 2.2-3: Site Boundary TLD Locations (ODCM 07.01 Figure 3)

Figure 2.2-4 below illustrates the control sample locations.

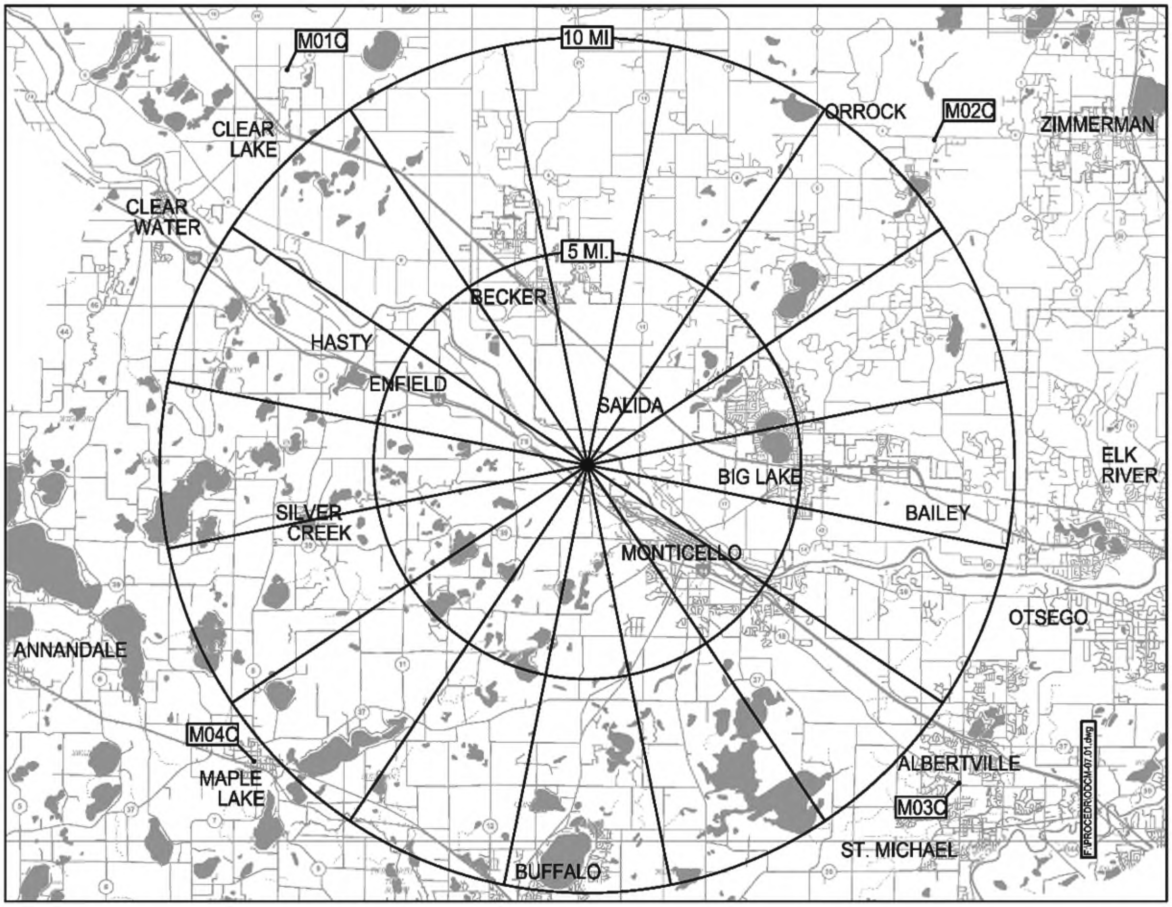


Figure 2.2-4: Control Locations (ODCM 07.01 Figure 4)

Figure 2.2-5 illustrates the ISFSI TLD locations.

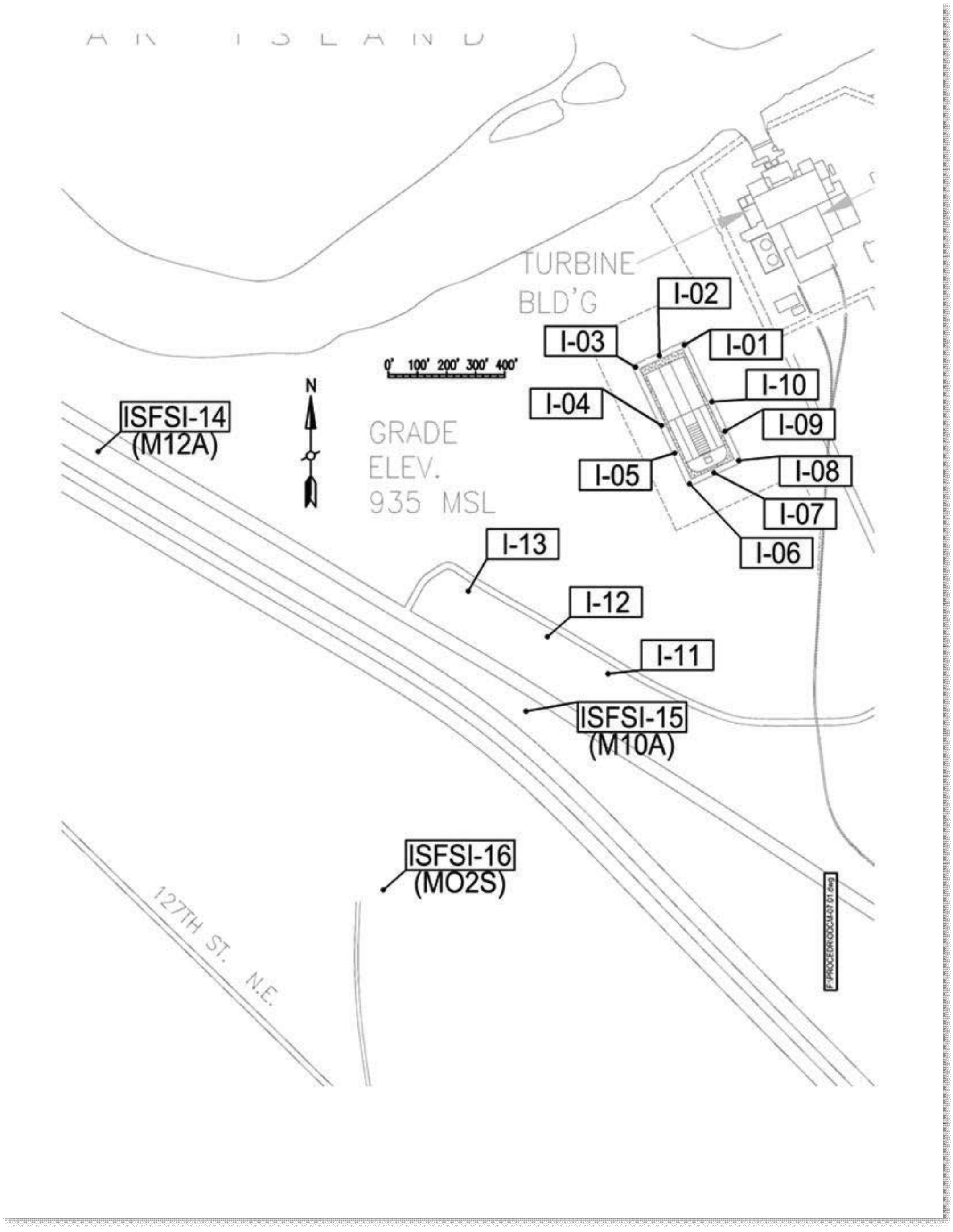


Figure 2.2-5: ISFSI TLD Locations (ODCM 07.01 Figure 5)

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.

In some cases, a Mann-Kendall trend test was used to determine whether a statistically significant trend is apparent in a dataset. Mann-Kendall tests were conducted at a 95 percent confidence level using ProUCL Version 5.2 (Barnett et al., 2022).

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

---

[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.

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.

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 Concentrations in Environmental Samples (ODCM 07.01 Table 2)

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 (CFR, 1975) 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) (ODCM 07.01 Table 3)

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]		

Notes:

[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 (BTP), 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:

[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 07.01 Revision 27)

[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 ± 0.019 picocuries per cubic meter (pCi/m^3) for 2023) and control locations (0.040 ± 0.014 pCi/m^3 for 2023). In the 2022 AREOR, Mann-Kendall tests were conducted on the air particulate data from 2009 to 2022 for control and indicator locations. The data from 2009 to 2022 showed a statistically significant increasing trend at a 95 percent confidence level; however, because this trend was observed with the control and indicator samples, the trend was not due to plant impact. In 2023, the control and indicator results were lower than the 2021 and 2022 results, and the Mann-Kendall test was not updated in 2023. The results are graphed below in Figure 4.1-1.

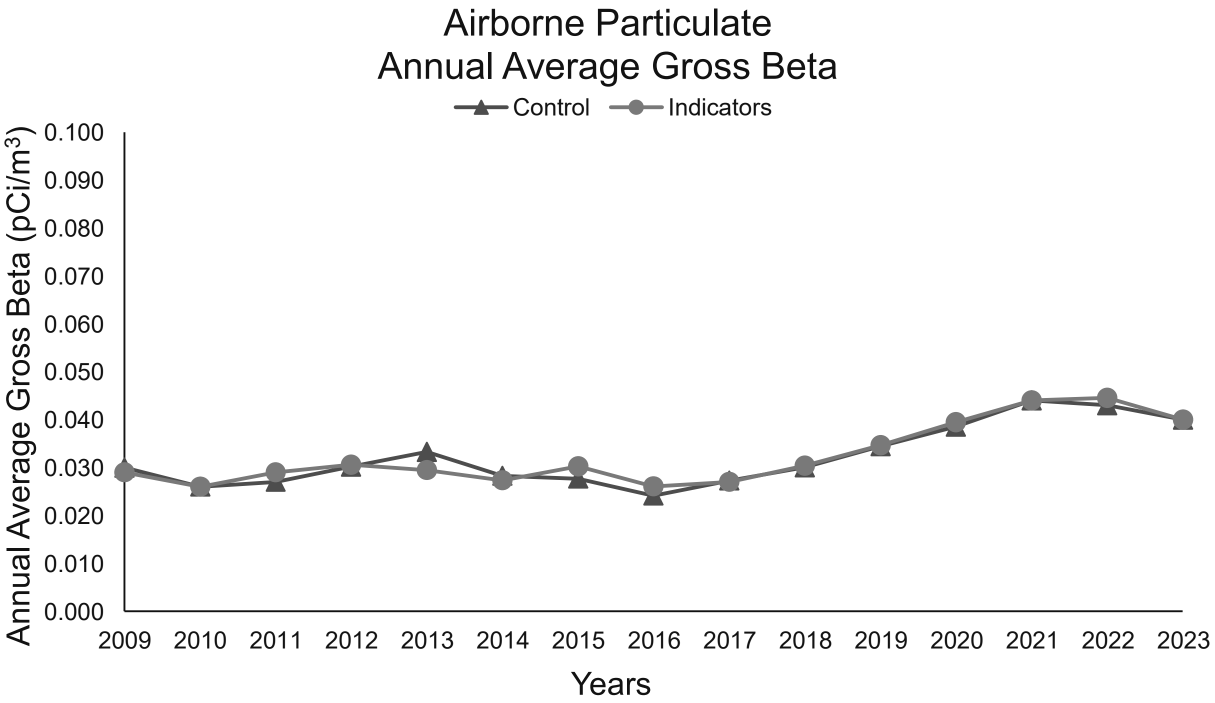


Figure 4.1-1: Graph of Historical Airborne Particulate Gross Beta

---

[11] Gross beta is a measurement of all beta activity present, regardless of specific radionuclide source. Beta particles are physically identical to electrons, but they 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 2023.[12,13] 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.

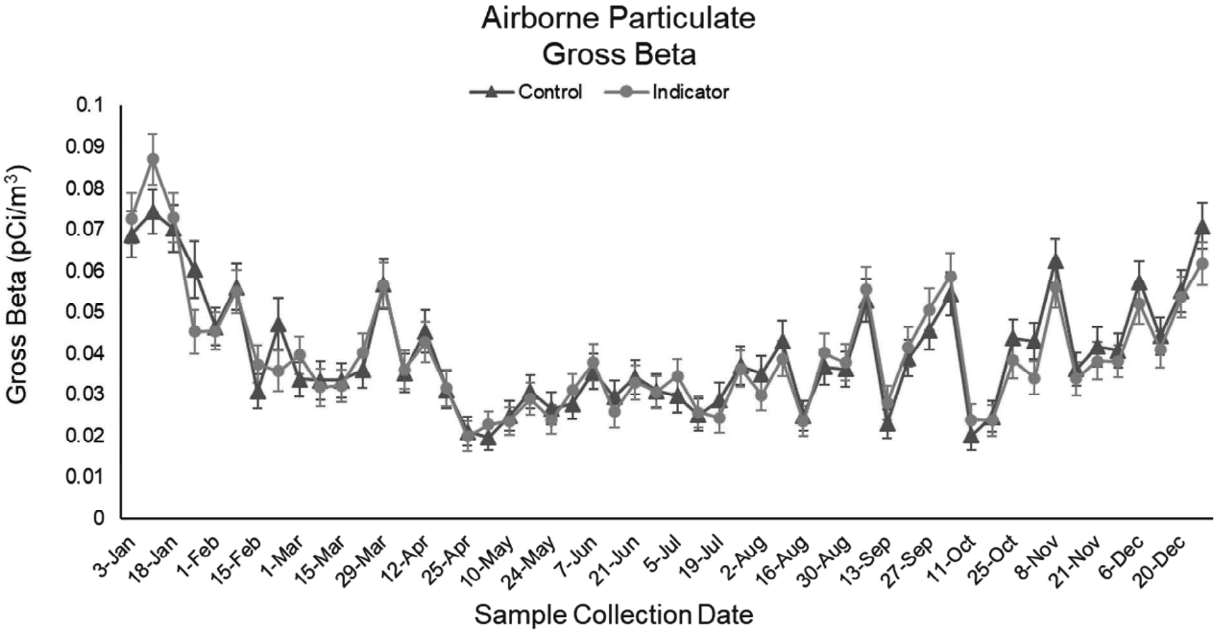


Figure 4.1-2: Graph of 2023 Average Airborne Particulate Gross Beta for Indicator and Control Locations

Mixing of the upper and lower atmospheres can transport suspended particles and beryllium-7[14] 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 0.070 ± 0.015 pCi/m^3 for the control locations, and 0.070 ± 0.018 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] For the week of 10/4/2023, a partial value was recorded at Air Station M-4. Since this value was counted as a missed sample, it was not included in the average. The missed sample is discussed further in Section 7.4 (Condition Report 501000077354).

[13] The 3/1/2023 samples at locations M-1, M-2, M-3, and M-4 and the 3/15/2023 sample taken at location M-1 were found with torn filters. Considered missed samples due to possibility of a partial sample (Condition Report 501000071013). See Section 7.4.

[14] 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 also below detection limits for all samples. Gross beta results were below detection limits for all samples. Gross beta averages are shown on Figure 4.2-1. There was no indication of an effect from MNGP. Because each measurement was below its respective LLD value, the annual dose for drinking water was assumed to be less than 1 mrem/year, and therefore iodine-131 analyses were not conducted in 2023 per ODCM 07.01 Revision 27.

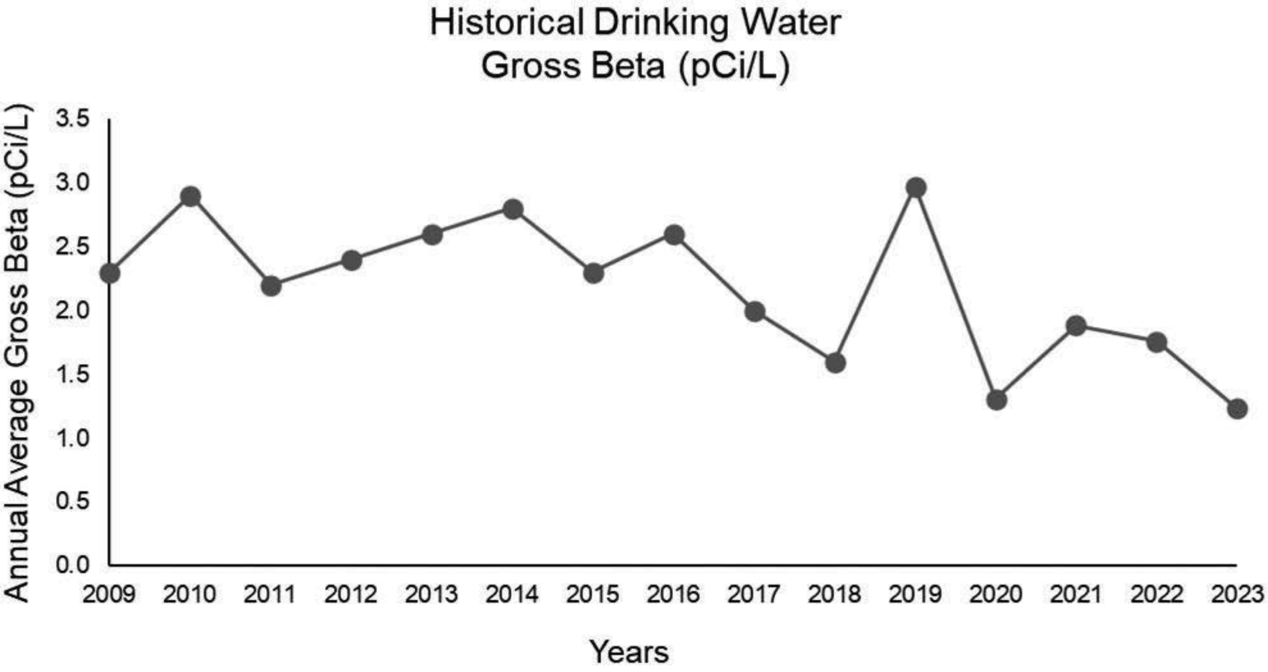


Figure 4.2-1: Graph of Historical Gross Beta for Drinking Water Sample

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. MNGP is reporting an abnormal discharge of tritium to the river during the 2023 reporting period after samples at monitoring wells near the Mississippi River were positive for tritium. A total of 0.167 Ci was estimated with modeling done by MNGP’s groundwater vendor. For full details, see the Monticello 2023 ARERR.

Barium-140 was detected at a value of 321 ± 344 pCi/L in the M-9 January 2023 sample. Although this value was below the measured (laboratory-established) MDC of 607 pCi/L, it was above the LLD of 60 pCi/L, and therefore it was not assigned a U flag. Although this value is above the reporting level of 200 pCi/L (Table 3.4-1), the quarterly average including February and March values (which were below the LLD) is below 200 pCi/L. ODCM 07.01 (Section 2.1.3 C.) states that the results need to be reported to the Commission within 30 days if they exceed the reporting level in Table 3.4-1 when averaged over any calendar quarter.

4.4 Groundwater

Tritium and gamma isotopic results were below the detection limit for all samples taken. The data for 2023 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[15], July, August, and September 2023. Gamma isotopic and iodine-131 concentrations were measured below the detection limit in all analyzed samples. These samples are required when milk samples are not available.

4.6 Food Products

Corn and potato samples were not required for 2023. There were no crops within five miles (mi) of MNGP irrigated using water from the Mississippi River.

---

[15] June samples were not analyzed. See Condition Report 501000075372 in Section 7.4.

4.7 Fish

Fish were analyzed in 2023, including two fish species collected from upstream locations and two collected from downstream locations in June. In September, one fish species was collected from upstream and downstream locations due to water levels in the river being too low for electrofishing. One sample of one game species of fish located upstream and downstream of site is required semi-annually per the ODCM (ODCM 07.01). Shorthead redhorse and smallmouth bass were collected from each location in June, and smallmouth bass were collected from each location in September. 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 3.55 ± 0.38 picocuries per gram (pCi/g) wet weight for the four upstream samples and 2.48 ± 0.38 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 2023 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. 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.

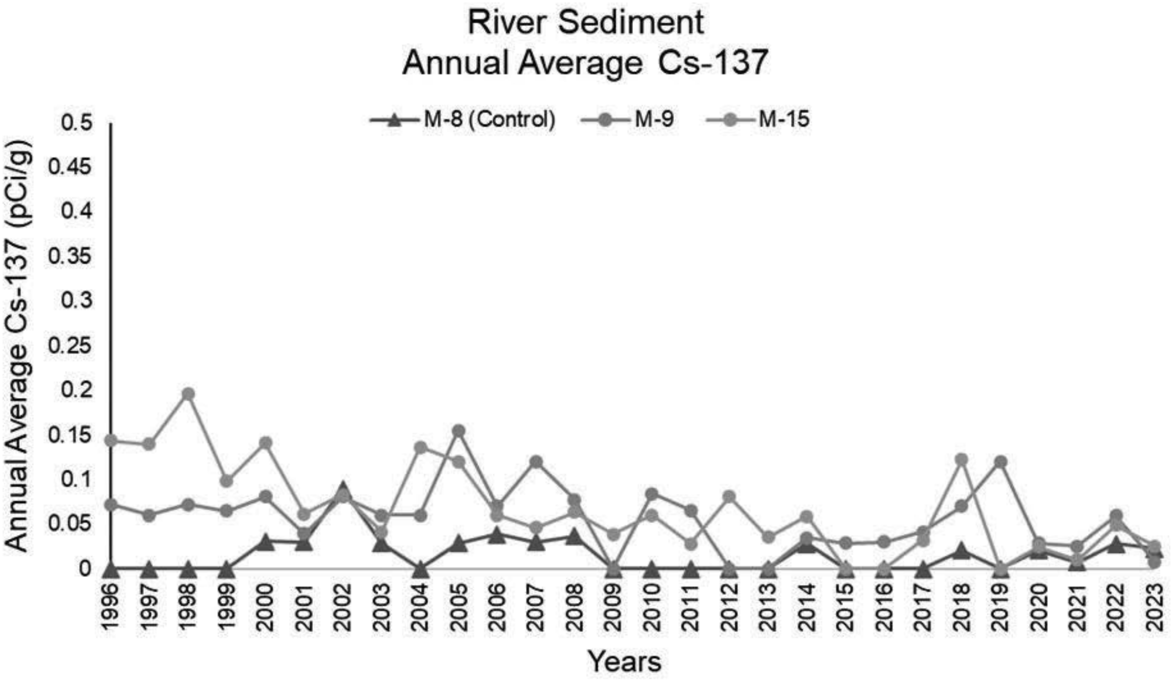


Figure 4.8-1: Graph of Historical Cesium-137 in River Sediment

4.9 Direct Gamma Radiation

4.9.1 Environmental TLD

Direct gamma radiation was measured in the general area of the Site boundary, at the inner ring, at an outer ring 4 to 5 miles from the Plant, at special interest areas, and at four control locations using TLDs. 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 14.2 and 13.7 millirem (mrem)/standard quarter (std quarter), respectively.[16] The mean for special interest locations was 13.8 mrem/std quarter and the mean for the control locations was 12.5 mrem/std quarter. Figure 4.9.1-1 shows the average measured dose from each std quarter.[17] The error bars represent the statistical uncertainty associated with each average measurement.

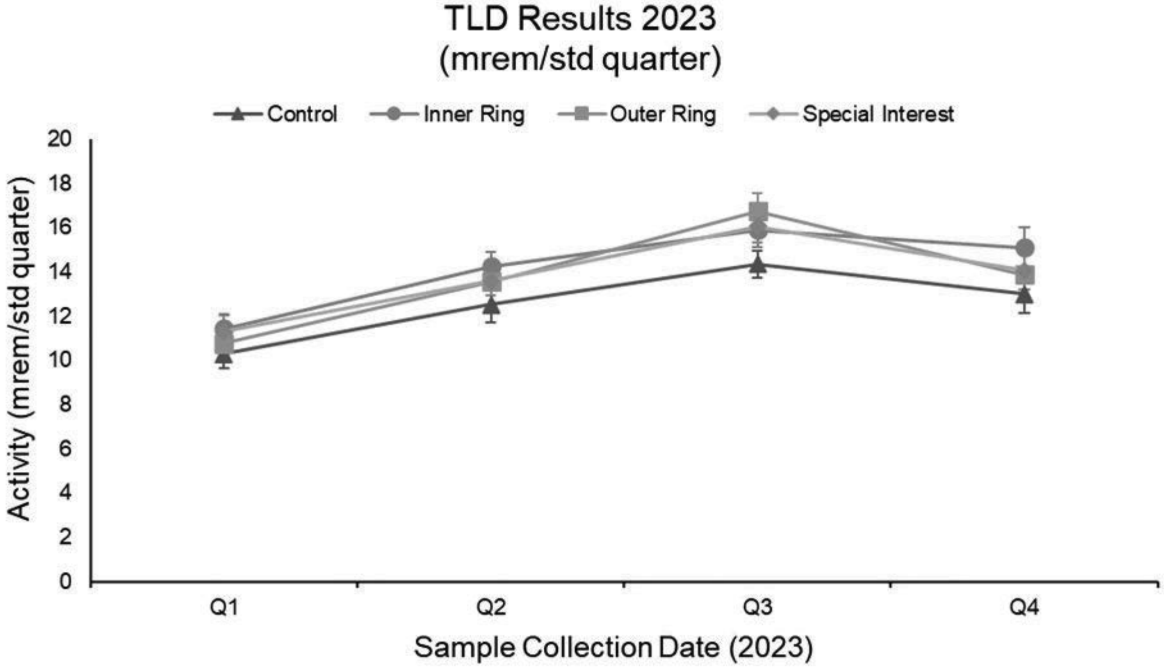


Figure 4.9.1-1: Graph of Direct Gamma Radiation Measurements

---

[16] The TLD at M-11A was left in place for two consecutive quarters (Q1 and Q2). The laboratory results were normalized according to the actual time left in place, and the same TLD value was applied to Q1 and Q2. See Condition Report 501000072555 in Section 7.4.

[17] 4th Quarter TLD M01A result was higher than baseline for this area by 10.2 mrem. This high result is likely due to construction in the area. See Condition Report 501000082357 in Section 7.4.

Dose rates measured at the inner and outer ring locations in 2023 were similar to those observed from 1999 through 2022 and are shown in Figure 4.9.1-2. No MNGP effect on ambient gamma radiation is indicated.

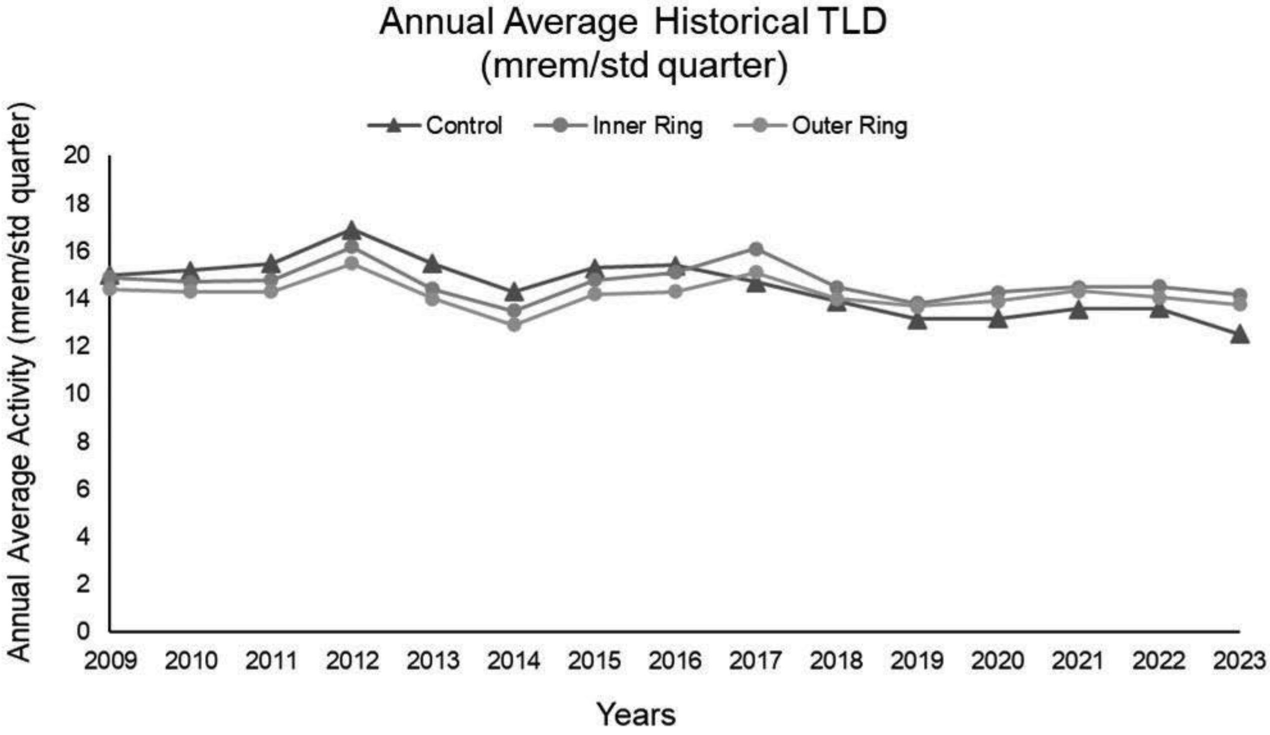


Figure 4.9.1-2: Graph of Historical Direct Gamma Measurements

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 2023. 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 2023.

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.

Photo Credit: Darin Jensen, Senior Design Engineer, MNGP

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 2023 survey was performed using door-to-door surveys and visual observations while driving; additionally, inputs from the 2022 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 2023 Land Use Census

The 2023 Land Use Census was conducted between September 6th 2023, and September 30th 2023, by the REMP Program Owner in accordance with MNGP's Chemistry Manual, Procedure I.05.41, "Annual Land Use Census and Critical Receptor Identification" (MNGP, n.d.).

There were 10 sectors that had an increase in the nearest garden D/Q of greater than 20 percent compared to 2022.[18] A new garden was identified in the SE Sector which is the new highest in the region. This garden also had the highest D/Q. The highest D/Q garden for 2023 is now in sector SE at 1.1 miles from MNGP.

---

[18] ODCM-APP-A was updated with dispersion and deposition parameters using data from 2016-2020. This resulted in most sectors having changes to D/Q values above 20%.

Photo Credit: Matt Mcclannahan, Senior Chemist, MNGP

Pigs identified 3.43 miles away from the plant

In 2023, there were four sectors where the highest Meat Animal D/Q values increased by 20 percent. There were no new meat animals identified that were the highest in their respective sector. The WSW sector remains the sector with the highest D/Q for meat animals.

There were eight sectors in which the highest D/Q values for the nearest resident increased by more than 20 percent in 2023. The highest D/Q resident remains at 0.99 miles from the Plant in the SSE sector.

Three of six previously identified Meat and Garden receptors had their D/Q increase by more than 20%. No new Meat and Garden receptors were identified.

Since 2019, one milk cow has been located at 3.25 miles from MNGP in the NNE sector. The animal is infrequently milked and only provides enough for the family usage. The owner indicated that the cow had birthed a calf that will eventually be milked as well. There is also a beef cow at the location. 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 0.0265 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 Updated Final Safety Analysis Report.

The highest D/Q location for each pathway is described in Table 5.3-1.

Table 5.3-1: Summary of Highest Location for Each Pathway in 2023

Pathway	Sector	Distance (mi)	D/Q
Resident	SSE SW	0.99 0.52	1.20E-08 1.20E-08
Meat	WSW	1.77	1.00E-09
Meat + Garden	W	1.82	1.10E-09
Garden	SE	1.11	7.30E-09
Milk[1]	NNE	3.24	4.40E-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 2023 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 2022 Annual Effluent Data report source term as input. This year the ODCM-APP-A was updated with MET data from 2016-2020. This resulted in a new critical receptor being identified. The location is a residential garden located 1.11 miles in the SE receptor (designated GG) and the pathway identified is the combined plane, inhalation, and vegetable ingestion to the thyroid of the child age group. ODC 616000000080 has been generated to update ODCM 07.01 with the new critical receptor. 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 0.0480 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 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 2023. A summary of the GEL QA program results for the sample media types sent to GEL during 2023 is documented in Appendix A.

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.

6.6 Environmental Dosimetry Company

EDC participates in an internal performance acceptance criteria and a quarterly independent testing TLD intercomparison program. In 2023, 100 percent of the individual dosimeters passed the performance criteria. A summary of the 2023 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 in 2023.

7.2 Change of Sampling Procedures

There were no changes to sampling procedures in 2023.

7.3 Change of Analysis Procedures

There were no changes to the analysis procedures in 2023.

7.4 Sample Deviations and Unavailable Analyses

Table 7.4-1 lists the deviations from the required REMP sample collection in 2023. Despite these sample deviations, 98.8 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
Direct Radiation	Gamma Dose	M07A	Q1	TLD went through X-ray machine in security.	Notified vendor at Standford Dosimetry. Documented in case abnormal results reported.	501000069793
River Water	Gamma Isotopic	M-8	Jan, Feb 2023[1]	Unsafe condition for sampling due to frozen river surface.	Sample obtained when water thawed.	501000069833
Direct Radiation	Gamma Dose	M13A	Q1	TLD was attached to a power pole that was replaced. TLD and holder missing.	Updated DAR 603000007937 with this CAP number for tracking.	501000072135
Direct Radiation	Gamma Dose	M06B	Q1	Sampler was likely struck by snow removal equipment. TLD and holder missing.	Updated DAR 603000007937 with this CAP number for tracking.	501000072135
Airborne Particulate	Gross Beta and Radioiodine	M-1 M-2 M-3 M-4	Week of 3/1/2023	Filters appeared damaged on collection. Damage likely due to heavy rain and snow. Declaring as missed sample due to possibility of partial sample.	Increased monitoring of air filters surrounding precipitation events. Ensured tears were not caused by faulty manufacturing.	501000071013
Airborne Particulate	Gross Beta and Radioiodine	M-1	Week of 3/15/2023	Filters appeared damaged on collection. Damage likely due to heavy rain and snow. Declaring as missed sample due to possibility of partial sample.	Increased monitoring of air filters surrounding precipitation events. Ensured tears were not caused by faulty manufacturing.	501000071013

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.

Sample Type	Analysis	Location	Collection Date or Period	Reason for not conducting REMP as required	Corrective Action	Condition Report
Direct Radiation	Gamma Dose	M-11A	Q2	TLD not collected during quarterly TLD changeout.	Contacted vendor, TLD remained posted for two quarters. Vendor indicated TLDs posted for two quarters get a good result, this is not a missed sample.	501000072555
Vegetation	Gamma Isotopic and Radioiodine	M-43 M-41 M-42	Jun 2023	June samples were not shipped to the lab within required hold time.	Informed supervision, provided coaching to warehouse staff to prevent a reoccurrence, and wrote CAP.	501000075372
Airborne Particulate	Gross Beta and Radioiodine	M-4	Week of 10/4/2023	Blown fuse caused sampler pump to fail. Partial sample collected but is considered a missed sample.	Replaced blown fuse and filter set for next sample collection period.	501000077354
Direct Radiation	Gamma Dose	M01A	Q4	REMP conducted as required; a condition report was prepared noting abnormal sample result. Q4 result was 10.2 mRem above quarterly baseline for this area.	Contacted vendor to verify result. Vendor confirmed no analysis errors but suggested construction in the area may contribute to abnormally high results.	501000082357

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 2023, the LLD was not satisfied in six of the barium-140/lanthanum-140 samples (12%). 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. A delay in the analysis of the sample by the laboratory, coupled with short radiochemical half-life, caused the deviations. Table 7.5-1 below details the analytical deviations.

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)
M-8 Upstream of Plant	8/30/2023 10:36	10/16/2023 19:33	La-140	3.42 U	15	23.7
			Ba-140	-9.89 U	60	63.8
	11/29/2023 11:20	1/10/2024 10:05	La-140	-3.61 U	15	15.6
M-9 Downstream of Plant	1/24/2023 10:40	4/26/2023 10:37	La-140	-103 U	15	195
			Ba-140	321	60	607
	2/21/2023 8:22	4/25/2023 16:28	La-140	-8.62 U	15	69.2
			Ba-140	-26.2 U	60	213
	8/30/2023 9:55	10/16/2023 19:32	La-140	2.73 U	15	21.7
			Ba-140	29.2 U	60	64.1
	11/29/2023 11:00	1/10/2024 9:53	La-140	-0.558 U	15	15.6

Notes:

U qualifier indicates that the analyte was analyzed for, but not detected above the MDC.

8 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM – SUMMARY OF RESULTS

This section presents a summary of MNGP's REMP sampling and monitoring results for the 2023 period for airborne particulates, airborne radioiodine, direct radiation, and measurable radioactivity in milk, broadleaf vegetation, river water, 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 2023 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 2023

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/m^3)	Gross Beta (259)	0.01	0.040 (207/207) 0.015 - 0.213	M-1, Air Station 11.0 m @ 307/NW & M-5, Air Station 2.6 m @ 134/SE	0.040 (52/52) 0.020-0.074 0.040 (52/52) 0.022 - 0.093	0.040 (52/52) 0.020-0.074	0
	Gamma (20)						0
	Be-7[3]	-	0.070 (16/16) 0.048 - 0.103	M-3, Air Station 0.6 m @ 104/ESE	0.074 (4/4) 0.062 - 0.100	0.070 (4/4) 0.055 - 0.091	
	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/m^3)	I-131 (260)	0.07	<LLD	-	-	<LLD	0
Broadleaf Vegetation (pCi/kg-wet)	Gamma (12)						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	

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.

Table 8.1-1: Radiological Environmental Monitoring Program Summary (Continued)

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		Control Mean[1] (f)[2] Range[1]	Number of Nonroutine Reported Measurements
				Name Distance and Direction	Mean[1] (f)[2] Range[1]		
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
Fish (pCi/kg-wet)	Gamma (8)						0
	K-40[3]	-	2744 (4/4) 3460 - 3640	M-8 Upstream of Plant	3550 (3/3) 3700 - 3730	3550 (3/3) 3700 - 3730	
	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]	-	1090 (1/4) 1090 - 1090	M-15 Montissippi Park	1090 (1/2) 1090 - 1090	- (0/2) -	
	K-40[3]	-	11160 (4/4) 9740 - 13100	M-15 Montissippi Park	11420 (2/2) 9740 - 13100	10150 (2/2) 10100 - 10200	
	Mn-54	-	<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	
				-		<LLD	
	Cs-137	180	<LLD	-	-		
						<LLD	
				-			
	Ba-La-140	-	<LLD		-	<LLD	
	Ce-144	-	<LLD		-	<LLD	
				-			
				-			
Drinking Water (pCi/L)	Gross Beta (12)	4	<LLD	-	-	None	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.

Table 8.1-1: Radiological Environmental Monitoring Program Summary (Continued)

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		Control Mean[1] (f)[2] Range[1]	Number of Nonroutine Reported Measurements
				Name Distance and Direction	Mean[1] (f)[2] Range[1]		
Drinking Water (pCi/L)	Gamma (12)						0
	Mn-54	15	<LLD	-	-	None	
				-			
			<LLD	-	-		
	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[6]	-	-	None	
	Ba-La-140	15[4]	<LLD		-	None	
	Ce-144	-				None	
	I-131 (0)	1	-	-	-	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[6] (0)	1[5]	<LLD	-	-	<LLD	0
	Tritium (4)	2000	<LLD	-	-	<LLD	0

Notes:

[1] Mean and range are based upon detectible measurements only.
[2] (f) Fraction of detectible measurements at a specific location.
[4] The specified LLD applies to the daughter nuclide of an equilibrium mixture of the parent and daughter nuclides. Per the BPT, 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] Not required.

Table 8.1-1: Radiological Environmental Monitoring Program Summary (Continued)

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		Control Mean[1] (f)[2] Range[1]	Number of Nonroutine Reported Measurements
				Name Distance and Direction	Mean[1] (f)[2] Range[1]		
River Water (pCi/L)	Gamma (21)						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]	321 (1/12)	M-9 Downstream of PLant	321 (1/12)	- (0/10) -	
	Ce-144	-	<LLD	-	-	<LLD	
	Tritium (8)	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	13.3 (4/4) (11.2 - 15.3)	12.5 (16/16) (9.9 - 15.3)	0
Direct Radiation: Inner Ring (General Area at Site Boundary) (mrem/91 days)	Gamma (54)	-	14.2 (55/55) (10.1 - 25.3)	M01A, 0.75 mi @ 353/N	17.7 (4/4) (12.8 -25.3)		0
Direct Radiation: Outer Ring (4-5 mi. distant) (mrem/91 days)	Gamma (63)	-	13.8 (63/63) (9.9 – 19.25)	M06B, 4.3 mi @ 117/ESE	15.8 (4/4) (13.7 – 19.0)		0
Direct Radiation: Special Interest Areas (mrem/91 days)	Gamma (36)	-	13.8 (36/36) (10.0 - 17.1)	I-13 0.34 mi @ 240/WSW	14.8 (4/4) (11.8 - 17.2)		0

Notes:

[1] Mean and range are based upon detectible measurements only.

[2] (f) Fraction of detectible measurements at a specific location.

[4] The specified LLD applies to the daughter nuclide of an equilibrium mixture of the parent and daughter nuclides. Per the BPT, 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.

9 ERRATA TO PREVIOUS REPORTS

9.1 Errata to the MNGP AREOR

Included in this report is an errata to the 2022 AREOR. In the 2022 AREOR, Figure 4.8-1 included 2022 sediment results for Cs-137 at M-8 (Control) and M-9 which inadvertently included river water results in the calculated annual averages. This issue did not affect the sediment annual average results for M-15. The errata updates Figure 4.8-1 in Section 4.8 of the 2022 AREOR. The updates to the Cs-137 average values did not change the conclusions of the AREOR, and no changes to the text were required.

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 h, 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

h	Preparation or preservation holding time was exceeded.
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 Minimum Detection Limit (MDL), Minimum Detectable Activity (MDA), MDC, or Limit of Detection (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.” Results with blank qualifiers and results with only h, L or M qualifiers (i.e., without also U, UI, or ND qualifiers) are considered to be “detected.”

AIRBORNE CARTRIDGE: RADIOIODINE

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)
1/3/2023	1.38E-03 ± 1.23E-02 U	4.76E-04 ± 9.65E-03 U	6.09E-04 ± 1.10E-02 U	-4.66E-03 ± 1.39E-02 U	1.20E-02 ± 1.25E-02 U
1/11/2023	3.64E-03 ± 9.25E-03 U	1.38E-04 ± 1.01E-02 U	-5.96E-03 ± 1.24E-02 U	-5.93E-03 ± 1.17E-02 U	8.18E-03 ± 1.01E-02 U
1/18/2023	1.85E-03 ± 8.21E-03 U	7.38E-03 ± 1.41E-02 U	-3.40E-03 ± 7.70E-03 U	-5.97E-03 ± 9.11E-03 U	-4.75E-03 ± 1.02E-02 U
1/24/2023	-7.60E-03 ± 1.19E-02 U	6.11E-03 ± 9.63E-03 U	-7.20E-03 ± 1.25E-02 U	9.46E-03 ± 1.37E-02 U	-5.98E-03 ± 1.25E-02 U
2/1/2023	-9.15E-04 ± 7.43E-03 U	-2.25E-03 ± 7.14E-03 U	-9.34E-03 ± 9.29E-03 U	-1.33E-03 ± 9.73E-03 U	9.11E-03 ± 9.90E-03 U
2/8/2023	3.82E-03 ± 8.44E-03 U	2.92E-03 ± 5.38E-03 U	1.18E-02 ± 8.11E-03 U	1.43E-04 ± 8.22E-03 U	4.57E-03 ± 6.40E-03 U
2/15/2023	1.56E-02 ± 2.58E-02 UI	4.48E-03 ± 9.70E-03 U	7.89E-03 ± 1.26E-02 U	8.75E-04 ± 9.23E-03 U	-7.92E-03 ± 9.80E-03 U
2/21/2023	-1.06E-03 ± 1.65E-02 U	4.00E-03 ± 1.03E-02 U	-4.34E-03 ± 1.26E-02 U	3.07E-04 ± 1.12E-02 U	5.41E-03 ± 1.48E-02 U
3/1/2023	9.03E-03 ± 1.14E-02 U*	-1.22E-04 ± 6.25E-03 U*	3.68E-03 ± 9.55E-03 U*	1.68E-02 ± 1.43E-02 U*	1.09E-03 ± 9.67E-03 U
3/7/2023	-7.62E-03 ± 1.44E-02 U	-3.53E-03 ± 9.81E-03 U	-4.70E-04 ± 1.46E-02 U	4.17E-04 ± 1.21E-02 U	4.38E-03 ± 1.41E-02 U
3/15/2023	8.04E-04 ± 8.13E-03 U*	8.50E-04 ± 7.54E-03 U	-7.71E-03 ± 1.06E-02 U	5.64E-03 ± 7.53E-03 U	-4.87E-03 ± 1.10E-02 U
3/22/2023	9.59E-04 ± 9.91E-03 U	-5.13E-04 ± 1.07E-02 U	-8.01E-03 ± 1.12E-02 U	-3.97E-03 ± 1.06E-02 U	-7.69E-03 ± 1.01E-02 U
3/29/2023	4.11E-02 ± 3.43E-02 U	3.40E-04 ± 9.60E-03 U	-8.78E-03 ± 1.93E-02 U	-3.10E-03 ± 1.92E-02 U	-3.57E-03 ± 2.21E-02 U
4/5/2023	7.58E-03 ± 1.71E-02 U	5.99E-03 ± 1.43E-02 U	6.60E-03 ± 1.68E-02 U	3.31E-03 ± 1.87E-02 U	3.99E-03 ± 1.49E-02 U
4/12/2023	1.08E-02 ± 2.00E-02 U	-2.76E-03 ± 1.51E-02 U	3.85E-03 ± 1.52E-02 U	4.03E-03 ± 1.73E-02 U	-4.28E-03 ± 1.94E-02 U
4/19/2023	2.92E-03 ± 1.06E-02 U	-3.97E-03 ± 1.11E-02 U	-2.39E-03 ± 1.15E-02 U	-8.92E-04 ± 1.43E-02 U	-2.32E-03 ± 8.17E-03 U
4/25/2023	-2.52E-03 ± 7.01E-03 U	-3.94E-03 ± 1.06E-02 U	2.69E-03 ± 8.92E-03 U	4.50E-03 ± 7.97E-03 U	-4.33E-04 ± 6.28E-03 U
5/3/2023	-3.72E-03 ± 1.17E-02 U	2.22E-03 ± 1.05E-02 U	3.47E-03 ± 1.09E-02 U	1.90E-03 ± 1.33E-02 U	-5.11E-03 ± 7.98E-03 U
5/10/2023	8.77E-03 ± 1.07E-02 U	-2.47E-03 ± 9.96E-03 U	-4.15E-03 ± 9.13E-03 U	4.53E-03 ± 1.65E-02 U	-1.11E-03 ± 8.89E-03 U
5/17/2023	-5.25E-03 ± 8.43E-03 U	2.04E-03 ± 9.78E-03 U	-7.49E-03 ± 1.06E-02 U	1.19E-03 ± 1.39E-02 U	6.63E-06 ± 6.79E-03 U
5/24/2023	-1.22E-02 ± 1.41E-02 U	2.66E-03 ± 1.35E-02 U	-1.66E-03 ± 1.16E-02 U	1.76E-03 ± 1.18E-02 U	9.88E-03 ± 9.25E-03 U

Note:

* The 3/1/2023 samples at locations M-1, M-2, M-3, and M-4 and the 3/15/2023 sample at location M-1 are declared missed samples due to the possibility of partial sample collection, since the filters were torn on collection (Condition Report 501000071013). See Section 7.4.

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)
5/31/2023	6.09E-02 ± 4.54E-02 **UI**	-1.02E-02 ± 2.17E-02 **U**	9.61E-04 ± 1.49E-02 **U**	-2.15E-02 ± 1.98E-02 **U**	-1.86E-03 ± 1.75E-02 **U**
6/7/2023	2.14E-03 ± 2.20E-02 **U**	-1.48E-02 ± 1.82E-02 **U**	1.45E-03 ± 2.01E-02 **U**	1.04E-02 ± 2.10E-02 **U**	1.41E-03 ± 1.91E-02 **U**
6/14/2023	2.00E-03 ± 1.61E-02 **U**	8.07E-03 ± 1.78E-02 **U**	-1.71E-02 ± 1.41E-02 **U**	-9.61E-04 ± 2.27E-02 **U**	-4.79E-03 ± 1.13E-02 **U**
6/21/2023	1.17E-02 ± 1.27E-02 **U**	-2.24E-04 ± 8.12E-03 **U**	-4.46E-03 ± 9.67E-03 **U**	-1.27E-04 ± 9.87E-03 **U**	7.51E-03 ± 7.54E-03 **U**
6/28/2023	-7.37E-03 ± 1.00E-02 **U**	-3.99E-03 ± 8.67E-03 **U**	3.95E-03 ± 8.27E-03 **U**	-4.82E-03 ± 7.85E-03 **U**	-5.17E-03 ± 8.37E-03 **U**
7/5/2023	4.32E-03 ± 4.98E-03 **U**	-4.36E-03 ± 4.93E-03 **U**	-1.57E-03 ± 4.02E-03 **U**	-6.41E-03 ± 4.49E-03 **U**	5.32E-03 ± 3.99E-03 **U**
7/12/2023	7.90E-03 ± 1.51E-02 **U**	-5.38E-03 ± 9.77E-03 **U**	-4.90E-03 ± 1.28E-02 **U**	-1.53E-03 ± 9.33E-03 **U**	2.74E-03 ± 9.00E-03 **U**
7/19/2023	-4.16E-03 ± 1.24E-02 **U**	4.39E-03 ± 1.04E-02 **U**	6.82E-03 ± 1.19E-02 **U**	-4.76E-04 ± 1.10E-02 **U**	3.78E-04 ± 8.08E-03 **U**
7/26/2023	3.63E-03 ± 9.15E-03 **U**	-4.11E-04 ± 9.13E-03 **U**	2.35E-03 ± 9.02E-03 **U**	6.14E-04 ± 8.71E-03 **U**	-5.85E-03 ± 1.03E-02 **U**
8/2/2023	4.36E-03 ± 8.03E-03 **U**	1.71E-03 ± 7.95E-03 **U**	4.42E-03 ± 7.65E-03 **U**	-2.20E-03 ± 7.15E-03 **U**	1.92E-04 ± 8.01E-03 **U**
8/9/2023	7.05E-04 ± 9.58E-03 **U**	-7.90E-03 ± 1.45E-02 **U**	-6.10E-03 ± 1.63E-02 **U**	-4.91E-03 ± 1.58E-02 **U**	4.73E-04 ± 1.40E-02 **U**
8/16/2023	-7.21E-03 ± 1.72E-02 **U**	-6.36E-03 ± 1.75E-02 **U**	1.21E-02 ± 1.78E-02 **U**	1.64E-02 ± 1.38E-02 **U**	-3.70E-03 ± 1.70E-02 **U**
8/23/2023	1.08E-02 ± 1.07E-02 **U**	-4.57E-04 ± 1.15E-02 **U**	8.24E-04 ± 1.45E-02 **U**	6.45E-03 ± 1.13E-02 **U**	-2.90E-03 ± 1.29E-02 **U**
8/30/2023	8.06E-03 ± 3.67E-02 **U**	-7.48E-03 ± 2.81E-02 **U**	-1.04E-02 ± 3.90E-02 **U**	6.84E-03 ± 3.70E-02 **U**	-1.74E-03 ± 3.47E-02 **U**
9/6/2023	-1.30E-02 ± 2.98E-02 **U**	1.16E-02 ± 2.20E-02 **U**	-1.93E-02 ± 2.27E-02 **U**	-1.15E-02 ± 1.91E-02 **U**	-2.68E-03 ± 1.83E-02 **U**
9/13/2023	-8.34E-03 ± 1.02E-02 **U**	8.23E-03 ± 9.37E-03 **U**	-6.10E-03 ± 1.24E-02 **U**	1.29E-03 ± 9.71E-03 **U**	-3.35E-03 ± 1.40E-02 **U**
9/20/2023	1.22E-02 ± 2.20E-02 **U**	8.92E-03 ± 1.12E-02 **U**	6.47E-03 ± 1.91E-02 **U**	-1.05E-02 ± 1.57E-02 **U**	-1.94E-03 ± 1.04E-02 **U**
9/27/2023	4.08E-03 ± 1.83E-02 **U**	3.78E-03 ± 1.19E-02 **U**	-8.77E-03 ± 1.18E-02 **U**	7.29E-04 ± 1.20E-02 **U**	1.02E-02 ± 1.33E-02 **U**
10/4/2023	-1.04E-02 ± 1.81E-02 **U**	1.25E-02 ± 2.36E-02 **U**	-2.23E-02 ± 2.64E-02 **U**	3.41E-02 ± 2.15E-01 **U***	1.61E-02 ± 2.06E-02 **U**
10/11/2023	-8.04E-03 ± 2.34E-02 **U**	-8.78E-03 ± 2.38E-02 **U**	2.42E-02 ± 2.63E-02 **U**	-1.66E-04 ± 1.49E-02 **U**	4.53E-03 ± 1.78E-02 **U**
10/18/2023	6.68E-03 ± 1.06E-02 **U**	-5.76E-03 ± 7.64E-03 **U**	1.64E-03 ± 1.39E-02 **U**	1.64E-03 ± 1.02E-02 **U**	2.56E-04 ± 8.53E-03 **U**
10/25/2023	1.23E-02 ± 1.59E-02 **U**	7.02E-03 ± 1.39E-02 **U**	7.19E-04 ± 1.66E-02 **U**	-9.13E-04 ± 1.83E-02 **U**	-7.12E-03 ± 1.45E-02 **U**

Note:

* The M-4 air sampler (10/4/2023 sample date) was found to not be running on the indicated sample collection date. Partial sample was collected. Although results are provided, this is considered a missed sample (Condition Report 501000077354). See Section 7.4.

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)**
11/1/2023	1.38E-02 ± 3.51E-02 **U**	-5.69E-03 ± 3.23E-02 **U**	3.30E-02 ± 3.35E-02 **U**	-8.38E-03 ± 2.92E-02 **U**	2.80E-02 ± 2.88E-02 **U**
11/8/2023	4.66E-03 ± 2.02E-02 **U**	3.50E-02 ± 2.07E-02 **UI**	1.12E-02 ± 2.22E-02 **U**	-1.07E-02 ± 2.67E-02 **U**	5.37E-03 ± 2.33E-02 **U**
11/15/2023	8.31E-04 ± 1.52E-02 **U**	2.68E-03 ± 1.34E-02 **U**	2.89E-03 ± 1.73E-02 **U**	7.68E-03 ± 1.65E-02 **U**	7.84E-03 ± 1.20E-02 **U**
11/21/2023	1.36E-03 ± 1.26E-02 **U**	-2.11E-03 ± 9.29E-03 **U**	7.70E-03 ± 9.41E-03 **U**	5.35E-03 ± 1.10E-02 **U**	-3.54E-03 ± 1.22E-02 **U**
11/29/2023	2.24E-03 ± 8.59E-03 **U**	8.59E-03 ± 8.80E-03 **U**	2.28E-03 ± 7.40E-03 **U**	-1.15E-04 ± 8.83E-03 **U**	6.14E-04 ± 5.76E-03 **U**
12/6/2023	2.32E-03 ± 6.75E-03 **U**	-1.30E-03 ± 7.53E-03 **U**	1.24E-03 ± 7.88E-03 **U**	-5.27E-03 ± 9.43E-03 **U**	8.12E-04 ± 8.51E-03 **U**
12/13/2023	-3.44E-03 ± 1.53E-02 **U**	-8.48E-03 ± 2.11E-02 **U**	-4.14E-03 ± 1.79E-02 **U**	3.22E-02 ± 2.30E-02 **UI**	-8.68E-03 ± 1.64E-02 **U**
12/20/2023	-2.68E-03 ± 1.47E-02 **U**	1.68E-03 ± 1.41E-02 **U**	3.28E-03 ± 2.03E-02 **U**	1.37E-03 ± 1.20E-02 **U**	1.88E-02 ± 1.85E-02 **U**
12/27/2023	-1.16E-03 ± 1.67E-02 **U**	-1.51E-03 ± 1.59E-02 **U**	6.89E-03 ± 1.53E-02 **U**	-8.23E-03 ± 1.51E-02 **U**	4.02E-03 ± 1.45E-02 **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)
1/3/2023	0.069 ± 0.006	0.069 ± 0.006	0.076 ± 0.006	0.077 ± 0.007	0.069 ± 0.006
1/11/2023	0.074 ± 0.005	0.089 ± 0.006	0.083 ± 0.006	0.083 ± 0.006	0.093 ± 0.006
1/18/2023	0.070 ± 0.006	0.073 ± 0.006	0.072 ± 0.006	0.073 ± 0.006	0.073 ± 0.006
1/24/2023	0.060 ± 0.007	0.039 ± 0.005	0.045 ± 0.005	0.051 ± 0.006	0.046 ± 0.005
2/1/2023	0.046 ± 0.005	0.041 ± 0.004	0.049 ± 0.005	0.048 ± 0.005	0.045 ± 0.004
2/8/2023	0.056 ± 0.006	0.056 ± 0.005	0.057 ± 0.005	0.047 ± 0.005	0.060 ± 0.006
2/15/2023	0.031 ± 0.004	0.031 ± 0.004	0.039 ± 0.005	0.039 ± 0.005	0.042 ± 0.005
2/21/2023	0.047 ± 0.006	0.029 ± 0.004	0.034 ± 0.005	0.040 ± 0.005	0.041 ± 0.005
3/1/2023	0.034 ± 0.004*	0.039 ± 0.004*	0.038 ± 0.004*	0.043 ± 0.005*	0.039 ± 0.004
3/7/2023	0.034 ± 0.005	0.028 ± 0.004	0.037 ± 0.005	0.032 ± 0.005	0.029 ± 0.004
3/15/2023	0.034 ± 0.004*	0.030 ± 0.004	0.033 ± 0.004	0.034 ± 0.004	0.032 ± 0.004
3/22/2023	0.036 ± 0.004	0.032 ± 0.004	0.043 ± 0.005	0.043 ± 0.005	0.043 ± 0.005
3/29/2023	0.057 ± 0.006	0.054 ± 0.005	0.055 ± 0.005	0.057 ± 0.006	0.060 ± 0.006
4/5/2023	0.035 ± 0.005	0.032 ± 0.004	0.035 ± 0.005	0.039 ± 0.005	0.038 ± 0.005
4/12/2023	0.045 ± 0.005	0.038 ± 0.004	0.043 ± 0.005	0.044 ± 0.005	0.045 ± 0.005
4/19/2023	0.031 ± 0.004	0.031 ± 0.004	0.032 ± 0.004	0.034 ± 0.005	0.029 ± 0.004
4/25/2023	0.021 ± 0.004	0.015 ± 0.003	0.020 ± 0.004	0.022 ± 0.004	0.022 ± 0.004
5/3/2023	0.020 ± 0.003	0.022 ± 0.003	0.021 ± 0.003	0.025 ± 0.004	0.022 ± 0.003
5/10/2023	0.025 ± 0.004	0.025 ± 0.004	0.022 ± 0.003	0.022 ± 0.003	0.025 ± 0.004
5/17/2023	0.031 ± 0.004	0.031 ± 0.004	0.029 ± 0.004	0.028 ± 0.004	0.028 ± 0.003
5/24/2023	0.027 ± 0.004	0.024 ± 0.004	0.022 ± 0.003	0.025 ± 0.004	0.025 ± 0.003
5/31/2023	0.028 ± 0.004	0.033 ± 0.004	0.027 ± 0.004	0.031 ± 0.004	0.033 ± 0.004
6/7/2023	0.036 ± 0.004	0.043 ± 0.005	0.035 ± 0.004	0.038 ± 0.005	0.035 ± 0.004
6/14/2023	0.029 ± 0.004	0.028 ± 0.004	0.022 ± 0.003	0.024 ± 0.004	0.029 ± 0.004
6/21/2023	0.034 ± 0.004	0.034 ± 0.004	0.031 ± 0.004	0.035 ± 0.005	0.032 ± 0.004
6/28/2023	0.031 ± 0.004	0.030 ± 0.004	0.029 ± 0.004	0.033 ± 0.004	0.031 ± 0.004
7/5/2023	0.030 ± 0.004	0.038 ± 0.005	0.029 ± 0.004	0.035 ± 0.005	0.036 ± 0.004
7/12/2023	0.025 ± 0.004	0.026 ± 0.004	0.026 ± 0.004	0.027 ± 0.004	0.024 ± 0.003
7/19/2023	0.029 ± 0.004	0.027 ± 0.004	0.023 ± 0.003	0.025 ± 0.004	0.023 ± 0.003
7/26/2023	0.037 ± 0.005	0.039 ± 0.005	0.032 ± 0.004	0.038 ± 0.005	0.036 ± 0.004

Note:

* The 3/1/2023 samples at locations M-1, M-2, M-3, and M-4 and the 3/15/2023 sample at location M-1 are declared missed samples due to the possibility of partial sample collection, since the filters were torn on collection (Condition Report 501000071013). See Section 7.4.

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)
8/2/2023	0.035 ± 0.004	0.029 ± 0.004	0.029 ± 0.004	0.029 ± 0.004	0.033 ± 0.004
8/9/2023	0.043 ± 0.005	0.041 ± 0.005	0.034 ± 0.004	0.042 ± 0.004	0.038 ± 0.004
8/16/2023	0.025 ± 0.004	0.023 ± 0.004	0.026 ± 0.004	0.022 ± 0.003	0.023 ± 0.003
8/23/2023	0.037 ± 0.004	0.040 ± 0.005	0.042 ± 0.005	0.035 ± 0.004	0.044 ± 0.005
8/30/2023	0.036 ± 0.004	0.038 ± 0.004	0.038 ± 0.005	0.037 ± 0.004	0.038 ± 0.004
9/6/2023	0.053 ± 0.005	0.062 ± 0.006	0.052 ± 0.006	0.056 ± 0.005	0.052 ± 0.005
9/13/2023	0.023 ± 0.003	0.028 ± 0.004	0.027 ± 0.004	0.028 ± 0.004	0.029 ± 0.004
9/20/2023	0.039 ± 0.004	0.044 ± 0.005	0.042 ± 0.005	0.042 ± 0.005	0.039 ± 0.004
9/27/2023	0.046 ± 0.005	0.046 ± 0.004	0.050 ± 0.005	0.052 ± 0.005	0.055 ± 0.005
10/4/2023	0.054 ± 0.005	0.060 ± 0.006	0.058 ± 0.006	0.213 ± 0.099*	0.058 ± 0.006
10/11/2023	0.020 ± 0.004	0.028 ± 0.004	0.021 ± 0.004	0.024 ± 0.004	0.022 ± 0.004
10/18/2023	0.025 ± 0.004	0.024 ± 0.004	0.021 ± 0.004	0.021 ± 0.004	0.030 ± 0.004
10/25/2023	0.044 ± 0.005	0.040 ± 0.004	0.034 ± 0.004	0.038 ± 0.004	0.042 ± 0.004
11/1/2023	0.043 ± 0.005	0.034 ± 0.004	0.030 ± 0.004	0.034 ± 0.004	0.037 ± 0.004
11/8/2023	0.062 ± 0.005	0.062 ± 0.005	0.055 ± 0.005	0.057 ± 0.005	0.051 ± 0.005
11/15/2023	0.036 ± 0.004	0.032 ± 0.004	0.033 ± 0.004	0.036 ± 0.004	0.035 ± 0.004
11/21/2023	0.042 ± 0.005	0.037 ± 0.004	0.046 ± 0.005	0.035 ± 0.004	0.035 ± 0.004
11/29/2023	0.041 ± 0.004	0.038 ± 0.004	0.041 ± 0.004	0.039 ± 0.004	0.035 ± 0.004
12/6/2023	0.057 ± 0.005	0.057 ± 0.005	0.050 ± 0.005	0.048 ± 0.005	0.053 ± 0.005
12/13/2023	0.044 ± 0.005	0.043 ± 0.004	0.037 ± 0.004	0.042 ± 0.004	0.043 ± 0.004
12/20/2023	0.055 ± 0.005	0.054 ± 0.005	0.056 ± 0.005	0.051 ± 0.005	0.054 ± 0.005
12/27/2023	0.071 ± 0.006	0.064 ± 0.005	0.052 ± 0.005	0.067 ± 0.006	0.064 ± 0.005

Note:

* The M-4 air sampler (10/4/2023 sample date) was found to not be running on the indicated sample collection date. Partial sample was collected. Although results are provided, this is considered a missed sample (Condition Report 501000077354). See Section 7.4.

AIRBORNE PARTICULATES: GAMMA ISOTOPIC

Air Station M-1	Qtr 1 (pCi/m^3)	Qtr 2 (pCi/m^3)	Qtr 3 (pCi/m^3)	Qtr 4 (pCi/m^3)
Barium-140	8.24E-03 ± 7.69E-03 U	-2.50E-04 ± 7.24E-03 U	5.72E-03 ± 5.23E-03 U	2.72E-03 ± 8.65E-03 U
Beryllium-7	5.51E-02 ± 7.39E-03	6.27E-02 ± 1.13E-02	9.09E-02 ± 1.02E-02	7.28E-02 ± 8.83E-03
Cerium-141	2.31E-05 ± 4.18E-04 U	-1.20E-04 ± 8.48E-04 U	2.59E-05 ± 6.07E-04 U	3.34E-04 ± 6.97E-04 U
Cerium-144	-3.57E-05 ± 9.07E-04 U	8.87E-04 ± 1.61E-03 U	3.63E-04 ± 1.19E-03 U	-1.38E-03 ± 1.20E-03 U
Cesium-134	6.27E-05 ± 2.41E-04 U	5.85E-05 ± 2.73E-04 U	1.78E-04 ± 2.77E-04 U	4.07E-05 ± 2.77E-04 U
Cesium-137	1.15E-04 ± 2.08E-04 U	6.17E-05 ± 3.32E-04 U	7.15E-06 ± 2.84E-04 U	3.62E-05 ± 2.55E-04 U
Cobalt-58	-2.44E-04 ± 2.74E-04 U	2.42E-04 ± 3.95E-04 U	7.21E-05 ± 3.29E-04 U	-2.52E-04 ± 3.36E-04 U
Cobalt-60	-4.03E-05 ± 3.01E-04 U	3.61E-05 ± 3.11E-04 U	2.87E-04 ± 5.07E-04 U	-2.58E-04 ± 3.47E-04 U
Lanthanum-140	3.28E-04 ± 1.46E-03 U	-2.26E-03 ± 3.56E-03 U	1.37E-03 ± 2.54E-03 U	4.24E-04 ± 2.85E-03 U
Manganese-54	5.89E-05 ± 2.50E-04 U	2.27E-04 ± 3.53E-04 U	4.35E-04 ± 3.27E-04 U	3.73E-05 ± 2.72E-04 U
Niobium-95	-9.26E-05 ± 2.21E-04 U	-4.16E-04 ± 4.05E-04 U	2.95E-04 ± 3.31E-04 U	8.79E-05 ± 4.46E-04 U
Ruthenium-103	-1.82E-04 ± 2.49E-04 U	-6.79E-04 ± 6.59E-04 U	2.10E-04 ± 6.81E-04 U	4.21E-05 ± 4.63E-04 U
Ruthenium-106	3.25E-04 ± 1.72E-03 U	-8.99E-04 ± 2.77E-03 U	-8.39E-04 ± 2.20E-03 U	2.91E-04 ± 2.41E-03 U
Zinc-65	1.25E-04 ± 4.36E-04 U	2.78E-04 ± 9.92E-04 U	2.98E-05 ± 7.35E-04 U	4.03E-04 ± 1.12E-03 U
Zirconium-95	1.37E-04 ± 5.86E-04 U	3.12E-04 ± 8.35E-04 U	6.86E-04 ± 1.08E-03 U	2.61E-04 ± 6.87E-04 U

Air Station M-2	Qtr 1 (pCi/m^3)	Qtr 2 (pCi/m^3)	Qtr 3 (pCi/m^3)	Qtr 4 (pCi/m^3)
Barium-140	2.36E-03 ± 6.49E-03 U	7.82E-04 ± 6.01E-03 U	3.49E-03 ± 6.01E-03 U	9.54E-04 ± 1.05E-02 U
Beryllium-7	4.81E-02 ± 1.06E-02	5.73E-02 ± 9.02E-03	8.65E-02 ± 1.15E-02	7.14E-02 ± 1.08E-02
Cerium-141	9.75E-05 ± 5.72E-04 U	-3.36E-04 ± 5.19E-04 U	-1.81E-04 ± 5.74E-04 U	-1.64E-04 ± 6.65E-04 U
Cerium-144	-1.54E-03 ± 1.25E-03 U	1.58E-04 ± 9.38E-04 U	-6.19E-04 ± 8.99E-04 U	7.41E-05 ± 1.27E-03 U
Cesium-134	1.83E-04 ± 2.77E-04 U	3.06E-05 ± 2.54E-04 U	-1.87E-04 ± 2.73E-04 U	3.31E-04 ± 3.63E-04 U
Cesium-137	-3.17E-05 ± 2.84E-04 U	-2.94E-05 ± 2.70E-04 U	2.90E-05 ± 2.77E-04 U	-3.46E-04 ± 2.67E-04 U
Cobalt-58	-1.36E-04 ± 3.45E-04 U	1.47E-04 ± 3.35E-04 U	3.26E-05 ± 3.27E-04 U	4.85E-04 ± 2.83E-04 U
Cobalt-60	1.44E-04 ± 3.16E-04 U	3.11E-04 ± 4.52E-04 U	-2.16E-04 ± 1.98E-04 U	2.20E-05 ± 3.70E-04 U
Lanthanum-140	-3.81E-04 ± 2.58E-03 U	-2.74E-04 ± 2.05E-03 U	-2.51E-04 ± 3.09E-03 U	-3.65E-03 ± 4.85E-03 U
Manganese-54	-3.01E-02 ± 2.82E-04 U	1.53E-04 ± 2.71E-04 U	-9.84E-05 ± 3.15E-04 U	2.82E-05 ± 3.84E-04 U

Air Station M-2	**Qtr 1 (pCi/m3)**	**Qtr 2 (pCi/m3)**	**Qtr 3 (pCi/m3)**	**Qtr 4 (pCi/m3)**
Niobium-95	6.27E-04 ± 4.52E-04 **U**	-2.11E-04 ± 2.93E-04 **U**	-6.63E-05 ± 3.94E-04 **U**	-3.33E-04 ± 4.48E-04 **U**
Ruthenium-103	-1.42E-04 ± 4.09E-04 **U**	-1.98E-04 ± 3.56E-04 **U**	-3.64E-04 ± 5.30E-04 **U**	4.36E-04 ± 5.00E-04 **U**
Ruthenium-106	-6.84E-04 ± 2.43E-03 **U**	3.77E-04 ± 2.14E-03 **U**	1.12E-03 ± 2.19E-03 **U**	4.29E-04 ± 2.73E-03 **U**
Zinc-65	-5.85E-04 ± 6.07E-04 **U**	-2.70E-04 ± 7.02E-04 **U**	-6.56E-04 ± 7.84E-04 **U**	4.57E-04 ± 8.45E-04 **U**
Zirconium-95	4.19E-04 ± 6.71E-04 **U**	-8.60E-05 ± 5.65E-04 **U**	-6.39E-06 ± 6.96E-04 **U**	-4.12E-04 ± 7.87E-04 **U**

Air Station M-3	**Qtr 1 (pCi/m^3)**	**Qtr 2 (pCi/m^3)**	**Qtr 3 (pCi/m^3)**	**Qtr 4 (pCi/m^3)**
Barium-140	-3.19E-03 ± 6.30E-03 **U**	1.18E-03 ± 6.89E-03 **U**	-3.23E-03 ± 6.68E-03 **U**	1.21E-03 ± 9.32E-03 **U**
Beryllium-7	6.15E-02 ± 1.04E-02	6.16E-02 ± 1.15E-02	1.00E-01 ± 1.15E-02	7.36E-02 ± 8.93E-03
Cerium-141	4.43E-04 ± 6.16E-04 **U**	-5.11E-04 ± 7.53E-04 **U**	-7.08E-05 ± 5.68E-04 **U**	-3.15E-04 ± 5.93E-04 **U**
Cerium-144	-4.04E-05 ± 8.42E-04 **U**	2.19E-04 ± 1.31E-03 **U**	3.44E-04 ± 1.05E-03 **U**	3.12E-04 ± 9.99E-04 **U**
Cesium-134	3.25E-04 ± 3.35E-04 **U**	2.31E-04 ± 3.49E-04 **U**	2.21E-04 ± 2.52E-04 **U**	1.79E-04 ± 2.73E-04 **U**
Cesium-137	-9.45E-05 ± 3.86E-04 **U**	-3.40E-05 ± 3.45E-04 **U**	2.10E-04 ± 2.65E-04 **U**	3.97E-05 ± 2.11E-04 **U**
Cobalt-58	-1.73E-04 ± 4.68E-04 **U**	-2.93E-05 ± 4.66E-04 **U**	-2.14E-04 ± 3.36E-04 **U**	1.43E-04 ± 3.00E-04 **U**
Cobalt-60	-2.33E-04 ± 4.17E-04 **U**	6.21E-05 ± 3.66E-04 **U**	-3.31E-05 ± 1.89E-04 **U**	-1.87E-04 ± 2.28E-04 **U**
Lanthanum-140	-3.88E-04 ± 1.85E-03 **U**	-1.84E-03 ± 2.84E-03 **U**	-3.65E-05 ± 1.89E-03 **U**	-6.64E-04 ± 3.66E-03 **U**
Manganese-54	1.09E-04 ± 2.68E-04 **U**	3.95E-05 ± 2.94E-04 **U**	8.95E-06 ± 2.99E-04 **U**	4.85E-04 ± 3.02E-04 **UI**
Niobium-95	2.34E-04 ± 4.17E-04 **U**	-1.59E-04 ± 4.41E-04 **U**	6.29E-05 ± 3.65E-04 **U**	-1.57E-05 ± 4.36E-04 **U**
Ruthenium-103	2.92E-04 ± 4.39E-04 **U**	-1.73E-04 ± 4.79E-04 **U**	2.81E-04 ± 4.29E-04 **U**	-3.34E-05 ± 4.15E-04 **U**
Ruthenium-106	-3.64E-04 ± 2.66E-03 **U**	6.20E-04 ± 2.75E-03 **U**	-1.01E-03 ± 2.25E-03 **U**	7.73E-04 ± 2.59E-03 **U**
Zinc-65	-4.82E-04 ± 7.45E-04 **U**	4.24E-04 ± 6.13E-04 **U**	-9.58E-05 ± 6.56E-04 **U**	-1.96E-04 ± 6.15E-04 **U**
Zirconium-95	1.09E-04 ± 7.30E-04 **U**	2.63E-04 ± 8.70E-04 **U**	3.21E-06 ± 6.68E-04 **U**	1.88E-05 ± 6.03E-04 **U**

Air Station M-4	**Qtr 1 (pCi/m^3)**	**Qtr 2 (pCi/m^3)**	**Qtr 3 (pCi/m^3)**	**Qtr 4 (pCi/m^3)**
Barium-140	2.70E-05 ± 7.19E-03 **U**	-9.29E-03 ± 1.38E-02 **U**	-2.13E-03 ± 7.27E-03 **U**	7.89E-03 ± 8.51E-03 **U**
Beryllium-7	4.97E-02 ± 7.92E-03	5.69E-02 ± 1.73E-02	1.03E-01 ± 1.19E-02	7.05E-02 ± 1.01E-02
Cerium-141	-2.50E-04 ± 6.81E-04 **U**	2.23E-04 ± 1.24E-03 **U**	1.36E-04 ± 1.22E-03 **U**	-2.78E-04 ± 8.48E-04 **U**
Cerium-144	-4.18E-04 ± 1.34E-03 **U**	1.14E-03 ± 2.13E-03 **U**	-5.56E-04 ± 1.45E-03 **U**	7.56E-04 ± 1.38E-03 **U**
Cesium-134	9.55E-05 ± 3.21E-04 **U**	-1.54E-05 ± 6.70E-04 **U**	2.76E-04 ± 4.10E-04 **U**	-5.49E-05 ± 3.12E-04 **U**

Air Station M-4	**Qtr 1 (pCi/m3)**	**Qtr 2 (pCi/m3)**	**Qtr 3 (pCi/m3)**	**Qtr 4 (pCi/m3)**
Cesium-137	4.84E-05 ± 3.76E-04 **U**	-1.45E-04 ± 5.34E-04 **U**	-7.59E-05 ± 2.57E-04 **U**	-8.45E-06 ± 3.26E-04 **U**
Cobalt-58	1.80E-04 ± 4.68E-04 **U**	1.93E-04 ± 8.55E-04 **U**	8.68E-05 ± 4.10E-04 **U**	2.44E-04 ± 6.18E-04 **U**
Cobalt-60	8.79E-05 ± 4.23E-04 **U**	1.01E-03 ± 6.64E-04 **U**	2.03E-04 ± 4.02E-04 **U**	3.78E-05 ± 2.76E-04 **U**
Lanthanum-140	-1.26E-03 ± 2.77E-03 **U**	-3.78E-04 ± 5.34E-03 **U**	-1.38E-03 ± 2.31E-03 **U**	-1.57E-03 ± 3.74E-03 **U**
Manganese-54	9.83E-05 ± 3.48E-04 **U**	2.20E-04 ± 6.30E-04 **U**	1.92E-05 ± 3.51E-04 **U**	2.59E-04 ± 2.81E-04 **U**
Niobium-95	4.43E-04 ± 4.78E-04 **U**	5.81E-04 ± 8.63E-04 **U**	2.48E-05 ± 4.75E-04 **U**	2.38E-04 ± 3.93E-04 **U**
Ruthenium-103	1.23E-04 ± 4.82E-04 **U**	-3.25E-04 ± 6.69E-04 **U**	1.08E-03 ± 1.78E-03 **UI**	2.32E-04 ± 5.08E-04 **U**
Ruthenium-106	1.97E-03 ± 1.95E-03 **U**	1.21E-03 ± 4.80E-03 **U**	-2.54E-03 ± 2.90E-03 **U**	-2.21E-03 ± 2.75E-03 **U**
Zinc-65	-3.29E-04 ± 8.40E-04 **U**	1.31E-04 ± 7.66E-04 **U**	4.15E-04 ± 6.79E-04 **U**	-3.94E-04 ± 7.95E-04 **U**
Zirconium-95	1.13E-04 ± 8.25E-04 **U**	5.74E-04 ± 1.62E-03 **U**	-1.19E-04 ± 8.06E-04 **U**	-1.99E-05 ± 6.89E-04 **U**

Air Station M-5	**Qtr 1 (pCi/m^3)**	**Qtr 2 (pCi/m^3)**	**Qtr 3 (pCi/m^3)**	**Qtr 4 (pCi/m^3)**
Barium-140	-2.54E-03 ± 6.23E-03 **U**	2.82E-03 ± 7.63E-03 **U**	2.72E-03 ± 5.65E-03 **U**	3.59E-03 ± 6.98E-03 **U**
Beryllium-7	5.07E-02 ± 9.34E-03	6.95E-02 ± 1.10E-02	9.44E-02 ± 9.56E-03	6.22E-02 ± 8.88E-03
Cerium-141	-3.18E-04 ± 5.50E-04 **U**	-1.53E-04 ± 7.67E-04 **U**	-3.11E-05 ± 5.63E-04 **U**	1.84E-04 ± 5.29E-04 **U**
Cerium-144	5.81E-04 ± 9.71E-04 **U**	4.56E-04 ± 1.41E-03 **U**	-3.82E-04 ± 1.27E-03 **U**	-5.91E-04 ± 9.53E-04 **U**
Cesium-134	-7.88E-05 ± 3.16E-04 **U**	-4.31E-05 ± 3.87E-04 **U**	-1.08E-04 ± 2.85E-04 **U**	5.29E-05 ± 2.73E-04 **U**
Cesium-137	1.23E-04 ± 2.92E-04 **U**	-9.01E-05 ± 3.71E-04 **U**	3.19E-05 ± 2.96E-04 **U**	-1.06E-04 ± 2.42E-04 **U**
Cobalt-58	-2.67E-04 ± 3.40E-04 **U**	-8.78E-05 ± 3.98E-04 **U**	-3.52E-05 ± 3.91E-04 **U**	-8.31E-05 ± 2.94E-04 **U**
Cobalt-60	1.41E-04 ± 2.85E-04 **U**	-5.74E-05 ± 3.46E-04 **U**	1.11E-04 ± 2.73E-04 **U**	-7.61E-05 ± 2.63E-04 **U**
Lanthanum-140	-4.89E-03 ± 4.07E-03 **U**	2.32E-03 ± 2.69E-03 **U**	3.01E-03 ± 2.70E-03 **U**	-2.03E-03 ± 3.02E-03 **U**
Manganese-54	3.16E-05 ± 3.46E-04 **U**	-7.75E-06 ± 3.50E-04 **U**	5.50E-05 ± 2.90E-04 **U**	-1.64E-04 ± 2.48E-04 **U**
Niobium-95	3.63E-04 ± 3.83E-04 **U**	1.09E-04 ± 4.79E-04 **U**	-5.90E-05 ± 4.15E-04 **U**	1.68E-05 ± 2.95E-04 **U**
Ruthenium-103	-4.45E-04 ± 4.00E-04 **U**	-1.93E-04 ± 5.47E-04 **U**	-3.52E-04 ± 4.21E-04 **U**	-3.13E-04 ± 3.68E-04 **U**
Ruthenium-106	-4.02E-04 ± 2.74E-03 **U**	-4.12E-04 ± 2.82E-03 **U**	-9.96E-04 ± 2.26E-03 **U**	5.66E-04 ± 1.66E-03 **U**
Zinc-65	-2.08E-04 ± 7.37E-04 **U**	6.44E-04 ± 1.33E-03 **U**	-3.31E-04 ± 6.58E-04 **U**	2.14E-04 ± 4.93E-04 **U**
Zirconium-95	3.62E-04 ± 7.63E-04 **U**	-1.26E-04 ± 6.73E-04 **U**	-5.09E-04 ± 5.79E-04 **U**	7.79E-04 ± 5.63E-04 **U**

SEDIMENT: GAMMA ISOTOPIC

M-8c Upstream of Plant	**Qtr 2 (pCi/Kg, dry)**	**Qtr 4 (pCi/Kg, dry)**
Barium-140	8.0 ± 237.0 **U**	63.0 ± 122.0 **U**
Beryllium-7	314.0 ± 327.0 **UI**	44.9 ± 203.0 **U**
Cerium-144	-63.2 ± 104.0 **U**	11.0 ± 86.7 **U**
Cesium-134	13.9 ± 26.6 **U**	27.6 ± 39.2 **U**
Cesium-137	53.3 ± 37.9 **UI**	-7.5 ± 26.8 **U**
Cobalt-58	2.8 ± 23.0 **U**	-1.5 ± 30.1 **U**
Cobalt-60	5.4 ± 23.7 **U**	-24.2 ± 32.3 **U**
Iron-59	5.6 ± 60.6 **U**	-29.9 ± 71.8 **U**
Lanthanum-140	70.2 ± 99.6 **U**	-3.0 ± 51.3 **U**
Manganese-54	16.3 ± 20.7 **U**	3.5 ± 27.6 **U**
Niobium-95	5.3 ± 23.0 **U**	-8.5 ± 31.7 **U**
Potassium-40	11000.0 ± 1030.0	19600.0 ± 1590.0
Ruthenium-103	7.3 ± 22.7 **U**	-9.1 ± 22.8 **U**
Ruthenium-106	-77.5 ± 175.0 **U**	31.4 ± 223.0 **U**
Zinc-65	53.4 ± 49.2 **U**	15.9 ± 83.6 **U**
Zirconium-95	-27.0 ± 43.2 **U**	26.2 ± 56.7 **U**

M-9 Downstream of Plant	**Qtr 2 (pCi/Kg, dry)**	**Qtr 4 (pCi/Kg, dry)**
Barium-140	106.0 ± 178.0 **U**	86.7 ± 77.3 **U**
Beryllium-7	530.0 ± 382.0 **UI**	24.2 ± 127.0 **U**
Cerium-144	169.0 ± 220.0 **UI**	20.1 ± 84.6 **U**
Cesium-134	27.6 ± 38.2 **U**	16.2 ± 40.9 **U**
Cesium-137	6.0 ± 22.5 **U**	14.9 ± 21.6 **U**
Cobalt-58	12.4 ± 18.3 **U**	3.8 ± 19.4 **U**
Cobalt-60	-2.5 ± 22.0 **U**	6.7 ± 17.5 **U**
Iron-59	-30.6 ± 47.0 **U**	-13.3 ± 43.9 **U**
Lanthanum-140	6.8 ± 55.7 **U**	-14.7 ± 25.8 **U**
Manganese-54	4.1 ± 15.3 **U**	14.6 ± 15.1 **U**
Niobium-95	-13.9 ± 24.0 **U**	-0.8 ± 20.1 **U**
Potassium-40	11800.0 ± 905.0	12500.0 ± 1010.0
Ruthenium-103	-10.2 ± 19.4 **U**	2.2 ± 17.7 **U**
Ruthenium-106	-68.5 ± 162.0 **U**	88.7 ± 155.0 **U**
Zinc-65	10.5 ± 47.1 **U**	-9.6 ± 52.3 **U**
Zirconium-95	-33.8 ± 37.2 **U**	13.8 ± 30.7 **U**

M-15 Montissippi Park	**Qtr 2** **(pCi/Kg, dry)**	**Qtr 4** **(pCi/Kg, dry)**
Barium-140	105.0 ± 187.0 **U**	14.5 ± 84.5 **U**
Beryllium-7	378.0 ± 296.0 **UI**	1090.0 ± 293.0
Cerium-144	-10.3 ± 95.5 **U**	-67.1 ± 96.3 **U**
Cesium-134	11.8 ± 20.4 **U**	37.2 ± 32.1 **UI**
Cesium-137	51.2 ± 42.2 **UI**	-0.2 ± 20.8 **U**
Cobalt-58	-1.1 ± 19.6 **U**	0.1 ± 16.6 **U**
Cobalt-60	-5.4 ± 20.4 **U**	6.2 ± 18.9 **U**
Iron-59	-1.7 ± 46.9 **U**	-20.9 ± 44.8 **U**
Lanthanum-140	-7.7 ± 57.6 **U**	-4.0 ± 25.8 **U**
Manganese-54	16.8 ± 21.1 **U**	17.3 ± 17.4 **U**
Niobium-95	5.2 ± 24.9 **U**	3.7 ± 19.2 **U**
Potassium-40	13400.0 ± 1080.0	11600.0 ± 869.0
Ruthenium-103	26.2 ± 43.7 **U**	1.5 ± 16.3 **U**
Ruthenium-106	-14.8 ± 164.0 **U**	-137.0 ± 137.0 **U**
Zinc-65	-3.0 ± 79.8 **U**	3.4 ± 49.8 **U**
Zirconium-95	62.2 ± 41.8 **U**	5.1 ± 31.5 **U**

TISSUE – FISH: GAMMA ISOTOPIC

(pCi/Kg, wet)	**M-8c Upstream of Plant**			**M-9 Downstream of Plant**		
	June		**Sep**	**June**		**Sep**
	Fish 1	**Fish 2**	**Fish 2***	**Fish 1**	**Fish 2**	**Fish 1***
Barium-140	-25.4 ± 30.9 **U**	13.7 ± 33.6 **U**	12.1 ± 22.5 **U**	-0.3 ± 37.1 **U**	12.2 ± 41.3 **U**	6.1 ± 32.0 **U**
Cerium-144	17.7 ± 36.2 **U**	-9.0 ± 37.7 **U**	-19.6 ± 33.5 **U**	-7.0 ± 34.6 **U**	-19.0 ± 45.2 **U**	26.5 ± 29.3 **U**
Cesium-134	4.8 ± 7.8 **U**	-8.1 ± 8.3 **U**	-2.8 ± 7.1 **U**	5.3 ± 8.5 **U**	8.7 ± 8.6 **U**	3.3 ± 6.2 **U**
Cesium-137	1.9 ± 6.3 **U**	-1.5 ± 7.9 **U**	-1.5 ± 7.2 **U**	-0.4 ± 8.8 **U**	9.0 ± 8.5 **U**	1.7 ± 6.4 **U**
Cobalt-58	1.3 ± 6.9 **U**	1.0 ± 6.8 **U**	0.3 ± 6.8 **U**	-1.6 ± 8.1 **U**	1.1 ± 9.6 **U**	-3.2 ± 6.1 **U**
Cobalt-60	0.4 ± 7.2 **U**	3.2 ± 7.5 **U**	1.9 ± 5.6 **U**	3.6 ± 8.3 **U**	-0.6 ± 10.7 **U**	2.1 ± 6.2 **U**
Iron-59	-7.1 ± 13.1 **U**	2.0 ± 12.3 **U**	3.9 ± 11.6 **U**	3.9 ± 20.6 **U**	-1.1 ± 20.7 **U**	2.2 ± 13.4 **U**
Lanthanum-140	6.2 ± 9.4 **U**	-3.5 ± 12.0 **U**	-6.0 ± 7.9 **U**	-1.6 ± 8.9 **U**	-6.9 ± 15.1 **U**	-2.2 ± 9.9 **U**
Manganese-54	-2.8 ± 7.0 **U**	3.1 ± 7.6 **U**	-0.1 ± 5.4 **U**	-1.3 ± 7.1 **U**	4.3 ± 7.1 **U**	2.4 ± 6.3 **U**
Niobium-95	4.2 ± 7.8 **U**	-4.4 ± 8.0 **U**	-0.1 ± 5.9 **U**	-1.4 ± 8.9 **U**	24.5 ± 8.1 **U**	1.1 ± 5.8 **U**
Potassium-40	3770.0 ± 374.0	3640.0 ± 379.0	3460.0 ± 372.0	3580.0 ± 403.0	3730.0 ± 446.0	3700.0 ± 310.0
Zinc-65	8.8 ± 16.2 **U**	11.2 ± 16.0 **U**	0.4 ± 16.7 **U**	-3.8 ± 23.6 **U**	4.2 ± 19.9 **U**	-5.2 ± 14.2 **U**
Zirconium-95	4.6 ± 11.9 **U**	-2.5 ± 10.3 **U**	5.1 ± 12.3 **U**	1.8 ± 14.2 **U**	1.5 ± 15.9 **U**	0.4 ± 11.0 **U**

Note:

* The September fish samples were collected for one fish species only, smallmouth bass, because river water levels were too low for electrofishing. This is not a missed sample.

TISSUE – PLANT: GAMMA ISOTOPIC

pCi/Kg	M-41 Training Center *			M-42 Biology Station Road *		
	Jul	Aug	Sep	Jul	Aug	Sep
Cesium-134	-6.5 ± 21.4 **U**	10.2 ± 14.1 **U**	8.5 ± 12.8 **U**	-9.6 ± 22.6 **U**	10.3 ± 17.5 **U**	-0.7 ± 12.6 **U**
Cesium-137	-1.1 ± 26.0 **U**	8.6 ± 14.4 **U**	-9.1 ± 12.2 **U**	14.0 ± 25.1 **U**	-3.8 ± 16.9 **U**	4.3 ± 14.2 **U**
Cobalt-58	-20.3 ± 21.2 **U**	-2.0 ± 13.2 **U**	-3.4 ± 10.7 **U**	14.3 ± 21.8 **U**	-5.6 ± 15.1 **U**	-7.3 ± 12.5 **U**
Cobalt-60	-3.4 ± 18.8 **U**	-1.0 ± 15.1 **U**	4.4 ± 11.6 **U**	2.3 ± 23.9 **U**	-7.1 ± 19.9 **U**	-9.7 ± 14.0 **U**
Iodine-131	6.0 ± 25.4 **U**	-8.6 ± 20.9 **U**	16.7 ± 17.4 **U**	-5.0 ± 24.7 **U**	-1.7 ± 24.7 **U**	5.2 ± 16.3 **U**
Iron-59	-32.3 ± 46.2 **U**	-29.6 ± 30.5 **U**	4.9 ± 22.1 **U**	-5.3 ± 44.0 **U**	-7.6 ± 34.2 **U**	-20.6 ± 33.7 **U**
Manganese-54	8.5 ± 28.2 **U**	1.1 ± 14.7 **U**	3.9 ± 11.9 **U**	4.9 ± 22.5 **U**	-1.3 ± 16.6 **U**	8.2 ± 13.1 **U**
Niobium-95	-0.3 ± 14.1 **U**	19.0 ± 28.3 **U**	2.5 ± 9.9 **U**	5.4 ± 18.4 **U**	-0.1 ± 16.3 **U**	9.4 ± 14.2 **U**
Zinc-65	-12.5 ± 43.7 **U**	-4.0 ± 35.8 **U**	-8.8 ± 26.9 **U**	-37.2 ± 46.4 **U**	2.8 ± 36.3 **U**	3.4 ± 33.1 **U**

pCi/Kg	M-43 Imholte Farm*		
	Jul	Aug	Sep
Cesium-134	28.0 ± 26.0 **U**	10.5 ± 16.1 **U**	46.2 ± 60.7 **UI**
Cesium-137	28.4 ± 51.6 **U**	-4.2 ± 17.5 **U**	7.0 ± 13.0 **U**
Cobalt-58	-0.7 ± 22.7 **U**	-4.9 ± 12.9 **U**	-1.0 ± 13.1 **U**
Cobalt-60	-11.5 ± 25.1 **U**	4.3 ± 11.8 **U**	-5.6 ± 11.3 **U**
Iodine-131	-1.6 ± 26.5 **U**	-16.9 ± 19.2 **U**	21.6 ± 25.4 **U**
Iron-59	30.2 ± 57.6 **U**	-15.3 ± 30.1 **U**	26.4 ± 40.5 **U**
Manganese-54	-1.9 ± 23.6 **U**	2.7 ± 16.0 **U**	4.8 ± 13.6 **U**
Niobium-95	-10.1 ± 25.7 **U**	0.7 ± 13.2 **U**	-2.4 ± 13.8 **U**
Zinc-65	-8.9 ± 44.6 **U**	24.1 ± 29.9 **U**	-5.1 ± 27.7 **U**

Note:

* June vegetation samples were collected but not shipped to the lab for analysis. This is considered a missed sample (Condition Report 501000075372).

WATER: TRITIUM

pCi/L	Qtr 1	Qtr 2	Qtr 3	Qtr 4*
M-11 City of Monticello	-60.6 ± 189 **U**	291 ± 225 **U**	-10.1 ± 190 **U**	-117 ± 257 **U**
M-12 Plant Well #11	215 ± 224 **U**	61.1 ± 206 **U**	-98.9 ± 184 **U**	-110 ± 279 **U**
M-14 City of Minneapolis1	-24.2 ± 194 **U**	22.2 ± 147 **U**	118 ± 212 **U**	-96.2 ± 262 **U**
M-43 Imholte Farm	19.8 ± 202 **U**	234 ± 222 **U**	213 ± 222 **U**	-188 ± 267 **U**
M-55 Hasbrouck Residence	235 ± 226 **U**	73.6 ± 221 **U**	210 ± 216 **U**	-144 ± 247 **U**
M-8 Upstream of Plant	29.5 ± 112 **U**	-48.0 ± 218 **U**	-181 ± 217 **U**	-68.8 ± 279 **U**
M-9 Downstream of Plant	-5.10 ± 106 **U**	-142 ± 222 **U**	-260 ± 208 **U**	-185 ± 281 **U**

Note:

*Q4 2022 composite sample collection continued into January 3, 2023. These data were provided in the 2022 AREOR and are not discussed in this 2023 AREOR.

WATER – DRINKING: GROSS BETA

M-14 City of Minneapolis	**Gross Beta (pCi/L)**
Jan	-4.070 ± 1.760 **U**
Feb	1.610 ± 1.790 **U**
Mar	27.900 ± 1.870 **U**
Apr	-2.950 ± 1.710 **U**
May	-3.560 ± 1.970 M
Jun	9.510 ± 2.150 **U**
Jul	-2.160 ± 1.400 **U**
Aug	-7.310 ± 1.850 **U**
Sep	-1.290 ± 2.130 **U**
Oct	13.900 ± 1.940 **U**
Nov	3.040 ± 2.310 **U**
Dec	4.460 ± 1.530 **U**

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	1.28E+00 ± 1.22E+01 **U**	-2.34E+00 ± 1.75E+01 **U**	-7.70E-01 ± 1.84E+01 **U**	2.42E+00 ± 2.06E+01 **U**
Cerium-144	1.94E-01 ± 1.54E+01 **U**	-1.17E+01 ± 1.65E+01 **U**	-2.02E+01 ± 1.72E+01 **U**	7.19E+00 ± 1.30E+01 **U**
Cesium-134	-5.85E-01 ± 2.39E+00 **U**	-2.62E-01 ±2.57E+00 **U**	-2.43E-01 ± 3.77E+00 **U**	1.27E+00 ± 2.28E+00 **U**
Cesium-137	-2.80E+00 ± 2.24E+00 **U**	-2.96E-01 ± 2.45E+00 **U**	-5.23E-02 ± 3.44E+00 **U**	4.51E-01 ± 2.11E+00 **U**
Cobalt-58	-1.19E+00 ± 2.65E+00 **U**	4.50E+00 ± 3.82E+00 **U**	-4.74E-01 ± 3.23E+00 **U**	-1.86E+00 ± 2.23E+00 **U**
Cobalt-60	-8.15E-01 ± 2.14E+00 **U**	-2.03E-01 ± 2.78E+00 **U**	3.79E-01 ± 3.65E+00 **U**	2.53E-01 ± 2.12E+00 **U**
Iron-59	5.95E+00 ± 8.95E+00 **U**	4.68E+00 ± 6.07E+00 **U**	-5.70E-01 ± 6.20E+00 **U**	4.27E+00 ± 4.34E+00 **U**
Lanthanum-140	-2.36E+00 ± 3.76E+00 **U**	7.46E-01 ± 6.92E+00 **U**	-5.12E+00 ± 8.02E+00 **U**	-3.78E+00 ± 7.14E+00 **U**
Manganese-54	-1.79E+00 ± 2.14E+00 **U**	-9.00E-01 ± 2.52E+00 **U**	-2.23E+00 ± 3.57E+00 **U**	-1.96E+00 ± 2.27E+00 **U**
Niobium-95	-7.60E-01 ± 2.70E+00 **U**	7.79E-01 ± 2.83E+00 **U**	-7.96E-01 ± 3.26E+00 **U**	-1.75E+00 ± 2.56E+00 **U**
Zinc-65	5.17E-01 ± 4.86E+00 **U**	2.42E+00 ± 6.16E+00 **U**	-5.10E+00 ± 7.63E+00 **U**	-1.06E+00 ± 4.39E+00 **U**
Zirconium-95	3.33E-01 ± 3.61E+00 **U**	2.84E+00 ± 4.13E+00 **U**	-2.73E+00 ± 6.58E+00 **U**	1.51E-01 ± 4.53E+00 **U**

M-12 Plant Well #11	**Qtr 1 (pCi/L)**	**Qtr 2 (pCi/L)**	**Qtr 3 (pCi/L)**	**Qtr 4 (pCi/L)**
Barium-140	7.63E+00 ± 1.16E+01 **U**	-2.45E-01 ± 1.85E+01 **U**	1.16E+01 ± 1.40E+01 **U**	-2.64E+00 ± 1.91E+01 **U**
Cerium-144	-2.88E-01 ± 1.77E+01 **U**	3.27E+00 ± 1.68E+01 **U**	3.42E+00 ± 1.60E+01 **U**	1.90E+00 ± 1.28E+01 **U**
Cesium-134	4.93E-01 ± 2.59E+00 **U**	-1.21E+00 ± 2.53E+00 **U**	2.28E+00 ± 2.63E+00 **U**	-1.78E+00 ± 2.55E+00 **U**
Cesium-137	3.20E+00 ± 5.04E+00 **U**	9.36E-02 ± 2.72E+00 **U**	1.35E-01 ± 2.65E+00 **U**	-7.39E-01 ± 1.77E+00 **U**
Cobalt-58	-1.83E+00 ± 2.32E+00 **U**	-1.49E+00 ± 2.19E+00 **U**	-2.75E-01 ± 2.42E+00 **U**	6.96E-01 ± 2.19E+00 **U**
Cobalt-60	4.48E-01 ± 2.62E+00 **U**	-2.65E+00 ± 2.54E+00 **U**	2.68E-01 ± 2.88E+00 **U**	-4.73E-01 ± 1.56E+00 **U**
Iron-59	-1.02E+00 ± 4.14E+00 **U**	3.88E-01 ± 4.84E+00 **U**	-1.17E+00 ± 4.93E+00 **U**	3.23E+00 ± 5.11E+00 **U**
Lanthanum-140	-1.77E-01 ± 4.81E+00 **U**	-4.77E+00 ± 4.78E+00 **U**	1.17E+00 ± 4.19E+00 **U**	-8.51E-01 ± 6.86E+00 **U**
Manganese-54	2.26E+00 ± 2.20E+00 **U**	-5.14E-01 ± 2.60E+00 **U**	1.06E+00 ± 2.29E+00 **U**	-3.79E-01 ± 2.13E+00 **U**
Niobium-95	-2.84E+00 ± 2.93E+00 **U**	-6.39E-01 ± 2.41E+00 **U**	1.60E-02 ± 3.11E+00 **U**	8.37E-01 ± 2.32E+00 **U**
Zinc-65	-2.13E+00 ± 5.15E+00 **U**	-2.23E+00 ± 5.20E+00 **U**	-3.64E+00 ± 7.05E+00 **U**	-1.62E+00 ± 4.04E+00 **U**
Zirconium-95	-1.87E+00 ± 4.38E+00 **U**	-1.73E+00 ± 4.15E+00 **U**	2.80E+00 ± 4.63E+00 **U**	4.82E-01 ± 3.85E+00 **U**

M-43 Imholte Farm	**Qtr 1 (pCi/L)**	**Qtr 2 (pCi/L)**	**Qtr 3 (pCi/L)**	**Qtr 4 (pCi/L)**
Barium-140	-5.45E+00 ± 1.54E+01 **U**	-3.83E+00 ± 1.61E+01 **U**	-2.19E+00 ± 1.02E+01 **U**	-3.13E+00 ± 2.21E+01 **U**
Cerium-144	8.44E+00 ± 1.83E+01 **U**	1.20E+00 ± 1.82E+01 **U**	6.14E+00 ± 1.32E+01 **U**	-5.08E-01 ± 1.34E+01 **U**
Cesium-134	-7.03E-01 ± 3.10E+00 **U**	6.52E-01 ± 2.65E+00 **U**	1.95E+00 ± 4.56E+00 **U**	-6.50E-01 ± 2.05E+00 **U**
Cesium-137	-2.51E-01 ± 2.72E+00 **U**	2.18E+00 ± 4.35E+00 **U**	4.43E-01 ± 2.06E+00 **U**	-1.11E+00 ± 2.11E+00 **U**
Cobalt-58	-3.24E-01 ± 2.22E+00 **U**	1.53E+00 ± 2.95E+00 **U**	5.95E-01 ± 1.82E+00 **U**	-1.30E+00 ± 2.36E+00 **U**
Cobalt-60	1.22E+00 ± 3.37E+00 **U**	-1.10E+00 ± 2.59E+00 **U**	3.24E-01 ± 1.85E+00 **U**	-5.66E-01 ± 1.77E+00 **U**
Iron-59	-5.58E+00 ± 5.56E+00 **U**	2.26E+00 ± 4.49E+00 **U**	1.82E+00 ± 3.45E+00 **U**	-2.84E+00 ± 4.65E+00 **U**
Lanthanum-140	3.57E+00 ± 4.22E+00 **U**	-1.53E+00 ± 4.90E+00 **U**	2.03E+00 ± 4.31E+00 **U**	-4.18E+00 ± 6.98E+00 **U**
Manganese-54	-1.20E+00 ± 3.02E+00 **U**	-7.78E-01 ± 2.46E+00 **U**	-2.66E+00 ± 2.04E+00 **U**	1.31E+00 ± 1.77E+00 **U**
Niobium-95	1.58E+00 ± 2.23E+00 **U**	-1.80E+00 ± 4.05E+00 **U**	-1.23E+00 ± 2.37E+00 **U**	1.75E-01 ± 2.18E+00 **U**
Zinc-65	1.57E+00 ± 6.36E+00 **U**	6.50E+00 ± 4.06E+00 **U**	1.93E+00 ± 4.97E+00 **U**	-1.58E+00 ± 4.56E+00 **U**
Zirconium-95	3.38E+00 ± 5.26E+00 **U**	-1.12E+00 ± 4.86E+00 **U**	2.50E+00 ± 3.40E+00 **U**	-3.39E+00 ± 3.91E+00 **U**

M-55 Hasbrouck Residence	**Qtr 1 (pCi/L)**	**Qtr 2 (pCi/L)**	**Qtr 3 (pCi/L)**	**Qtr 4 (pCi/L)**
Barium-140	2.57E+00 ± 1.30E+01 **U**	8.59E+00 ± 1.37E+01 **U**	1.08E+01 ± 1.02E+01 **U**	1.09E+01 ± 2.12E+01 **U**
Cerium-144	-3.33E+00 ± 1.58E+01 **U**	-1.96E+00 ± 1.38E+01 **U**	-8.19E+00 ± 1.35E+01 **U**	-4.13E-01 ± 1.59E+01 **U**
Cesium-134	-1.19E+00 ± 3.53E+00 **U**	1.73E+00 ± 2.34E+00 **U**	1.34E+00 ± 1.82E+00 **U**	2.40E+00 ± 2.89E+00 **U**
Cesium-137	1.50E+00 ± 2.59E+00 **U**	6.57E-01 ± 2.15E+00 **U**	2.82E+00 ± 3.95E+00 **U**	1.68E+00 ± 3.41E+00 **U**
Cobalt-58	9.51E-01 ± 2.62E+00 **U**	9.58E-01 ± 2.00E+00 **U**	-2.67E-01 ± 2.18E+00 **U**	1.10E+00 ± 2.33E+00 **U**
Cobalt-60	3.24E+00 ± 3.13E+00 **U**	1.35E-01 ± 1.90E+00 **U**	1.79E+00 ± 2.86E+00 **U**	1.41E-01 ± 2.01E+00 **U**
Iron-59	1.69E+00 ± 5.49E+00 **U**	-4.02E-01 ± 5.31E+00 **U**	-1.73E-01 ± 4.54E+00 **U**	-9.52E-01 ± 4.86E+00 **U**
Lanthanum-140	-5.82E-01 ± 4.54E+00 **U**	-4.44E-01 ± 5.00E+00 **U**	2.30E+00 ± 3.37E+00 **U**	-4.85E+00 ± 7.87E+00 **U**
Manganese-54	-3.92E-01 ± 2.63E+00 **U**	1.06E-01 ± 1.54E+00 **U**	-8.80E-01 ± 2.35E+00 **U**	1.49E+00 ± 2.13E+00 **U**
Niobium-95	1.58E+00 ± 3.20E+00 **U**	8.65E-01 ± 2.11E+00 **U**	-1.36E+00 ± 2.29E+00 **U**	1.06E+00 ± 2.72E+00 **U**
Zinc-65	-5.94E-03 ± 6.64E+00 **U**	1.52E+00 ± 4.10E+00 **U**	-7.98E-01 ± 5.78E+00 **U**	-5.24E-01 ± 3.72E+00 **U**
Zirconium-95	-3.32E+00 ± 4.92E+00 **U**	1.15E+00 ± 3.55E+00 **U**	1.03E+00 ± 2.65E+00 **U**	6.58E-01 ± 4.46E+00 **U**

WATER – DRINKING: GAMMA ISOTOPIC

M-14 City of Minneapolis

pCi/L	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Barium-140	-2.620 ± 20.100 **U**	-1.500 ± 13.800 **U**	8.930 ± 12.100 **U**	-1.860 ± 8.210 **U**	-9.800 ± 17.000 **U**	4.980 ± 14.100 **U**	2.630 ± 18.100 **U**	6.410 ± 15.200 **U**	0.517 ± 4.970 **U**	5.660 ± 24.000 **U**	4.160 ± 20.300 **U**	5.830 ± 16.900 **U**
Cerium-144	-4.070 ± 1.760 **U**	1.610 ± 1.790 **U**	27.900 ± 1.870 **UI**	-2.950 ± 1.710 **U**	-3.560 ± 1.970 **U**	9.510 ± 2.150 **U**	-2.160 ± 1.400 **U**	-7.310 ± 1.850 **U**	-1.290 ± 2.130 **U**	13.900 ± 1.940 **U**	3.040 ± 2.310 **U**	4.460 ± 1.530 **U**
Cesium-134	1.990 ± 20.500 **U**	1.590 ± 15.700 **U**	-0.937 ± 25.900 **U**	-0.794 ± 5.150 **U**	0.643 ± 11.400 **U**	-0.228 ± 14.400 **U**	2.950 ± 15.000 **U**	0.323 ± 17.800 **U**	-0.258 ± 6.700 **U**	-0.260 ± 16.200 **U**	0.818 ± 17.600 **U**	0.609 ± 7.810 **U**
Cesium-137	-0.456 ± 3.100 **U**	0.175 ± 2.150 **U**	-0.633 ± 2.030 **U**	-0.202 ± 1.250 **U**	-0.386 ± 3.520 **U**	-1.210 ± 2.270 **U**	-1.270 ± 2.580 **U**	5.780 ± 2.640 **UI**	0.858 ± 1.020 **U**	0.670 ± 3.880 **U**	1.950 ± 3.690 **U**	0.009 ± 0.895 **U**
Cobalt-58	-2.010 ± 2.760 **U**	-0.063 ± 2.280 **U**	1.470 ± 2.230 **U**	-0.025 ± 0.807 **U**	-1.090 ± 2.760 **U**	-0.526 ± 2.710 **U**	-0.760 ± 2.740 **U**	-0.046 ± 3.250 **U**	0.104 ± 1.100 **U**	1.490 ± 3.530 **U**	-0.939 ± 3.490 **U**	-0.646 ± 0.719 **U**
Cobalt-60	-0.501 ± 2.870 **U**	0.616 ± 2.330 **U**	0.000 ± 2.140 **U**	-0.028 ± 0.969 **U**	1.700 ± 2.910 **U**	0.828 ± 2.680 **U**	-2.190 ± 2.590 **U**	1.020 ± 2.570 **U**	-0.560 ± 1.030 **U**	0.683 ± 3.860 **U**	-1.740 ± 3.660 **U**	0.504 ± 1.020 **U**
Iron-59	-3.780 ± 2.660 **U**	-1.820 ± 2.530 **U**	0.560 ± 1.660 **U**	-1.240 ± 0.943 **U**	3.290 ± 3.410 **U**	-0.735 ± 1.990 **U**	-1.060 ± 3.510 **U**	2.760 ± 2.290 **U**	-0.268 ± 0.988 **U**	-3.840 ± 3.700 **U**	6.510 ± 4.080 **U**	-0.143 ± 0.869 **U**
Lanthanum-140	1.270 ± 6.370 **U**	2.320 ± 4.930 **U**	-3.110 ± 4.180 **U**	-1.600 ± 2.120 **U**	0.838 ± 5.570 **U**	1.140 ± 4.530 **U**	-2.880 ± 6.470 **U**	-2.950 ± 5.670 **U**	-1.350 ± 1.800 **U**	-0.917 ± 8.240 **U**	-1.920 ± 8.610 **U**	-2.550 ± 2.350 **U**
Manganese-54	0.661 ± 4.930 **U**	2.000 ± 4.290 **U**	-1.500 ± 4.510 **U**	0.721 ± 2.880 **U**	-0.241 ± 7.340 **U**	0.676 ± 3.180 **U**	-1.150 ± 7.610 **U**	0.753 ± 7.470 **U**	0.931 ± 2.240 **U**	2.890 ± 8.080 **U**	0.232 ± 7.800 **U**	0.744 ± 6.050 **U**
Niobium-95	0.177 ± 2.650 **U**	-2.530 ± 2.410 **U**	-1.250 ± 1.930 **U**	0.836 ± 0.818 **U**	1.180 ± 2.500 **U**	0.709 ± 2.380 **U**	1.460 ± 2.530 **U**	0.028 ± 2.020 **U**	-1.340 ± 0.927 **U**	-3.350 ± 3.760 **U**	0.276 ± 2.960 **U**	-0.106 ± 0.765 **U**
Zinc-65	0.840 ± 3.660 **U**	1.970 ± 2.480 **U**	-1.170 ± 2.630 **U**	-1.250 ± 0.940 **U**	-1.610 ± 3.130 **U**	-0.554 ± 2.220 **U**	0.268 ± 2.930 **U**	0.101 ± 2.810 **U**	-1.530 ± 1.660 **U**	6.090 ± 4.780 **U**	-4.010 ± 3.560 **U**	-0.248 ± 1.060 **U**
Zirconium-95	-0.393 ± 5.460 **U**	-1.760 ± 4.960 **U**	0.278 ± 3.640 **U**	-1.260 ± 1.580 **U**	3.390 ± 6.230 **U**	-1.040 ± 5.610 **U**	-1.440 ± 5.360 **U**	0.442 ± 4.400 **U**	-0.493 ± 2.690 **U**	0.664 ± 7.000 **U**	8.390 ± 7.000 **U**	-2.220 ± 1.710 **U**

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	-	-	11.600 ± 21.600 U	-9.310 ± 20.900 hU	-3.650 ± 15.900 U	18.600 ± 16.700 U	1.040 ± 22.300 U	-9.890 ± 37.400 U	-15.100 ± 14.400 U	-4.570 ± 12.000 U	-13.100 ± 40.300 U	-13.000 ± 13.600 U
Cerium-144	-	-	1.810 ± 6.120 U	9.370 ± 14.900 hU	-3.890 ± 18.300 U	12.400 ± 14.000 U	-7.170 ± 16.700 U	-2.090 ± 5.950 U	-2.140 ± 5.420 U	3.000 ± 16.000 U	2.830 ± 6.460 U	-2.730 ± 12.800 U
Cesium-134	-	-	-0.159 ± 0.901 U	1.210 ± 2.210 hU	1.660 ± 4.340 U	-1.640 ± 2.550 U	2.350 ± 2.300 U	0.742 ± 0.966 U	1.540 ± 1.640 UI	-0.196 ± 2.460 U	-1.080 ± 1.550 U	-0.972 ± 2.010 U
Cesium-137	-	-	0.097 ± 1.510 U	-0.974 ± 2.420 hU	3.830 ± 3.640 U	0.695 ± 2.070 U	-0.583 ± 2.520 U	-0.071 ± 0.872 U	0.423 ± 0.851 U	0.152 ± 2.810 U	0.597 ± 0.821 U	1.010 ± 2.300 U
Cobalt-58	-	-	0.037 ± 0.995 U	2.210 ± 2.390 hU	-0.476 ± 2.740 U	1.080 ± 2.170 U	1.160 ± 2.870 U	0.886 ± 1.370 U	-0.503 ± 1.020 U	-0.270 ± 2.270 U	0.213 ± 1.210 U	-0.122 ± 2.020 U
Cobalt-60	-	-	-0.859 ± 1.460 U	-0.582 ± 1.920 hU	0.668 ± 3.030 U	0.591 ± 2.180 U	-1.790 ± 1.870 U	0.654 ± 0.949 U	0.331 ± 0.775 U	-0.161 ± 2.050 U	1.060 ± 1.970 U	0.792 ± 1.830 U
Iron-59	-	-	1.600 ± 2.490 U	-0.251 ± 4.410 hU	0.230 ± 5.210 U	1.030 ± 4.710 U	-0.288 ± 4.640 U	-1.930 ± 6.390 U	0.868 ± 1.760 U	3.050 ± 4.090 U	-1.610 ± 3.400 U	-0.305 ± 4.230 U
Lanthanum-140	-	-	-3.010 ± 4.340 U	-5.800 ± 7.660 hU	-1.320 ± 6.570 U	-1.440 ± 3.320 U	-2.360 ± 7.480 U	3.420 ± 13.900 U	0.685 ± 2.490 U	1.080 ± 4.230 U	-3.610 ± 9.730 U	0.248 ± 4.300 U
Manganese-54	-	-	-1.580 ± 0.946 U	-0.260 ± 2.070 hU	-1.620 ± 2.830 U	1.350 ± 2.210 U	2.070 ± 2.150 U	-0.447 ± 1.060 U	0.997 ± 0.846 U	1.220 ± 2.040 U	-0.094 ± 1.030 U	0.934 ± 1.830 U
Niobium-95	-	-	1.510 ± 1.100 U	-0.345 ± 2.570 hU	-1.780 ± 3.440 U	-0.242 ± 2.720 U	-1.450 ± 2.770 U	-0.679 ± 1.360 U	-0.002 ± 0.924 U	3.350 ± 3.060 U	0.027 ± 1.120 U	-0.126 ± 2.170 U
Zinc-65	-	-	-0.259 ± 1.850 U	2.090 ± 4.500 hU	-2.020 ± 6.120 U	-1.070 ± 4.460 U	3.490 ± 4.050 U	1.340 ± 2.110 U	0.043 ± 1.700 U	1.280 ± 4.020 U	0.727 ± 2.170 U	2.080 ± 4.160 U
Zirconium-95	-	-	0.256 ± 2.010 U	1.760 ± 4.180 hU	3.180 ± 5.100 U	3.870 ± 3.980 U	0.349 ± 4.890 U	3.220 ± 2.320 U	2.290 ± 1.690 U	2.930 ± 4.220 U	-0.837 ± 2.110 U	-0.533 ± 3.180 U

Note:

[1] Sample unavailable due to unsafe condition for sampling resulting from frozen river conditions (Condition Report 501000069833).

M-9 Downstream of Plant

pCi/L	Jan[1]	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Barium-140	321.000 ± 344.000	-26.200 ± 132.000 **U**	-7.170 ± 12.700 **U**	-0.660 ± 24.800 **hU**	-5.590 ± 15.400 **U**	-0.805 ± 15.300 **U**	4.330 ± 19.600 **U**	29.200 ± 36.700 **U**	6.240 ± 8.690 **U**	8.210 ± 11.900 **U**	8.630 ± 23.000 **U**	6.260 ± 11.800 **U**
Cerium-144	1.630 ± 6.020 **U**	1.230 ± 9.520 **U**	6.180 ± 5.990 **U**	-3.090 ± 15.400 **hU**	-12.000 ± 15.800 **U**	7.480 ± 13.000 **U**	-3.400 ± 13.800 **U**	-3.250 ± 5.470 **U**	0.126 ± 6.290 **U**	-5.180 ± 13.100 **U**	-2.360 ± 7.310 **U**	-3.510 ± 12.500 **U**
Cesium-134	-0.159 ± 0.810 **U**	-0.862 ± 1.890 **U**	-0.337 ± 1.000 **U**	1.540 ± 2.590 **hU**	-3.800 ± 2.260 **U**	1.050 ± 1.970 **U**	-0.295 ± 2.220 **U**	0.160 ± 0.966 **U**	0.146 ± 0.870 **U**	0.246 ± 2.780 **U**	-0.099 ± 1.440 **U**	0.202 ± 2.090 **U**
Cesium-137	0.034 ± 0.748 **U**	1.740 ± 1.270 **U**	-1.010 ± 1.660 **U**	3.140 ± 3.850 **hU**	-0.921 ± 1.930 **U**	0.453 ± 1.860 **U**	1.560 ± 2.270 **U**	0.355 ± 0.991 **U**	0.322 ± 0.898 **U**	-1.630 ± 2.180 **U**	1.160 ± 1.100 **U**	1.120 ± 1.940 **U**
Cobalt-58	-0.185 ± 1.550 **U**	0.002 ± 1.890 **U**	0.895 ± 1.070 **U**	-0.211 ± 2.900 **hU**	-0.095 ± 2.310 **U**	-0.652 ± 2.180 **U**	-0.937 ± 2.070 **U**	-0.992 ± 1.150 **U**	-0.302 ± 0.944 **U**	1.040 ± 2.200 **U**	0.339 ± 0.959 **U**	0.684 ± 1.970 **U**
Cobalt-60	-0.350 ± 0.694 **U**	0.469 ± 1.210 **U**	0.574 ± 1.350 **U**	-0.774 ± 2.640 **hU**	-0.408 ± 2.090 **U**	-0.198 ± 2.120 **U**	-1.250 ± 2.230 **U**	-0.085 ± 0.959 **U**	0.631 ± 0.964 **U**	0.681 ± 2.090 **U**	-0.142 ± 0.774 **U**	0.048 ± 1.800 **U**
Iron-59	-2.850 ± 5.120 **U**	0.026 ± 5.440 **U**	-1.780 ± 2.340 **U**	-0.407 ± 5.820 **hU**	0.804 ± 4.910 **U**	4.650 ± 6.950 **U**	3.850 ± 6.430 **U**	-1.280 ± 3.960 **U**	-0.924 ± 2.140 **U**	0.172 ± 4.050 **U**	-1.200 ± 2.740 **U**	2.340 ± 3.960 **U**
Lanthanum-140	-103.000 ± 126.000 **U**	-8.620 ± 41.100 **U**	1.240 ± 4.300 **U**	3.030 ± 6.400 **hU**	-3.980 ± 4.690 **U**	-3.640 ± 5.190 **U**	4.520 ± 5.720 **U**	2.730 ± 12.400 **U**	-2.340 ± 2.740 **U**	1.580 ± 4.550 **U**	-0.558 ± 9.260 **U**	2.530 ± 4.840 **U**
Manganese-54	-0.520 ± 0.997 **U**	-0.387 ± 1.240 **U**	-0.779 ± 1.000 **U**	0.591 ± 2.570 **hU**	2.520 ± 2.640 **U**	0.856 ± 1.780 **U**	-1.540 ± 2.100 **U**	-0.569 ± 0.834 **U**	-0.209 ± 1.220 **U**	-0.714 ± 2.270 **U**	-0.178 ± 0.715 **U**	1.050 ± 1.710 **U**
Niobium-95	0.272 ± 1.800 **U**	8.190 ± 3.510 **UI**	0.267 ± 1.200 **U**	1.360 ± 2.770 **hU**	-0.698 ± 2.480 **U**	-1.860 ± 2.340 **U**	-1.090 ± 2.200 **U**	0.729 ± 1.440 **U**	0.126 ± 0.991 **U**	-0.225 ± 2.350 **U**	-0.151 ± 0.979 **U**	1.850 ± 2.030 **U**
Zinc-65	0.003 ± 1.700 **U**	1.150 ± 4.340 **U**	-0.879 ± 1.940 **U**	1.730 ± 5.090 **hU**	2.170 ± 4.590 **U**	-2.250 ± 4.140 **U**	0.402 ± 4.570 **U**	-0.248 ± 2.270 **U**	0.363 ± 2.200 **U**	-0.255 ± 4.120 **U**	0.100 ± 1.670 **U**	10.300 ± 5.640 **U**
Zirconium-95	2.190 ± 3.210 **U**	0.030 ± 3.750 **U**	2.430 ± 1.960 **U**	-1.970 ± 4.740 **hU**	-0.802 ± 3.470 **U**	1.230 ± 3.750 **U**	-1.790 ± 6.230 **U**	-0.145 ± 2.650 **U**	0.000 ± 1.710 **U**	-1.580 ± 3.510 **U**	0.669 ± 1.820 **U**	-2.810 ± 3.320 **U**

Note:

[1] 2022 December M9 data were collected at the beginning of January. These data were provided in the 2022 AREOR and are not discussed in this 2023 AREOR.

Data below were analyzed by 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	9.9 ± 0.6	12.5 ± 0.7	14.4 ± 0.7	13.5 ± 0.6
M02C Cty Rd 4 & 15	10.2 ± 0.5	11.9 ± 0.9	13.9 ± 0.6	12.2 ± 0.6
M03C Cty Rd 19 & Jason Ave	11.2 ± 0.6	13.4 ± 0.9	15.3 ± 0.9	13.4 ± 0.6
M04C Maple Lake Water Tower	9.9 ± 0.5	12.3 ± 0.9	13.8 ± 0.8	12.9 ± 0.6
Inner				
M01A Sherburne Ave. So.[1]	12.8 ± 0.5	14.8 ± 0.9	17.9 ± 1.2	25.3 ± 1.4
M02A Sherburne Ave. So.	12.4 ± 0.6	14.6 ± 0.9	16.7 ± 1.3	15.1 ± 0.7
M03A Sherburne Ave. So.	11.1 ± 0.7	14.5 ± 0.9	15.6 ± 1.0	14.7 ± 0.7
M04A Biology Station Rd.	10.8 ± 0.9	13.2 ± 1.0	15.3 ± 0.9	12.7 ± 0.6
M05A Biology Station Rd.	10.1 ± 0.7	13.5 ± 0.9	15.7 ± 1.1	13.5 ± 0.9
M06A Biology Station Rd.	10.5 ± 0.6	14.7 ± 0.8	16.7 ± 0.7	14.5 ± 0.7
M07A Parking Lot H	10.4 ± 0.4	13.4 ± 0.8	15.2 ± 0.6	14.2 ± 0.8
M08A Parking Lot F	10.9 ± 0.7	13.9 ± 0.8	15.5 ± 0.7	14.2 ± 0.9
M09A County Road 75	10.6 ± 0.8	14.5 ± 0.9	15.7 ± 0.8	15.1 ± 0.6
M10A County Road 75	10.6 ± 0.6	14.3 ± 0.7	15.7 ± 1.2	14.6 ± 0.6
M11A County Road 75 [2]	13.9 ± 0.9	17.5 ± 1.3	17.5 ± 1.3	14.8 ± 0.8
M12A County Road 75	12.0 ± 0.7	14.2 ± 1.0	15.3 ± 1.0	15.2 ± 0.9
M13A North Boundary Rd.	See Note 3	11.3 ± 0.8	12.7 ± 0.6	11.8 ± 0.8
M14A North Boundary Rd.	12.5 ± 0.6	15.2 ± 1.0	17.2 ± 1.0	16.0 ± 0.8
Outer				
M01B 117th Street	10.2 ± 0.7	13.3 ± 0.6	17.3 ± 1.2	13.9 ± 0.9
M02B County Road 11	11.1 ± 0.8	13.3 ± 0.8	17.7 ± 1.2	14.4 ± 0.7
M03B County Rd. 73 & 81	10.1 ± 0.6	10.9 ± 0.7	16.1 ± 1.5	12.1 ± 0.7
M04B County Rd. 73 (196th Street)	10.2 ± 0.6	12.5 ± 0.8	17.1 ± 1.2	13.2 ± 0.6
M05B City of Big Lake	11.5 ± 0.7	13.0 ± 0.7	19.2 ± 1.6	14.1 ± 1.0
M06B County Rd 14 & 196th Street	See Note 3	13.7 ± 0.7	19.0 ± 1.2	14.6 ± 1.0
M07B Monticello Industrial Dr.	11.7 ± 0.6	13.7 ± 0.8	17.8 ± 1.0	14.2 ± 0.6
M08B Residence Hwy 25 & Davidson Ave	11.7 ± 0.7	13.6 ± 0.8	15.1 ± 1.8	12.9 ± 0.6
M09B Weinand Farm	10.8 ± 0.5	15.0 ± 0.9	17.6 ± 1.2	14.3 ± 0.8
M10B Reisewitz Farm - Acacia Ave	9.9 ± 0.6	13.8 ± 0.8	16.0 ± 0.8	14.0 ± 0.8
M11B Vanlith Farm - 97th Ave	10.1 ± 0.7	14.7 ± 0.7	16.3 ± 0.6	14.7 ± 0.8
M12B Lake Maria St. Park	10.1 ± 0.6	14.4 ± 0.9	15.8 ± 0.6	14.4 ± 0.9

Notes:

[1] 4th Quarter REMP TLD M01A result was higher than baseline for this area by 10.2 mrem. This high result is likely due to construction in the area (Condition Report 501000082357).

[2] TLD left out for two subsequent quarters (Condition Report 501000072555).

[3] Location could not be sampled due to missing TLD (Condition Report 501000072135).

mrem/91 day	Qtr 1	Qtr 2	Qtr 3	Qtr 4
Outer				
M13B Bridgewater Sta.	12.0 ± 0.6	13.7 ± 0.7	16.3 ± 0.8	14.3 ± 0.7
M14B Anderson Res. - Cty Rd 111	11.6 ± 0.5	14.4 ± 0.7	16.5 ± 0.7	14.5 ± 0.8
M15B Barton Ave NW	10.2 ± 0.8	13.7 ± 1.0	15.0 ± 0.6	13.1 ± 0.7
M16B University Ave and Hancock St, Becker	10.4 ± 0.7	13.1 ± 0.8	15.1 ± 0.7	13.6 ± 0.7
Special Interest				
mrem/91 day	**Qtr 1**	**Qtr 2**	**Qtr 3**	**Qtr 4**
M01S 127th St. NE	11.3 ± 0.7	14.5 ± 0.7	16.0 ± 1.5	14.2 ± 0.8
M02S Krone Residence	11.0 ± 0.9	14.8 ± 1.8	16.8 ± 1.5	15.0 ± 0.9
M03S Big Oaks Park	11.8 ± 0.9	14.9 ± 0.8	17.2 ± 1.5	15.1 ± 0.7
M04S Pinewood School	10.1 ± 0.5	10.7 ± 0.7	16.3 ± 1.2	12.5 ± 0.6
M05S 20500 Co. Rd 11, Big Lake	10.0 ± 0.8	11.4 ± 0.7	14.4 ± 0.7	11.8 ± 0.5
M06S Monticello Public Works	11.4 ± 0.8	13.9 ± 0.7	15.8 ± 0.7	14.9 ± 0.7
I-11 OCA Fence South, on exit road	11.5 ± 0.6	14.3 ± 0.9	16.8 ± 0.9	13.9 ± 0.8
I-12 OCA Fence Middle, on exit road	11.6 ± 0.7	13.6 ± 1.0	15.4 ± 0.6	13.7 ± 0.8
I-13 OCA Fence North, on exit road	12.9 ± 0.6	14.1 ± 0.7	15.8 ± 0.6	15.6 ± 0.8

DIRECT RADIATION – ISFSI: GAMMA

mrem/91 day	Type	Qtr1	Qtr2	Qtr3	Qtr4
I-01 NE corner of ISFS	Gamma	36.4 ± 1.8	35.5 ± 3.1	43.2 ± 3.1	40.9 ± 3.5
I-02 North side of ISFSI, center	Gamma	33.4 ± 2.5	31.7 ± 1.6	38.1 ± 2.3	36.4 ± 2.1
I-03 NW corner of ISFSI	Gamma	26.4 ± 2.5	25.3 ± 1.9	32.7 ± 2.9	33.2 ± 1.9
I-04 West side of ISFSI, middle	Gamma	66.0 ± 5.9	64.6 ± 5.0	75.0 ± 3.1	74.0 ± 3.6
I-05 West side of ISFSI, at center of array	Gamma	53.3 ± 4.2	48.1 ± 3.1	52.7 ± 3.5	52.1 ± 3.2
I-06 SW corner of ISFSI	Gamma	25.9 ± 1.8	27.2 ± 1.6	32.1 ± 1.8	29.1 ± 2.5
I-07 South side of ISFSI, center	Gamma	28.9 ± 2.0	28.9 ± 1.6	33.0 ± 2.8	30.3 ± 1.7
I-08 SE corner of ISFSI	Gamma	30.1 ± 4.1	28.0 ± 2.9	31.7 ± 3.0	30.7 ± 4.1
I-09 East side of ISFSI, at center of array	Gamma	65.3 ± 6.1	58.9 ± 7.0	70.9 ± 3.5	69.0 ± 4.4
I-10 East side of ISFSI, middle	Gamma	54.9 ± 3.2	55.4 ± 6.8	61.4 ± 4.4	56.3 ± 3.1

APPENDIX A

GEL Laboratories, LLC

2023 Annual Quality Assurance Report

GEL | Laboratories LLC
a member of The GEL Group INC

2040 Savage Road | Charleston, SC 29407
843.556.8171

gel.com

2023 ANNUAL QUALITY ASSURANCE REPORT

FOR THE

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (REMP)

2023 ANNUAL QUALITY ASSURANCE REPORT

FOR THE

RADIOLOGICAL ENVIRONMENTAL

MONITORING PROGRAM (REMP)

Approved By ______________________ February 28, 2024
Angela A. Johnson Date
Director, Quality Systems

TABLE OF CONTENTS

TABLES

TABLE OF CONTENTS (CONTINUED)

FIGURES

2023 ANNUAL QUALITY ASSURANCE REPORT FOR THE RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (REMP)

1. Introduction

GEL Laboratories, LLC (GEL) is a privately owned environmental laboratory dedicated to providing personalized client services of the highest quality. GEL was established as an analytical testing laboratory in 1981. Now a full service lab, our analytical divisions use state of the art equipment and methods to provide a comprehensive array of organic, inorganic, and radiochemical analyses to meet the needs of our clients.

At GEL, quality is emphasized at every level of personnel throughout the company. Management's ongoing commitment to good professional practice and to the quality of our testing services to our customers is demonstrated by their dedication of personnel and resources to develop, implement, assess, and improve our technical and management operations.

The purpose of GEL's quality assurance program is to establish policies, procedures, and processes to meet or exceed the expectations of our clients. To achieve this, all personnel that support these services to our clients are introduced to the program and policies during their initial orientation, and annually thereafter during company-wide training sessions.

GEL's primary goals are to ensure that all measurement data generated are scientifically and legally defensible, of known and acceptable quality per the data quality objectives (DQOs), and thoroughly documented to provide sound support for environmental decisions. In addition, GEL continues to ensure compliance with all contractual requirements, environmental standards, and regulations established by local, state and federal authorities.

GEL administers the QA program in accordance with the Quality Assurance Plan, GL-QS-B-001. Our Quality Systems include all quality assurance (QA) policies and quality control (QC) procedures necessary to plan, implement, and assess the work we perform. GEL's QA Program establishes a quality management system (QMS) that governs all of the activities of our organization.

This report entails the quality assurance program for the proficiency testing and environmental monitoring aspects of GEL for 2023. GEL's QA Program is designed to monitor the quality of analytical processing associated with environmental, radiobioassay, effluent (10 CFR Part 50), and waste (10 CFR Part 61) sample analysis.

This report covers the category of Radiological Environmental Monitoring Program (REMP) and includes:

- Intra-laboratory QC results analyzed during 2023.
- Inter-laboratory QC results analyzed during 2023 where known values are available.

2. Quality Assurance Programs for Inter-laboratory, Intra-laboratory and Third Party Cross-Check

In addition to internal and client audits, our laboratory participates in annual performance evaluation studies conducted by independent providers. We routinely participate in the following types of performance audits:

- Proficiency testing and other inter-laboratory comparisons
- Performance requirements necessary to retain certifications

- Evaluation of recoveries of certified reference and in-house secondary reference materials using statistical process control data.
- Evaluation of relative percent difference between measurements through SPC data.

We also participate in a number of proficiency testing programs for federal and state agencies and as required by contracts. It is our policy that no proficiency evaluation samples be analyzed in any special manner. Our annual performance evaluation participation generally includes a combination of studies that support the following:

- US Environmental Protection Agency Discharge Monitoring Report, Quality Assurance Program (DMR-QA). Annual national program sponsored by EPA for laboratories engaged in the analysis of samples associated with the NPDES monitoring program. Participation is mandatory for all holders of NPDES permits. The permit holder must analyze for all of the parameters listed on the discharge permit. Parameters include general chemistry, metals, BOD/COD, oil and grease, ammonia, nitrates, etc.

- Department of Energy Mixed Analyte Performance Evaluation Program (MAPEP). A semiannual program developed by DOE in support of DOE contractors performing waste analyses. Participation is required for all laboratories that perform environmental analytical measurements in support of environmental management activities. This program includes radioactive isotopes in water, soil, vegetation and air filters.

- ERA's MRAD-Multimedia Radiochemistry Proficiency test program. This program is for labs seeking certification for radionuclides in wastewater and solid waste. The program is conducted in strict compliance with USEPA National Standards for Water Proficiency study.

- ERA's InterLaB RadCheM Proficiency Testing Program for radiological analyses. This program completes the process of replacing the USEPA EMSL-LV Nuclear Radiation Assessment Division program discontinued in 1998. Laboratories seeking certification for radionuclide analysis in drinking water also use the study. This program is conducted in strict compliance with the USEPA National Standards for Water Proficiency Testing Studies. This program encompasses Uranium by EPA method 200.8 (for drinking water certification in Utah/Primary NELAP), gamma emitters, Gross Alpha/Beta, Iodine-131, naturally occurring radioactive isotopes, Strontium-89/90, and Tritium.

- ERA's Water Pollution (WP) biannual program for waste methodologies includes parameters for both organic and inorganic analytes.

- ERA's Water Supply (WS) biannual program for drinking water methodologies includes parameters for organic and inorganic analytes.

- Environmental Cross-Check Program administered by Eckert & Ziegler Analytics, Inc. This program encompasses radionuclides in water, soil, milk, naturally occurring radioactive isotopes in soil and air filters.

GEL procures single-blind performance evaluation samples from Eckert & Ziegler Analytics to verify the analysis of sample matrices processed at GEL. Samples are received on a quarterly basis. GEL's Third-Party Cross-Check Program provides environmental matrices encountered in a typical nuclear utility REMP. The Third-Party Cross-Check Program is intended to meet or exceed the inter-laboratory comparison program requirements discussed in NRC Regulatory Guide 4.15. Once performance evaluation samples have been prepared in accordance with the instructions provided by the PT provider, samples are managed and analyzed in the same manner as environmental samples from GEL's clients.

3. Quality Assurance Program for Internal and External Audits

During each annual reporting period, at least one internal assessment of each area of the laboratory is conducted in accordance with the pre-established schedule from Standard Operating Procedure for the Conduct of Quality Audits, GL-QS-E-001. The annual internal audit plan is reviewed for adequacy and includes the scheduled frequency and scope of quality control actions necessary to GEL's QA program. Internal audits are conducted at least annually in accordance with a schedule approved by the Quality Systems Director. Supplier audits are contingent upon the categorization of the supplies and may or may not be conducted prior to the use of a supplier or subcontractor. Type I suppliers and subcontractors, regardless of how they were initially qualified, are re-evaluated at least once every three years.

In addition, prospective customers audit GEL during pre-contract audits. GEL hosts several external audits each year for both our clients and other programs. These programs include environmental monitoring, waste characterization, and radiobioassay. The following list of programs may audit GEL at least annually or up to every three years depending on the program.

- TNI, The NELAC Institute, National Environmental Laboratory Accreditation Program
- DOECAP, U.S. Department of Energy Consolidated Audit Program
- DOELAP, U.S. Department of Energy Laboratory Accreditation Program
- DOE QSAS, U.S. Department of Energy, Quality Systems for Analytical Services
- ISO/IEC 17025:2017
- A2LA, American Association for Laboratory Accreditation
- DoD ELAP, US Department of Defense Environmental Accreditation Program
- NUPIC, Nuclear Procurement Issues Committee
- South Carolina Department of Health and Environmental Control (SC DHEC)

The annual radiochemistry laboratory internal audit (23-RAD-001) was conducted in August of 2023. There were no findings, two observations and one recommendation for improvement from this assessment.

4. Performance Evaluation Acceptance Criteria for Environmental Sample Analysis

GEL utilized an acceptance protocol based upon two performance models. For those inter-laboratory programs that already have established performance criteria for bias (i.e., MAPEP, and ERA/ELAP), GEL will utilize the criteria for the specific program. For intra-laboratory or third party quality control programs that do not have a specific acceptance criteria (i.e. the Eckert-Ziegler Analytics Environmental Cross-check Program), results will be evaluated in accordance with GEL's internal acceptance criteria.

5. Performance Evaluation Samples

Performance Evaluation (PE) results and internal quality control sample results are evaluated in accordance with GEL acceptance criteria. The first criterion concerns bias, which is defined as the deviation of any one result from the known value. The second criterion concerns precision, which deals with the ability of the measurement to be replicated by comparison of an individual result with the mean of all results for a given sample set.

At GEL, we also evaluate our analytical performance on a regular basis through statistical process control (SPC) acceptance criteria. Where feasible, this criterion is applied to both measures of precision and accuracy and is specific to sample matrix. We establish environmental process control limits at least annually.

For Radiochemistry analysis, quality control evaluation is based on static limits rather than those that are statistically derived. Our current process control limits are maintained in

GEL's AlphaLIMS. We also measure precision with matrix duplicates and/or matrix spike duplicates. The upper and lower control limits (UCL and LCL respectively) for precision are plus or minus three times the standard deviation from the mean of a series of relative percent differences. The static precision criteria for radiochemical analyses are 0 - 20%, for activity levels exceeding the contract required detection limit (CRDL).

6. Quality Control Program for Environmental Sample Analysis

GEL's internal QA Program is designed to include QC functions such as instrumentation calibration checks (to insure proper instrument response), blank samples, instrumentation backgrounds, duplicates, as well as overall staff qualification analyses and statistical process controls. Both quality control and qualification analyses samples are used to be as similar as the matrix type of those samples submitted for analysis by the various laboratory clients. These performance test samples (or performance evaluation samples) are either actual sample submitted in duplicate in order to evaluate the precision of laboratory measurements, or fortified blank samples, which have been given a known quantity of a radioisotope that is in the interest to GEL's clients.

Accuracy (or Bias) is measured through laboratory control samples and/or matrix spikes, as well as surrogates and internal standards. The UCLs and LCLs for accuracy are plus or minus three times the standard deviation from the mean of a series of recoveries. The static limit for most radiochemical analyses is 75 - 125%. Specific instructions for out-of-control situations are provided in the applicable analytical SOP.

GEL's Laboratory Control Standard (LCS) is an aliquot of reagent water or other blank matrix to which known quantities of the method analytes are added in the laboratory. The LCS is analyzed exactly like a sample, and its purpose is to determine whether the methodology is in control, and whether the laboratory is capable of making accurate and precise measurements. Some methods may refer to these samples as Laboratory Fortified Blanks (LFB). The requirement for recovery is between 75% and 125% for radiological analyses excluding drinking water matrix.

$$\text{Bias (\%)} = \frac{\text{(observed concentration)}}{\text{(known concentration)}} * 100\ \%$$

Precision is a data quality indicator of the agreement between measurements of the same property, obtained under similar conditions, and how well they conform to themselves. Precision is usually expressed as standard deviation, variance or range in either absolute or relative (percentage) terms.

GEL's laboratory duplicate (DUP or LCSD) is an aliquot of a sample taken from the same container and processed in the same manner under identical laboratory conditions. The aliquot is analyzed independently from the parent sample and the results are compared to measure precision and accuracy.

If a sample duplicate is analyzed, it will be reported as Relative Percent Difference (RPD). The RPD must be 20 percent or less, if both samples are greater than 5 times the MDC. If both results are less than 5 times MDC, then the RPD must be equal to or less than 100%. If one result is above the MDC and the other is below the MDC, then the RPD can be calculated using the MDC for the result of the one below the MDC. The RPD must be 100% or less. In the situation where both results are above the MDC but one result is greater than 5 times the MDC and the other is less than 5 times the MDC, the RPD must be less than or equal to 20%. If both results are below MDC, then the limits on % RPD are not applicable.

$$\text{Difference (\%)} = \frac{\text{(high duplicate result – low duplicate result)}}{\text{(average of results)}} * 100\ \%$$

7. Summary of Data Results

During 2023, forty-one (41) radioisotopes associated with six (6) matrix types were analyzed under GEL's Performance Evaluation program in participation with ERA, MAPEP, and Eckert & Ziegler Analytics. Matrix types were representative of client analyses performed during 2023. Of the three hundred eight (308) total results, 96.8% (298 of 308) were found to be acceptable within the PT providers three sigma or other statistical criteria. The list below contains the type of matrix evaluated by GEL.

- Air Filter
- Cartridge
- Water
- Milk
- Soil
- Vegetation

Graphs are provided in Figures 1-9 of this report to allow for the evaluation of trends or biases. These graphs include radioisotopes Cobalt-60, Cesium-137, Tritium, Strontium-90, Gross Alpha, Gross Beta, Iodine-131, Americium-241, and Plutonium-238.

8. Summary of Participation in the Eckert & Ziegler Analytics Environmental Cross-Check Program

Eckert & Ziegler Analytics provided samples for ninety-two (92) individual environmental analyses. The accuracy of each result reported to Eckert & Ziegler Analytics, Inc. is measured by the ratio of GEL's result to the known value. Of the 92 analyses reported, 98.9% (91 out of 92) fell within the acceptance criteria.

9. Summary of Participation in the MAPEP Monitoring Program

MAPEP Series 48 was analyzed by the laboratory. Of the sixty-eight (68) analyses reported, 97.1% (66 out of 68) fell within the PT provider's acceptance criteria.

.

10. Summary of Participation in the ERA MRaD PT Program

The ERA MRad program provided samples (MRAD-38 and MRAD-39) for one hundred forty-eight (148) individual environmental analyses reported. Of the 148 analyses reported, 98.6% (146 of the 148) fell within the PT provider's acceptance criteria.

11. Summary of Participation in the ERA PT Program

The ERA program provided samples (RAD-132, RAD-133 and RAD-134) for forty-six (46) individual environmental analyses. Of the 46 analyses, 86.9% fell within the PT provider's acceptance criteria.

All corrective actions for unacceptable PTs are summarized in Table 8.

12. Corrective Action Request and Report (CARR)

There are two categories of corrective action at GEL. One is corrective action implemented at the analytical and data review level in accordance with the analytical SOP. The other is formal corrective action documented by the Quality Systems Team in accordance with GL-QS-E-002. A formal corrective action is initiated when a nonconformance reoccurs or is so significant that permanent elimination or prevention of the problem is required. Formal corrective action investigations include root cause analysis.

GEL includes quality requirements in most analytical standard operating procedures to ensure that data are reported only if the quality control criteria are met or the quality control measures that did not meet the acceptance criteria are documented. A formal corrective action is implemented according to GL-QS-E-002 for Conducting Corrective/Preventive Action and Identifying Opportunities for Improvement. Recording and documentation is performed following guidelines stated in GL-QS-E-012 for Client NCR Database Operation.

Any employee at GEL can identify and report a nonconformance and request that corrective action be taken. Any GEL employee can participate on a corrective action team as requested by the QS team or Group Leaders. The steps for conducting corrective action are detailed in GL-QS-E-002. In the event that correctness or validity of the laboratory's test results in doubt, the laboratory will take corrective action. If investigations show that the results have been impacted, affected clients will be informed of the issue in writing within five (5) calendar days of the discovery.

Table 8 provides the status of CARRs for radiological performance testing during 2023. **It has been determined that causes of the unacceptable results did not impact any data reported to our clients.**

13. References

1. GEL Quality Assurance Plan, GL-QS-B-001
2. GEL Standard Operating Procedure for the Conduct of Quality Audits, GL-QS-E-001
3. GEL Standard Operating Procedure for Conducting Corrective/Preventive Action and Identifying Opportunities for Improvement, GL-QS-E-002
4. GEL Standard Operating Procedure for LIMS Documentation of Nonconformance Reporting and Dispositioning and Control of Nonconforming Items, GL-QS-E-004
5. GEL Standard Operating Procedure for Handling Proficiency Evaluation Samples, GL-QS-E-013
6. GEL Standard Operating Procedure for Quality Assurance Measurement Calculations and Processes, GL-QS-E-014
7. 40 CFR Part 136 Guidelines Establishing Test Procedures for the Analysis of Pollutants
8. ISO/IEC 17025-2017, General Requirements for the Competence of Testing and Calibration Laboratories
9. ANSI/ASQC E4-1994, Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs, American National Standard
10. 2016 TNI Standard, The NELAC Institute, National Environmental Accreditation Program
11. MARLAP, Multi-Agency Radiological Laboratory Analytical Protocols
12. 10 CFR Part 21, Reporting of Defects and Noncompliance
13. 10 CFR Part 50 Appendix B, Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants
14. 10 CFR Part 61, Licensing Requirements for Land Disposal and Radioactive Waste
15. NRC REG Guide 4.15 and NRC REG Guide 4.8

TABLE 1

2023 RADIOLOGICAL PROFICIENCY TESTING RESULTS AND ACCEPTANCE CRITERIA

PT Provider	Quarter / Year	Report Closing / Received Date	Sample Number	Sample Media	Units	Analyte	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Barium-133	32.8	30.5	24.2 - 34.6	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Barium-133	32.8	30.5	24.2 - 34.6	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Cesium-134	28.3	28.2	21.9 - 31.1	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Cesium-137	202	190	171 - 211	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Cobalt-60	120	110	99.0 - 123	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Gross Alpha	27.7	30	15.3 - 39.2	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Gross Alpha	26.4	30	15.3 - 39.2	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Gross Alpha	26.4	30	15.3 - 39.2	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Gross Beta	13.6	16.5	9.25 - 24.8	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Gross Beta	13.6	16.5	9.25 - 24.8	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Iodine-131	28.3	27	22.4 - 31.8	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Radium-228	5.97	7.17	4.51 - 9.20	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Radium-228	5.4	7.17	4.51 - 9.20	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Strontium-89	59.8	53.5	42.5 - 61.1	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Strontium-89	57.4	53.5	42.5 - 61.1	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Strontium-90	26.2	28.8	20.9 - 33.5	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Strontium-90	26.9	28.8	20.9 - 33.5	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Tritium	20600	21600	18900 - 23800	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	µg/L	Uranium (mass)	11.18	10.7	8.18 - 12.5	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Uranium (Nat)	6.41	7.36	5.64 - 8.60	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Zinc-65	126	105	94.5 - 125	Not Acceptable
EZA	1st/2023	05/18/23	E13851	Cartridge	pCi	Iodine-131	9.39E+01	8.98E+01	1.05	Acceptable
EZA	1st/2023	05/18/23	E13852	Milk	pCi/L	Strontium-89	6.91E+01	9.31E+01	0.74	Acceptable
EZA	1st/2023	05/18/23	E13852	Milk	pCi/L	Strontium-90	1.07E+01	1.47E+01	0.73	Acceptable
EZA	1st/2023	05/18/23	E13853	Milk	pCi/L	Cerium-141	1.44E+02	1.39E+02	1.04	Acceptable
EZA	1st/2023	05/18/23	E13853	Milk	pCi/L	Cobalt-58	1.43E+02	1.31E+02	1.10	Acceptable
EZA	1st/2023	05/18/23	E13853	Milk	pCi/L	Cobalt-60	2.90E+02	2.79E+02	1.04	Acceptable
EZA	1st/2023	05/18/23	E13853	Milk	pCi/L	Chromium-51	3.49E+02	3.02E+02	1.16	Acceptable
EZA	1st/2023	05/18/23	E13853	Milk	pCi/L	Cesium-134	1.85E+02	2.00E+02	0.93	Acceptable
EZA	1st/2023	05/18/23	E13853	Milk	pCi/L	Cesium-137	1.44E+02	1.40E+02	1.03	Acceptable
EZA	1st/2023	05/18/23	E13853	Milk	pCi/L	Iron-59	1.51E+02	1.22E+02	1.24	Acceptable
EZA	1st/2023	05/18/23	E13853	Milk	pCi/L	Iodine-131	8.93E+01	8.20E+01	1.09	Acceptable
EZA	1st/2023	05/18/23	E13853	Milk	pCi/L	Manganese-54	1.98E+02	1.80E+02	1.10	Acceptable
EZA	1st/2023	05/18/23	E13853	Milk	pCi/L	Zinc-65	3.40E+02	3.06E+02	1.11	Acceptable
EZA	1st/2023	05/18/23	E13854	Water	pCi/L	Cerium-141	1.60E+02	1.36E+02	1.17	Acceptable

EZA	1st/2023	05/18/23	E13854	Water	pCi/L	Cobalt-58	1.37E+02	1.28E+02	1.07	Acceptable
EZA	1st/2023	05/18/23	E13854	Water	pCi/L	Cobalt-60	2.97E+02	2.74E+02	1.08	Acceptable
EZA	1st/2023	05/18/23	E13854	Water	pCi/L	Chromium-51	3.44E+02	2.96E+02	1.16	Acceptable
EZA	1st/2023	05/18/23	E13854	Water	pCi/L	Cesium-134	1.87E+02	1.96E+02	0.95	Acceptable
EZA	1st/2023	05/18/23	E13854	Water	pCi/L	Cesium-137	1.37E+02	1.38E+02	0.99	Acceptable
EZA	1st/2023	05/18/23	E13854	Water	pCi/L	Iron-59	1.29E+02	1.19E+02	1.08	Acceptable
EZA	1st/2023	05/18/23	E13854	Water	pCi/L	Iodine-131	1.01E+02	8.78E+01	1.15	Acceptable
EZA	1st/2023	05/18/23	E13854	Water	pCi/L	Manganese-54	1.89E+02	1.76E+02	1.07	Acceptable
EZA	1st/2023	05/18/23	E13854	Water	pCi/L	Zinc-65	3.45E+02	3.00E+02	1.15	Acceptable
EZA	2nd/2023	08/21/23	E13893	Cartridge	pCi	Iodine-131	7.00E+01	6.66E+01	1.05	Acceptable
EZA	2nd/2023	08/21/23	E13890	Milk	pCi/L	Strontium-89	6.34E+01	8.68E+01	0.73	Acceptable
EZA	2nd/2023	08/21/23	E13890	Milk	pCi/L	Strontium-90	6.21E+00	1.27E+01	0.49	Not Acceptable
EZA	2nd/2023	08/21/23	E13891	Milk	pCi/L	Cerium-141	1.22E+02	1.20E+02	1.02	Acceptable
EZA	2nd/2023	08/21/23	E13891	Milk	pCi/L	Cobalt-58	1.49E+02	1.38E+02	1.08	Acceptable
EZA	2nd/2023	08/21/23	E13891	Milk	pCi/L	Cobalt-60	3.90E+02	3.66E+02	1.06	Acceptable
EZA	2nd/2023	08/21/23	E13891	Milk	pCi/L	Chromium-51	3.49E+02	2.92E+02	1.19	Acceptable
EZA	2nd/2023	08/21/23	E13891	Milk	pCi/L	Cesium-134	1.68E+02	1.83E+02	0.92	Acceptable
EZA	2nd/2023	08/21/23	E13891	Milk	pCi/L	Cesium-137	2.42E+02	2.30E+02	1.05	Acceptable
EZA	2nd/2023	08/21/23	E13891	Milk	pCi/L	Iron-59	1.97E+02	1.72E+02	1.15	Acceptable
EZA	2nd/2023	08/21/23	E13891	Milk	pCi/L	Iodine-131	8.18E+01	7.44E+01	1.10	Acceptable
EZA	2nd/2023	08/21/23	E13891	Milk	pCi/L	Manganese-54	1.84E+02	1.62E+02	1.13	Acceptable
EZA	2nd/2023	08/21/23	E13891	Milk	pCi/L	Zinc-65	2.72E+02	2.48E+02	1.10	Acceptable
EZA	2nd/2023	08/21/23	E13892	Water	pCi/L	Cerium-141	9.53E+01	8.25E+01	1.16	Acceptable
EZA	2nd/2023	08/21/23	E13892	Water	pCi/L	Cobalt-58	9.63E+01	9.47E+01	1.02	Acceptable
EZA	2nd/2023	08/21/23	E13892	Water	pCi/L	Cobalt-60	2.59E+02	2.52E+02	1.03	Acceptable
EZA	2nd/2023	08/21/23	E13892	Water	pCi/L	Chromium-51	2.07E+02	2.01E+02	1.03	Acceptable
EZA	2nd/2023	08/21/23	E13892	Water	pCi/L	Cesium-134	1.17E+02	1.26E+02	0.93	Acceptable
EZA	2nd/2023	08/21/23	E13892	Water	pCi/L	Cesium-137	1.57E+02	1.58E+02	0.99	Acceptable
EZA	2nd/2023	08/21/23	E13892	Water	pCi/L	Iron-59	1.37E+02	1.18E+02	1.16	Acceptable
EZA	2nd/2023	08/21/23	E13892	Water	pCi/L	Iodine-131	4.95E+01	5.57E+01	0.89	Acceptable
EZA	2nd/2023	08/21/23	E13892	Water	pCi/L	Manganese-54	1.22E+02	1.12E+02	1.09	Acceptable
EZA	2nd/2023	08/21/23	E13892	Water	pCi/L	Zinc-65	1.95E+02	1.70E+02	1.14	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Americium-241	54.8	55.6	39.7 - 74.1	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Cesium-134	140	153	99.3 - 188	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Cesium-137	856	892	733 - 1170	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Cobalt-60	488	467	397 - 593	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Gross Alpha	82.3	76.8	40.1 - 127	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Gross Beta	35.2	32.8	19.9 - 49.6	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Iron-55	430	578	211 - 922	Acceptable

ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Manganese-54	<4.23	<35.0	<35.0	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Plutonium-238	9.28	9.59	7.24 - 11.8	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Plutonium-239	63.9	68.9	51.5 - 83.1	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Strontium-90	148	137	86.7 - 187	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	µg/Filter	Uranium (mass)	148	158	127 - 185	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Uranium-234	45	53.1	39.4 - 62.2	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Uranium-238	49.3	52.6	39.7 - 62.8	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Uranium-Total	96.55	108	78.8 - 128	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Zinc-65	1160	1110	910 - 1700	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Actinium-228	1590	1670	1100 - 2100	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Americium-241	1380	1410	761 - 2000	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Bismuth-212	1750	1670	478 - 2490	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Bismuth-214	686	790	379 - 1180	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Cesium-134	1000	1170	800 - 1400	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Cesium-137	3430	3570	2700 - 4520	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Cobalt-60	3240	3490	2750 - 4310	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Lead-212	1770	1630	1140 - 2060	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Lead-214	901	838	352 - 1320	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Manganese-54	<25.0	<555	<555	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Plutonium-238	942	1040	519 - 1580	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Plutonium-239	1600	2000	1090 - 2880	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Potassium-40	43300	41800	28800 - 49900	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Strontium-90	2400	2580	803 - 4020	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Thorium-234	4280	4260	1610 - 7300	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	µg/kg	Uranium (mass)	13000	12800	5780 - 17300	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Uranium-234	3810	4300	2020 - 5630	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Uranium-234	4180	4300	2020 - 5630	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Uranium-238	4580	4260	2340 - 5720	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Uranium-238	4330	4260	2340 - 5720	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Uranium-Total	8710	8760	4860 - 11300	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Zinc-65	8990	8340	6660 - 11400	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Americium-241	2470	2760	1710 - 3900	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Cesium-134	1450	1730	1150 - 2300	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Cesium-137	1760	1840	1410 - 2480	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Cobalt-60	701	696	546 - 910	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Curium-244	2240	2930	1650 - 3640	Acceptable

ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Manganese-54	<27.1	<207	<207	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Plutonium-238	135	129	89.3 - 166	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Plutonium-239	1950	1990	1380 - 2520	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Potassium-40	34800	33300	25000 - 42200	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Strontium-90	4090	4550	2570 - 5930	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Strontium-90	4090	4550	2570-5930	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	µg/kg	Uranium (mass)	2310	2160	1660 - 2680	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Uranium-234	746	726	510 - 926	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Uranium-238	767	720	508 - 901	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Uranium-Total	1570	1480	945 - 2000	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Zinc-65	1360	1220	910 - 1810	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Americium-241	33.5	32.1	22.0 - 41.0	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Cesium-134	291	298	225 - 328	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Cesium-137	784	762	652 - 866	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Cobalt-60	432	412	355 - 473	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Gross Alpha	138	148	54.0 - 204	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Gross Beta	178	170	85.0 - 234	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Iron-55	1320	1380	811 - 2010	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Manganese-54	<2.69	<71.0	<71.0	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Plutonium-238	64.9	70.7	42.5 - 91.6	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Plutonium-239	80.3	92.4	57.2 - 114	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Strontium-90	143	121	87.1 - 150	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Tritium	24500	28000	21100 - 34100	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	µg/L	Uranium (mass)	173	160	130 - 181	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Uranium-234	42.3	53.9	41.0 - 61.6	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Uranium-238	57.6	53.4	41.4 - 62.9	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Uranium-Total	119	110	85.8 - 125	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Zinc-65	268	228	203 - 288	Acceptable
ERA	2nd2023	5/21/2023	040623G	Water	pCi/L	Tritium	16200	18100	15800-19900	Acceptable
ERA	2nd2023	5/21/2023	040623G	Water	pCi/L	Zinc-65	330	302	272 - 353	Acceptable
ERA	2nd2023	5/25/2023	RAD-133	Water	pCi/L	Iodine-131	26.8	28.7	23.9 - 33.6	Acceptable
ERA	2nd2023	5/25/2023	RAD-133	Water	pCi/L	Radium-226	6.13	7.68	5.78 - 9.07	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	Bq/smpl	Americium-241	0.000001		False pos. test	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	Bq/smpl	Cesium-134	1.48	1.52	1.06-1.98	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	Bq/smpl	Cesium-137	0.676	0.63	0.441-0.819	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	Bq/smpl	Cobalt-57	0.682	0.661	0.463-0.859	Acceptable

MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	Bq/smpl	Cobalt-60	1.12	1.05	0.74-1.37	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-GrF48	Filter	Bq/smpl	Gross Alpha	0.642	0.97	0.29-1.65	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-GrF48	Filter	Bq/smpl	Gross Beta	1.45	1.49	0.75-2.24	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	Bq/smpl	Manganese-54	2.15	2.14	1.50-2.78	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	Bq/smpl	Plutonium-238	0.106	0.111	0.078-0.144	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	Bq/smpl	Plutonium-239/240	0.106	0.109	0.076-0.142	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	Bq/smpl	Strontium-90	0.0159		False pos. test	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	Bq/smpl	Uranium-234/233	0.117	0.11	0.077-0.143	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	ug/smpl	Uranium-235	0.0702	0.0644	0.0451-0.0837	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	ug/smpl	Uranium-238	10.3	9.1	6.4-11.8	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	Bq/smpl	Uranium-238	0.116	0.114	0.080-0.148	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	ug/smpl	Uranium-Total	10.37	9.2	6.4-12.0	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	Bq/smpl	Zinc-65	2.42	2.25	1.58-2.93	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Americium-241	4.14	0.9	Sens Eval	Not Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Cesium-134	2.67		False pos. test	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Cesium-137	1.07		False pos. test	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Cobalt-57	802	698	489-907	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Cobalt-60	808	795	557-1034	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Iron-55	-53.2		False pos. test	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Manganese-54	1340	1230	861-1599	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Nickel-63	1030	1130	791-1469	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Plutonium-238	1.02	0.52	Sens Eval	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Plutonium-239/240	100	101	71-131	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Potassium-40	594	574	402-746	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Strontium-90	953	920	644-1196	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Technetium-99	1050	1100	770-1430	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Thorium 228	46.8	43.3	30.3-56.3	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Thorium 230	45.5	40	28.0-52.0	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Thorium 232	45	43.3	30.3-56.3	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	U-234/233	60.4	64	45-83	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Uranium-238	264	258	181-335	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Zinc-65	1120	990	693-1287	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdV48	veg	Bq/smpl	Americium-241	0.187	0.189	0.132-0.246	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdV48	veg	Bq/smpl	Cesium-134	7.15	7.6	5.32-9.88	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdV48	veg	Bq/smpl	Cesium-137	0.0488		False pos. test	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdV48	veg	Bq/smpl	Cobalt-57	7.35	6.93	4.85-9.01	Acceptable

MAPEP	2nd2023	6/21/2023	MAPEP-23-RdV48	veg	Bq/smpl	Cobalt-60	6.81	6.51	4.56-8.46	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdV48	veg	Bq/smpl	Manganese-54	8.77	8.03	5.62-10.44	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdV48	veg	Bq/smpl	Plutonium-238	0.175	0.187	0.131-0.243	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdV48	veg	Bq/smpl	Plutonium-239/240	0.163	0.178	0.125-0.231	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdV48	veg	Bq/smpl	Strontium-90	0.00491		False pos. test	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdV48	veg	Bq/smpl	Uranium-234/233	0.0005	0.00044	Sen Eval	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdV48	veg	Bq/smpl	Uranium-238	0.0005	0.000256	Sen Eval	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdV48	veg	Bq/smpl	Zinc-65	8.28	7.43	5.20-9.66	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Americium-241	0.39	0.387	0.271-0.503	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Cesium-134	9.19	9.6	6.7-12.5	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Cesium-137	9.55	8.7	6.1-11.3	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Cobalt-57	-0.0175		False pos. test	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Cobalt-60	7.61	7.24	5.07-9.41	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-GrW48	Water	Bq/L	Gross Alpha	1.07	1.19	0.36-2.02	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-GrW48	Water	Bq/L	Gross Beta	5.9	5.94	2.97-8.91	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Hydrogen-3	502	573	401-745	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Iron-55	-4.08		False pos. test	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Manganese-54	12.1	11.3	7.9-14.7	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Nickel-63	24.8	27.3	19.1-35.5	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Plutonium-238	0.756	0.846	0.592-1.10	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Plutonium-239/240	0.0268	0.0174	Sen Eval	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Potassium-40	0.137		False pos. test	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Radium-226	0.531	0.759	0.531-0.987	Not Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Strontium-90	0.022		False pos. test	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Technetium-99	8.66	9.31	6.52-12.10	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Uranium-234/233	1.23	1.15	0.81-1.50	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Uranium-238	1.27	1.16	0.81-1.51	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Zinc-65	18	15.3	10.7-19.9	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Barium-133	75.7	66.5	55.4-73.2	Not Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Cesium-134	88	90.8	74.5-99.9	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Cesium-137	161	163	147-181	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Cobalt-60	18.6	20.7	17.5-25.6	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Gross Alpha	55.3	47.9	24.9-60.3	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Gross Alpha	59.9	47.9	24.9-60.3	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Gross Beta	24.2	28.6	18.2-36.4	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Iodine-131	25.3	24.4	20.2-28.9	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Iodine-131	29.1	24.4	20.2-28.9	Not Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Radium-226	17.4	17.4	12.9-19.9	Acceptable

ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Radium-228	7.23	7.16	4.50-9.18	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Radium-228	7.61	7.16	4.50-9.18	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Strontium-89	61.8	51.2	40.4-58.7	Not Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Strontium-89	59.6	51.2	40.4-58.7	Not Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Strontium-90	51.4	45	33.2-51.6	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Strontium-90	58.2	45	33.2-51.6	Not Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Tritium	9040	9860	8570-10800	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Tritium	10200	9860	8570-10800	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	µg/L	Uranium (mass)	34.85	35.3	28.4-39.3	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Uranium (Nat)	23.2	24.2	19.5-27.0	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Zinc-65	319	290	261-339	Acceptable
EZA	3rd/2023	11/22/23	E13897	Cartridge	pCi	Iodine-131	7.86E+01	7.86E+01	1.00	Acceptable
EZA	3rd/2023	11/22/23	E13894	Milk	pCi/L	Strontium-89	6.26E+01	7.14E+01	0.88	Acceptable
EZA	3rd/2023	11/22/23	E13894	Milk	pCi/L	Strontium-90	8.92E+00	1.28E+01	0.70	Not Acceptable
EZA	3rd/2023	11/22/23	E13895	Milk	pCi/L	Cerium-141	1.17E+02	1.04E+02	1.13	Acceptable
EZA	3rd/2023	11/22/23	E13895	Milk	pCi/L	Cobalt-58	6.93E+01	6.58E+01	1.05	Acceptable
EZA	3rd/2023	11/22/23	E13895	Milk	pCi/L	Cobalt-60	2.33E+02	2.23E+02	1.05	Acceptable
EZA	3rd/2023	11/22/23	E13895	Milk	pCi/L	Chromium-51	2.83E+02	2.05E+02	1.16	Acceptable
EZA	3rd/2023	11/22/23	E13895	Milk	pCi/L	Cesium-134	1.06E+02	1.14E+02	0.93	Acceptable
EZA	3rd/2023	11/22/23	E13895	Milk	pCi/L	Cesium-137	1.43E+02	1.41E+02	1.01	Acceptable
EZA	3rd/2023	11/22/23	E13895	Milk	pCi/L	Iron-59	9.00E+01	7.88E+01	1.14	Acceptable
EZA	3rd/2023	11/22/23	E13895	Milk	pCi/L	Iodine-131	4.21E+01	3.74E+01	1.13	Acceptable
EZA	3rd/2023	11/22/23	E13895	Milk	pCi/L	Manganese-54	1.61E+02	1.46E+02	1.10	Acceptable
EZA	3rd/2023	11/22/23	E13895	Milk	pCi/L	Zinc-65	2.19E+02	2.03E+02	1.08	Acceptable
EZA	3rd/2023	11/22/23	E13896	Water	pCi/L	Cerium-141	1.34E+02	1.16E+02	1.15	Acceptable
EZA	3rd/2023	11/22/23	E13896	Water	pCi/L	Cobalt-58	7.99E+01	7.36E+01	1.09	Acceptable
EZA	3rd/2023	11/22/23	E13896	Water	pCi/L	Cobalt-60	2.62E+02	2.49E+02	1.05	Acceptable
EZA	3rd/2023	11/22/23	E13896	Water	pCi/L	Chromium-51	2.51E+02	2.29E+02	1.10	Acceptable
EZA	3rd/2023	11/22/23	E13896	Water	pCi/L	Cesium-134	1.27E+02	1.28E+02	0.99	Acceptable
EZA	3rd/2023	11/22/23	E13896	Water	pCi/L	Cesium-137	1.67E+02	1.58E+02	1.06	Acceptable
EZA	3rd/2023	11/22/23	E13896	Water	pCi/L	Iron-59	1.02E+02	8.81E+01	1.16	Acceptable
EZA	3rd/2023	11/22/23	E13896	Water	pCi/L	Iodine-131	5.79E+01	5.29E+01	1.10	Acceptable
EZA	3rd/2023	11/22/23	E13896	Water	pCi/L	Manganese-54	1.79E+02	1.64E+02	1.09	Acceptable
EZA	3rd/2023	11/22/23	E13896	Water	pCi/L	Zinc-65	2.59E+02	2.27E+02	1.14	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Americium-241	74.3	69.3	49.5 - 92.4	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Cesium-134	1260	1350	876 - 1660	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Cesium-137	962	932	765 - 1220	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Cobalt-60	99.9	95.5	81.2 - 121	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Gross Alpha	99.8	79.8	41.7-131	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Gross Beta	59.5	42.6	25.8-64.4	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Manganese-54	<2.97	<35.0	<35.0	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Plutonium-238	44.9	49.3	37.2 - 60.6	Acceptable

ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Plutonium-239	44.5	47.2	35.3 - 56.9	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Strontium-90	170	162	102 - 221	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	µg/Filter	Uranium (mass)	53.1	59.9	48.1 - 70.2	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	µg/Filter	Uranium (mass)	58.9	59.9	48.1 - 70.2	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Uranium-234	18.5	20.1	14.9 - 23.6	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Uranium-234	17.3	20.1	14.9 - 23.6	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Uranium-238	17.7	20	15.1 - 23.9	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Uranium-238	19.6	20	15.1 - 23.9	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Uranium-Total	37	41	29.9 - 48.6	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Uranium-Total	38.1	41	29.9 - 48.6	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Zinc-65	181	161	132 - 246	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Actinium-228	1520	1590	1050 - 2000	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Americium-241	934	1300	702 - 1840	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Bismuth-212	1760	1670	478 - 2490	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Bismuth-214	538	786	377 - 1170	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Cesium-134	1070	1570	1070 - 1880	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Cesium-137	1290	1780	1350 - 2250	Not Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Cobalt-60	5760	7960	6270 - 9830	Not Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Lead-212	1560	1650	1150 - 2090	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Lead-214	653	851	357 - 1340	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Manganese-54	<24.2	<555	<555	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Plutonium-238	380	481	240 - 731	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Plutonium-239	831	1250	681 - 1800	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Potassium-40	42500	41800	28800 - 49900	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Strontium-90	5190	6800	2120 - 10600	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Thorium-234	2950	3140	1190 - 5380	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	µg/kg	Uranium (mass)	7420	9400	4240 - 12700	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	µg/kg	Uranium (mass)	7270	9400	4240 - 12700	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Uranium-234	2320	3160	1480 - 4140	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Uranium-234	2400	3160	1480 - 4140	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Uranium-238	2480	3140	1720 - 4210	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Uranium-238	2420	3140	1720 - 4210	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Uranium-Total	4915	6440	3570 - 8330	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Uranium-Total	4960	6440	3570 - 8330	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Zinc-65	1670	2030	1620 - 2770	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Americium-241	3990	4580	2830 - 6470	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Cesium-134	370	455	302 - 606	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Cesium-137	905	949	730 - 1280	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Cobalt-60	2260	2250	1770 - 2940	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Manganese-54	<29.5	<207	<207	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Plutonium-238	1700	1940	1340 - 2500	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Plutonium-239	3730	4210	2910 - 5330	Acceptable

ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Potassium-40	36500	33300	25000 - 42200	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Strontium-90	1030	904	510 - 1180	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	µg/kg	Uranium (mass)	10800	11000	8440 - 13600	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Uranium-234	3570	3710	2610 - 4730	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Uranium-238	3590	3680	2600 - 4600	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Uranium-Total	7380	7550	4820 - 10200	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Zinc-65	1240	952	710 - 1410	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Americium-241	77.5	71	48.7 - 90.8	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Cesium-134	983	1010	763 - 1110	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Cesium-137	1030	1010	865 - 1150	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Cobalt-60	2200	2020	1740 - 2320	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Gross Alpha	63.3	71.6	26.1-98.7	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Gross Beta	57	51.1	25.6-70.3	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Manganese-54	<7.43	<71.0	<71.0	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Plutonium-238	152	177	106 - 229	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Plutonium-239	150	182	113 - 224	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Strontium-90	1020	878	632 - 1090	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Tritium	7820	8630	6500-10500	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	µg/L	Uranium (mass)	269	295	239 - 335	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	µg/L	Uranium (mass)	294	295	239 - 335	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Uranium-234	105	98.9	75.3 - 113	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Uranium-234	93.9	98.9	75.3 - 113	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Uranium-238	90	98.1	76.0 - 115	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Uranium-238	98	98.1	76.0 - 115	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Uranium-Total	199.12	202	158 - 230	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Uranium-Total	198	202	158 - 230	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Zinc-65	2230	1990	1770 - 2510	Acceptable
EZA	4th/2023	2/15/24	E13901	Cartridge	pCi	Iodine-131	7.98E+01	8.00E+01	1	Acceptable
EZA	4th/2023	2/15/24	E13898	Milk	pCi/L	Strontium-89	6.42E+01	8.59E+01	0.75	Acceptable
EZA	4th/2023	2/15/24	E13898	Milk	pCi/L	Strontium-90	7.60E+00	1.19E+01	0.64	Acceptable
EZA	4th/2023	2/15/24	E13899	Milk	pCi/L	Cerium-141	8.29E+01	8.87E+01	0.93	Acceptable
EZA	4th/2023	2/15/24	E13899	Milk	pCi/L	Cobalt-58	ND	not spiked	NA	Acceptable
EZA	4th/2023	2/15/24	E13899	Milk	pCi/L	Cobalt-60	9.74E+01	9.29E+01	1.05	Acceptable
EZA	4th/2023	2/15/24	E13899	Milk	pCi/L	Chromium-51	1.49E+02	1.52E+02	0.98	Acceptable
EZA	4th/2023	2/15/24	E13899	Milk	pCi/L	Cesium-134	1.24E+02	1.43E+02	0.87	Acceptable
EZA	4th/2023	2/15/24	E13899	Milk	pCi/L	Cesium-137	1.22E+02	1.21E+02	1.01	Acceptable
EZA	4th/2023	2/15/24	E13899	Milk	pCi/L	Iron-59	1.16E+02	1.08E+02	1.08	Acceptable
EZA	4th/2023	2/15/24	E13899	Milk	pCi/L	Iodine-131	4.40E+01	4.00E+01	1.10	Acceptable
EZA	4th/2023	2/15/24	E13899	Milk	pCi/L	Manganese-54	9.98E+01	9.83E+01	1.02	Acceptable
EZA	4th/2023	2/15/24	E13899	Milk	pCi/L	Zinc-65	1.34E+02	1.24E+02	1.05	Acceptable
EZA	4th/2023	2/15/24	E13900	Water	pCi/L	Cerium-141	9.56E+01	8.88E+01	1.08	Acceptable
EZA	4th/2023	2/15/24	E13900	Water	pCi/L	Cobalt-58	ND	not spiked	NA	Acceptable

EZA	4th/2023	2/15/24	E13900	Water	pCi/L	Cobalt-60	9.60E+01	9.30E+01	1.03	Acceptable
EZA	4th/2023	2/15/24	E13900	Water	pCi/L	Chromium-51	1.46E+02	1.53E+02	0.96	Acceptable
EZA	4th/2023	2/15/24	E13900	Water	pCi/L	Cesium-134	1.25E+02	1.43E+02	0.87	Acceptable
EZA	4th/2023	2/15/24	E13900	Water	pCi/L	Cesium-137	1.25E+02	1.21E+02	1.03	Acceptable
EZA	4th/2023	2/15/24	E13900	Water	pCi/L	Iron-59	1.26E+02	1.08E+02	1.17	Acceptable
EZA	4th/2023	2/15/24	E13900	Water	pCi/L	Iodine-131	3.92E+01	4.01E+01	0.98	Acceptable
EZA	4th/2023	2/15/24	E13900	Water	pCi/L	Manganese-54	1.01E+02	9.84E+01	1.03	Acceptable
EZA	4th/2023	2/15/24	E13900	Water	pCi/L	Zinc-65	1.43E+02	1.27E+02	1.12	Acceptable

TABLE 2
2023 ECKERT & ZIEGLER ANALYTICS PERFORMANCE EVALUATION RESULTS

PT Provider	Quarter / Year	Report Closing / Received Date	Sample Number	Sample Media	Units	Analyte	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation
EZA	1st/2023	05/18/23	E13893	Cartridge	pCi	Iodine-131	9.39E+01	8.98E+01	1.05	Acceptable
EZA	1st/2023	05/18/23	E13890	Milk	pCi/L	Strontium-89	6.91E+01	9.31E+01	0.74	Acceptable
EZA	1st/2023	05/18/23	E13890	Milk	pCi/L	Strontium-90	1.07E+01	1.47E+01	0.73	Acceptable
EZA	1st/2023	05/18/23	E13891	Milk	pCi/L	Cerium-141	1.44E+02	1.39E+02	1.04	Acceptable
EZA	1st/2023	05/18/23	E13891	Milk	pCi/L	Cobalt-58	1.43E+02	1.31E+02	1.10	Acceptable
EZA	1st/2023	05/18/23	E13891	Milk	pCi/L	Cobalt-60	2.90E+02	2.79E+02	1.04	Acceptable
EZA	1st/2023	05/18/23	E13891	Milk	pCi/L	Chromium-51	3.49E+02	3.02E+02	1.16	Acceptable
EZA	1st/2023	05/18/23	E13891	Milk	pCi/L	Cesium-134	1.85E+02	2.00E+02	0.93	Acceptable
EZA	1st/2023	05/18/23	E13891	Milk	pCi/L	Cesium-137	1.44E+02	1.40E+02	1.03	Acceptable
EZA	1st/2023	05/18/23	E13891	Milk	pCi/L	Iron-59	1.51E+02	1.22E+02	1.24	Acceptable
EZA	1st/2023	05/18/23	E13891	Milk	pCi/L	Iodine-131	8.93E+01	8.20E+01	1.09	Acceptable
EZA	1st/2023	05/18/23	E13891	Milk	pCi/L	Manganese-54	1.98E+02	1.80E+02	1.10	Acceptable
EZA	1st/2023	05/18/23	E13891	Milk	pCi/L	Zinc-65	3.40E+02	3.06E+02	1.11	Acceptable
EZA	1st/2023	05/18/23	E13892	Water	pCi/L	Cerium-141	1.60E+02	1.36E+02	1.17	Acceptable
EZA	1st/2023	05/18/23	E13892	Water	pCi/L	Cobalt-58	1.37E+02	1.28E+02	1.07	Acceptable
EZA	1st/2023	05/18/23	E13892	Water	pCi/L	Cobalt-60	2.97E+02	2.74E+02	1.08	Acceptable
EZA	1st/2023	05/18/23	E13892	Water	pCi/L	Chromium-51	3.44E+02	2.96E+02	1.16	Acceptable
EZA	1st/2023	05/18/23	E13892	Water	pCi/L	Cesium-134	1.87E+02	1.96E+02	0.95	Acceptable
EZA	1st/2023	05/18/23	E13892	Water	pCi/L	Cesium-137	1.37E+02	1.38E+02	0.99	Acceptable
EZA	1st/2023	05/18/23	E13892	Water	pCi/L	Iron-59	1.29E+02	1.19E+02	1.08	Acceptable
EZA	1st/2023	05/18/23	E13892	Water	pCi/L	Iodine-131	1.01E+02	8.78E+01	1.15	Acceptable
EZA	1st/2023	05/18/23	E13892	Water	pCi/L	Manganese-54	1.89E+02	1.76E+02	1.07	Acceptable
EZA	1st/2023	05/18/23	E13892	Water	pCi/L	Zinc-65	3.45E+02	3.00E+02	1.15	Acceptable
EZA	2nd/2023	08/21/23	E13893	Cartridge	pCi	Iodine-131	7.00E+01	6.66E+01	1.05	Acceptable
EZA	2nd/2023	08/21/23	E13890	Milk	pCi/L	Strontium-89	6.34E+01	8.68E+01	0.73	Acceptable
EZA	2nd/2023	08/21/23	E13890	Milk	pCi/L	Strontium-90	6.21E+00	1.27E+01	0.49	Not Acceptable
EZA	2nd/2023	08/21/23	E13891	Milk	pCi/L	Cerium-141	1.22E+02	1.20E+02	1.02	Acceptable
EZA	2nd/2023	08/21/23	E13891	Milk	pCi/L	Cobalt-58	1.49E+02	1.38E+02	1.08	Acceptable
EZA	2nd/2023	08/21/23	E13891	Milk	pCi/L	Cobalt-60	3.90E+02	3.66E+02	1.06	Acceptable
EZA	2nd/2023	08/21/23	E13891	Milk	pCi/L	Chromium-51	3.49E+02	2.92E+02	1.19	Acceptable
EZA	2nd/2023	08/21/23	E13891	Milk	pCi/L	Cesium-134	1.68E+02	1.83E+02	0.92	Acceptable
EZA	2nd/2023	08/21/23	E13891	Milk	pCi/L	Cesium-137	2.42E+02	2.30E+02	1.05	Acceptable
EZA	2nd/2023	08/21/23	E13891	Milk	pCi/L	Iron-59	1.97E+02	1.72E+02	1.15	Acceptable
EZA	2nd/2023	08/21/23	E13891	Milk	pCi/L	Iodine-131	8.18E+01	7.44E+01	1.10	Acceptable
EZA	2nd/2023	08/21/23	E13891	Milk	pCi/L	Manganese-54	1.84E+02	1.62E+02	1.13	Acceptable
EZA	2nd/2023	08/21/23	E13891	Milk	pCi/L	Zinc-65	2.72E+02	2.48E+02	1.10	Acceptable
EZA	2nd/2023	08/21/23	E13892	Water	pCi/L	Cerium-141	9.53E+01	8.25E+01	1.16	Acceptable
EZA	2nd/2023	08/21/23	E13892	Water	pCi/L	Cobalt-58	9.63E+01	9.47E+01	1.02	Acceptable
EZA	2nd/2023	08/21/23	E13892	Water	pCi/L	Cobalt-60	2.59E+02	2.52E+02	1.03	Acceptable
EZA	2nd/2023	08/21/23	E13892	Water	pCi/L	Chromium-51	2.07E+02	2.01E+02	1.03	Acceptable
EZA	2nd/2023	08/21/23	E13892	Water	pCi/L	Cesium-134	1.17E+02	1.26E+02	0.93	Acceptable
EZA	2nd/2023	08/21/23	E13892	Water	pCi/L	Cesium-137	1.57E+02	1.58E+02	0.99	Acceptable
EZA	2nd/2023	08/21/23	E13892	Water	pCi/L	Iron-59	1.37E+02	1.18E+02	1.16	Acceptable
EZA	2nd/2023	08/21/23	E13892	Water	pCi/L	Iodine-131	4.95E+01	5.57E+01	0.89	Acceptable

EZA	2nd/2023	08/21/23	E13892	Water	pCi/L	Manganese-54	1.22E+02	1.12E+02	1.09	Acceptable
EZA	2nd/2023	08/21/23	E13892	Water	pCi/L	Zinc-65	1.95E+02	1.70E+02	1.14	Acceptable
EZA	3rd/2023	11/22/23	E13897	Cartridge	pCi	Iodine-131	7.86E+01	7.86E+01	1.00	Acceptable
EZA	3rd/2023	11/22/23	E13894	Milk	pCi/L	Strontium-89	6.26E+01	7.14E+01	0.88	Acceptable
EZA	3rd/2023	11/22/23	E13894	Milk	pCi/L	Strontium-90	8.92E+00	1.28E+01	0.70	Not Acceptable
EZA	3rd/2023	11/22/23	E13895	Milk	pCi/L	Cerium-141	1.17E+02	1.04E+02	1.13	Acceptable
EZA	3rd/2023	11/22/23	E13895	Milk	pCi/L	Cobalt-58	6.93E+01	6.58E+01	1.05	Acceptable
EZA	3rd/2023	11/22/23	E13895	Milk	pCi/L	Cobalt-60	2.33E+02	2.23E+02	1.05	Acceptable
EZA	3rd/2023	11/22/23	E13895	Milk	pCi/L	Chromium-51	2.83E+02	2.05E+02	1.16	Acceptable
EZA	3rd/2023	11/22/23	E13895	Milk	pCi/L	Cesium-134	1.06E+02	1.14E+02	0.93	Acceptable
EZA	3rd/2023	11/22/23	E13895	Milk	pCi/L	Cesium-137	1.43E+02	1.41E+02	1.01	Acceptable
EZA	3rd/2023	11/22/23	E13895	Milk	pCi/L	Iron-59	9.00E+01	7.88E+01	1.14	Acceptable
EZA	3rd/2023	11/22/23	E13895	Milk	pCi/L	Iodine-131	4.21E+01	3.74E+01	1.13	Acceptable
EZA	3rd/2023	11/22/23	E13895	Milk	pCi/L	Manganese-54	1.61E+02	1.46E+02	1.10	Acceptable
EZA	3rd/2023	11/22/23	E13895	Milk	pCi/L	Zinc-65	2.19E+02	2.03E+02	1.08	Acceptable
EZA	3rd/2023	11/22/23	E13896	Water	pCi/L	Cerium-141	1.34E+02	1.16E+02	1.15	Acceptable
EZA	3rd/2023	11/22/23	E13896	Water	pCi/L	Cobalt-58	7.99E+01	7.36E+01	1.09	Acceptable
EZA	3rd/2023	11/22/23	E13896	Water	pCi/L	Cobalt-60	2.62E+02	2.49E+02	1.05	Acceptable
EZA	3rd/2023	11/22/23	E13896	Water	pCi/L	Chromium-51	2.51E+02	2.29E+02	1.10	Acceptable
EZA	3rd/2023	11/22/23	E13896	Water	pCi/L	Cesium-134	1.27E+02	1.28E+02	0.99	Acceptable
EZA	3rd/2023	11/22/23	E13896	Water	pCi/L	Cesium-137	1.67E+02	1.58E+02	1.06	Acceptable
EZA	3rd/2023	11/22/23	E13896	Water	pCi/L	Iron-59	1.02E+02	8.81E+01	1.16	Acceptable
EZA	3rd/2023	11/22/23	E13896	Water	pCi/L	Iodine-131	5.79E+01	5.29E+01	1.10	Acceptable
EZA	3rd/2023	11/22/23	E13896	Water	pCi/L	Manganese-54	1.79E+02	1.64E+02	1.09	Acceptable
EZA	3rd/2023	11/22/23	E13896	Water	pCi/L	Zinc-65	2.59E+02	2.27E+02	1.14	Acceptable
EZA	4th/2023	2/15/24	E13901	Cartridge	pCi	Iodine-131	7.98E+01	8.00E+01	1	Acceptable
EZA	4th/2023	2/15/24	E13898	Milk	pCi/L	Strontium-89	6.42E+01	8.59E+01	0.75	Acceptable
EZA	4th/2023	2/15/24	E13898	Milk	pCi/L	Strontium-90	7.60E+00	1.19E+01	0.64	Acceptable
EZA	4th/2023	2/15/24	E13899	Milk	pCi/L	Cerium-141	8.29E+01	8.87E+01	0.93	Acceptable
EZA	4th/2023	2/15/24	E13899	Milk	pCi/L	Cobalt-58	ND	not spiked	NA	Acceptable
EZA	4th/2023	2/15/24	E13899	Milk	pCi/L	Cobalt-60	9.74E+01	9.29E+01	1.05	Acceptable
EZA	4th/2023	2/15/24	E13899	Milk	pCi/L	Chromium-51	1.49E+02	1.52E+02	0.98	Acceptable
EZA	4th/2023	2/15/24	E13899	Milk	pCi/L	Cesium-134	1.24E+02	1.43E+02	0.87	Acceptable
EZA	4th/2023	2/15/24	E13899	Milk	pCi/L	Cesium-137	1.22E+02	1.21E+02	1.01	Acceptable
EZA	4th/2023	2/15/24	E13899	Milk	pCi/L	Iron-59	1.16E+02	1.08E+02	1.08	Acceptable
EZA	4th/2023	2/15/24	E13899	Milk	pCi/L	Iodine-131	4.40E+01	4.00E+01	1.10	Acceptable
EZA	4th/2023	2/15/24	E13899	Milk	pCi/L	Manganese-54	9.98E+01	9.83E+01	1.02	Acceptable
EZA	4th/2023	2/15/24	E13899	Milk	pCi/L	Zinc-65	1.34E+02	1.24E+02	1.05	Acceptable
EZA	4th/2023	2/15/24	E13900	Water	pCi/L	Cerium-141	9.56E+01	8.88E+01	1.08	Acceptable
EZA	4th/2023	2/15/24	E13900	Water	pCi/L	Cobalt-58	ND	not spiked	NA	Acceptable
EZA	4th/2023	2/15/24	E13900	Water	pCi/L	Cobalt-60	9.60E+01	9.30E+01	1.03	Acceptable
EZA	4th/2023	2/15/24	E13900	Water	pCi/L	Chromium-51	1.46E+02	1.53E+02	0.96	Acceptable
EZA	4th/2023	2/15/24	E13900	Water	pCi/L	Cesium-134	1.25E+02	1.43E+02	0.87	Acceptable
EZA	4th/2023	2/15/24	E13900	Water	pCi/L	Cesium-137	1.25E+02	1.21E+02	1.03	Acceptable
EZA	4th/2023	2/15/24	E13900	Water	pCi/L	Iron-59	1.26E+02	1.08E+02	1.17	Acceptable
EZA	4th/2023	2/15/24	E13900	Water	pCi/L	Iodine-131	3.92E+01	4.01E+01	0.98	Acceptable
EZA	4th/2023	2/15/24	E13900	Water	pCi/L	Manganese-54	1.01E+02	9.84E+01	1.03	Acceptable
EZA	4th/2023	2/15/24	E13900	Water	pCi/L	Zinc-65	1.43E+02	1.27E+02	1.12	Acceptable

TABLE 3

2023 DEPARTMENT OF ENERGY MIXED ANALYTE PERFORMANCE EVALUATION PROGRAM (MAPEP) RESULTS

PT Provider	Quarter / Year	Report	Sample Number	Sample Media	Unit	Analyte / Nuclide	GEL	Known value	Acceptance Range/ Ratio	Evaluation
		Received Date					Value			
MAPEP	2nd2023	6/21/2023	MAPEP-23-GrF48	Filter	Bq/smpl	Gross Alpha	0.642	0.97	0.29-1.65	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-GrF48	Filter	Bq/smpl	Gross Beta	1.45	1.49	0.75-2.24	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-GrW48	Water	Bq/L	Gross Alpha	1.07	1.19	0.36-2.02	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-GrW48	Water	Bq/L	Gross Beta	5.9	5.94	2.97-8.91	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Americium-241	4.14	0.9	Sens Eval	Not Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Cesium-134	2.67		False pos. test	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Cesium-137	1.07		False pos. test	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Cobalt-57	802	698	489-907	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Cobalt-60	808	795	557-1034	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Iron-55	-53.2		False pos.test	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Manganese-54	1340	1230	861-1599	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Nickel-63	1030	1130	791-1469	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Plutonium-238	1.02	0.52	Sens Eval	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Plutonium-239/240	100	101	71-131	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Potassium-40	594	574	402-746	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Strontium-90	953	920	644-1196	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Technetium-99	1050	1100	770-1430	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Thorium 228	46.8	43.3	30.3-56.3	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Thorium 230	45.5	40	28.0-52.0	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Thorium 232	45	43.3	30.3-56.3	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	U-234/233	60.4	64	45-83	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Uranium-238	264	258	181-335	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaS48	Soil	Bq/Kg	Zinc-65	1120	990	693-1287	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Americium-241	0.39	0.387	0.271-0.503	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Cesium-134	9.19	9.6	6.7-12.5	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Cesium-137	9.55	8.7	6.1-11.3	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Cobalt-57	-0.0175		False pos. test	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Cobalt-60	7.61	7.24	5.07-9.41	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Hydrogen-3	502	573	401-745	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Iron-55	-4.08		False pos. test	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Manganese-54	12.1	11.3	7.9-14.7	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Nickel-63	24.8	27.3	19.1-35.5	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Plutonium-238	0.756	0.846	0.592-1.10	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Plutonium-239/240	0.0268	0.0174	Sen Eval	Acceptable

MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Potassium-40	0.137		False pos. test	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Radium-226	0.531	0.759	0.531-0.987	Not Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Strontium-90	0.022		False pos. test	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Technetium-99	8.66	9.31	6.52-12.10	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Uranium-234/233	1.23	1.15	0.81-1.50	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Uranium-238	1.27	1.16	0.81-1.51	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-MaW48	Water	Bq/L	Zinc-65	18.0	15.3	10.7-19.9	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	ug/smpl	Uranium-235	0.0702	0.0644	0.0451-0.0837	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	ug/smpl	Uranium-238	10.3	9.1	6.4-11.8	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	ug/smpl	Uranium-Total	10.37	9.2	6.4-12.0	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	Bq/smpl	Americium-241	1E-06		False pos. test	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	Bq/smpl	Cesium-134	1.48	1.52	1.06-1.98	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	Bq/smpl	Cesium-137	0.676	0.63	0.441-0.819	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	Bq/smpl	Cobalt-57	0.682	0.661	0.463-0.859	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	Bq/smpl	Cobalt-60	1.12	1.05	0.74-1.37	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	Bq/smpl	Manganese-54	2.15	2.14	1.50-2.78	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	Bq/smpl	Plutonium-238	0.106	0.111	0.078-0.144	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	Bq/smpl	Plutonium-239/240	0.106	0.109	0.076-0.142	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	Bq/smpl	Strontium-90	0.0159		False pos. test	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	Bq/smpl	Uranium-234/233	0.117	0.11	0.077-0.143	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	Bq/smpl	Uranium-238	0.116	0.114	0.080-0.148	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdF48	Filter	Bq/smpl	Zinc-65	2.42	2.25	1.58-2.93	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdV48	veg	Bq/smpl	Americium-241	0.187	0.189	0.132-0.246	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdV48	veg	Bq/smpl	Cesium-134	7.15	7.6	5.32-9.88	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdV48	veg	Bq/smpl	Cesium-137	0.0488		False pos. test	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdV48	veg	Bq/smpl	Cobalt-57	7.35	6.93	4.85-9.01	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdV48	veg	Bq/smpl	Cobalt-60	6.81	6.51	4.56-8.46	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdV48	veg	Bq/smpl	Manganese-54	8.77	8.03	5.62-10.44	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdV48	veg	Bq/smpl	Plutonium-238	0.175	0.187	0.131-0.243	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdV48	veg	Bq/smpl	Plutonium-239/240	0.163	0.178	0.125-0.231	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdV48	veg	Bq/smpl	Strontium-90	0.00491		False pos. test	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdV48	veg	Bq/smpl	Uranium-234/233	0.0005	0.00044	Sen Eval	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdV48	veg	Bq/smpl	Uranium-238	0.0005	0.00026	Sen Eval	Acceptable
MAPEP	2nd2023	6/21/2023	MAPEP-23-RdV48	veg	Bq/smpl	Zinc-65	8.28	7.43	5.20-9.66	Acceptable

TABLE 4

2023 ERA PROGRAM PERFORMANCE EVALUATION RESULTS

PT Provider	Quarter / Year	Report Closing / Received Date	Sample Number	Sample Media	Units	Analyte	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Barium-133	32.8	30.5	24.2 - 34.6	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Barium-133	32.8	30.5	24.2 - 34.6	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Cesium-134	28.3	28.2	21.9 - 31.1	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Cesium-137	202	190	171 - 211	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Cobalt-60	120	110	99.0 - 123	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Zinc-65	126	105	94.5 - 125	Not Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Gross Alpha	27.7	30	15.3 - 39.2	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Gross Alpha	26.4	30	15.3 - 39.2	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Gross Alpha	26.4	30	15.3 - 39.2	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Gross Beta	13.6	16.5	9.25 - 24.8	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Gross Beta	13.6	16.5	9.25 - 24.8	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Radium-228	5.97	7.17	4.51 - 9.20	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Radium-228	5.4	7.17	4.51 - 9.20	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Uranium (Nat)	6.41	7.36	5.64 - 8.60	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	µg/L	Uranium (mass)	11.18	10.7	8.18 - 12.5	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Tritium	20600	21600	18900 - 23800	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Strontium-89	59.8	53.5	42.5 - 61.1	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Strontium-89	57.4	53.5	42.5 - 61.1	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Strontium-90	26.2	28.8	20.9 - 33.5	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Strontium-90	26.9	28.8	20.9 - 33.5	Acceptable
ERA	1st/2023	02/27/23	RAD 132	Water	pCi/L	Iodine-131	28.3	27	22.4 - 31.8	Acceptable
ERA	2nd2023	5/21/2023	040623G	Water	pCi/L	Zinc-65	330	302	272 - 353	Acceptable
ERA	2nd2023	5/21/2023	040623G	Water	pCi/L	Tritium	16200	18100	15800-19900	Acceptable
ERA	2nd2023	5/25/2023	RAD-133	Water	pCi/L	Radium-226	6.13	7.68	5.78 - 9.07	Acceptable
ERA	2nd2023	5/25/2023	RAD-133	Water	pCi/L	Iodine-131	26.8	28.7	23.9 - 33.6	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Barium-133	75.7	66.5	55.4-73.2	Not Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Cesium-134	88	90.8	74.5-99.9	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Cesium-137	161	163	147-181	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Cobalt-60	18.6	20.7	17.5-25.6	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Zinc-65	319	290	261-339	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Gross Alpha	55.3	47.9	24.9-60.3	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Gross Alpha	59.9	47.9	24.9-60.3	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Gross Beta	24.2	28.6	18.2-36.4	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Radium-226	17.4	17.4	12.9-19.9	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Radium-228	7.23	7.16	4.50-9.18	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Radium-228	7.61	7.16	4.50-9.18	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Uranium (Nat)	23.2	24.2	19.5-27.0	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	µg/L	Uranium (mass)	34.85	35.3	28.4-39.3	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Tritium	9040	9860	8570-10800	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Tritium	10200	9860	8570-10800	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Strontium-89	61.8	51.2	40.4-58.7	Not Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Strontium-89	59.6	51.2	40.4-58.7	Not Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Strontium-90	51.4	45	33.2-51.6	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Strontium-90	58.2	45	33.2-51.6	Not Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Iodine-131	25.3	24.4	20.2-28.9	Acceptable
ERA	3rd/2023	08/26/23	RAD-134	Water	pCi/L	Iodine-131	29.1	24.4	20.2-28.9	Not Acceptable

TABLE 5

2023 ERA PROGRAM (MRAD) PERFORMANCE EVALUATION RESULTS

PT Provider	Quarter / Year	Report	Sample Number	Sample Media	Unit	Analyte / Nuclide	GEL	Known value	Acceptance Range/ Ratio	Evaluation
		Received Date					Value			
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Actinium-228	1590	1670	1100 - 2100	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Americium-241	1380	1410	761 - 2000	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Bismuth-212	1750	1670	478 - 2490	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Bismuth-214	686	790	379 - 1180	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Cesium-134	1000	1170	800 - 1400	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Cesium-137	3430	3570	2700 - 4520	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Cobalt-60	3240	3490	2750 - 4310	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Lead-212	1770	1630	1140 - 2060	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Lead-214	901	838	352 - 1320	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Manganese-54	<25.0	<555	<555	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Plutonium-238	942	1040	519 - 1580	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Plutonium-239	1600	2000	1090 - 2880	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Potassium-40	43300	41800	28800 - 49900	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Strontium-90	2400	2580	803 - 4020	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Thorium-234	4280	4260	1610 - 7300	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Uranium-234	3810	4300	2020 - 5630	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Uranium-234	4180	4300	2020 - 5630	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Uranium-238	4580	4260	2340 - 5720	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Uranium-238	4330	4260	2340 - 5720	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Uranium-Total	8710	8760	4860 - 11300	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	µg/kg	Uranium (mass)	13000	12800	5780 - 17300	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Soil	pCi/kg	Zinc-65	8990	8340	6660 - 11400	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Americium-241	54.8	55.6	39.7 - 74.1	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Cesium-134	140	153	99.3 - 188	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Cesium-137	856	892	733 - 1170	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Cobalt-60	488	467	397 - 593	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Iron-55	430	578	211 - 922	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Manganese-54	<4.23	<35.0	<35.0	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Plutonium-238	9.28	9.59	7.24 - 11.8	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Plutonium-239	63.9	68.9	51.5 - 83.1	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Strontium-90	148	137	86.7 - 187	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Uranium-234	45	53.1	39.4 - 62.2	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Uranium-238	49.3	52.6	39.7 - 62.8	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Uranium-Total	96.55	108	78.8 - 128	Acceptable

ERA	2nd2023	5/19/2023	MRAD-38	Filter	μg/Filter	Uranium (mass)	148	158	127 - 185	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Zinc-65	1160	1110	910 - 1700	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Gross Alpha	82.3	76.8	40.1 - 127	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Filter	pCi/Filter	Gross Beta	35.2	32.8	19.9 - 49.6	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Tritium	24500	28000	21100 - 34100	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Americium-241	33.5	32.1	22.0 - 41.0	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Cesium-134	291	298	225 - 328	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Cesium-137	784	762	652 - 866	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Cobalt-60	432	412	355 - 473	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Iron-55	1320	1380	811 - 2010	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Manganese-54	<2.69	<71.0	<71.0	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Plutonium-238	64.9	70.7	42.5 - 91.6	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Plutonium-239	80.3	92.4	57.2 - 114	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Strontium-90	143	121	87.1 - 150	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Uranium-234	42.3	53.9	41.0 - 61.6	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Uranium-238	57.6	53.4	41.4 - 62.9	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Uranium-Total	119	110	85.8 - 125	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	μg/L	Uranium (mass)	173	160	130 - 181	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Zinc-65	268	228	203 - 288	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Gross Alpha	138	148	54.0 - 204	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Water	pCi/L	Gross Beta	178	170	85.0 - 234	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Americium-241	2470	2760	1710 - 3900	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Cesium-134	1450	1730	1150 - 2300	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Cesium-137	1760	1840	1410 - 2480	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Cobalt-60	701	696	546 - 910	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Curium-244	2240	2930	1650 - 3640	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Manganese-54	<27.1	<207	<207	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Plutonium-238	135	129	89.3 - 166	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Plutonium-239	1950	1990	1380 - 2520	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Potassium-40	34800	33300	25000 - 42200	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Strontium-90	4090	4550	2570 - 5930	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Uranium-234	746	726	510 - 926	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Uranium-238	767	720	508 - 901	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Uranium-Total	1570	1480	945 - 2000	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	μg/kg	Uranium (mass)	2310	2160	1660 - 2680	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Zinc-65	1360	1220	910 - 1810	Acceptable
ERA	2nd2023	5/19/2023	MRAD-38	Vegetation	pCi/kg	Strontium-90	4090	4550	2570-5930	Acceptable

ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Actinium-228	1520	1590	1050 - 2000	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Americium-241	934	1300	702 - 1840	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Bismuth-212	1760	1670	478 - 2490	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Bismuth-214	538	786	377 - 1170	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Cesium-134	1070	1570	1070 - 1880	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Cesium-137	1290	1780	1350 - 2250	Not Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Cobalt-60	5760	7960	6270 - 9830	Not Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Lead-212	1560	1650	1150 - 2090	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Lead-214	653	851	357 - 1340	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Manganese-54	<24.2	<555	<555	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Plutonium-238	380	481	240 - 731	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Plutonium-239	831	1250	681 - 1800	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Potassium-40	42500	41800	28800 - 49900	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Strontium-90	5190	6800	2120 - 10600	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Thorium-234	2950	3140	1190 - 5380	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Uranium-234	2320	3160	1480 - 4140	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Uranium-234	2400	3160	1480 - 4140	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Uranium-238	2480	3140	1720 - 4210	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Uranium-238	2420	3140	1720 - 4210	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Uranium-Total	4915	6440	3570 - 8330	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Uranium-Total	4960	6440	3570 - 8330	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	µg/kg	Uranium (mass)	7420	9400	4240 - 12700	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	µg/kg	Uranium (mass)	7270	9400	4240 - 12700	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Soil	pCi/kg	Zinc-65	1670	2030	1620 - 2770	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Americium-241	3990	4580	2830 - 6470	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Cesium-134	370	455	302 - 606	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Cesium-137	905	949	730 - 1280	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Cobalt-60	2260	2250	1770 - 2940	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Manganese-54	<29.5	<207	<207	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Plutonium-238	1700	1940	1340 - 2500	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Plutonium-239	3730	4210	2910 - 5330	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Potassium-40	36500	33300	25000 - 42200	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Strontium-90	1030	904	510 - 1180	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Uranium-234	3570	3710	2610 - 4730	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Uranium-238	3590	3680	2600 - 4600	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Uranium-Total	7380	7550	4820 - 10200	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	µg/kg	Uranium (mass)	10800	11000	8440 - 13600	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Vegetation	pCi/kg	Zinc-65	1240	952	710 - 1410	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Americium-241	74.3	69.3	49.5 - 92.4	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Cesium-134	1260	1350	876 - 1660	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Cesium-137	962	932	765 - 1220	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Cobalt-60	99.9	95.5	81.2 - 121	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Manganese-54	<2.97	<35.0	<35.0	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Plutonium-238	44.9	49.3	37.2 - 60.6	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Plutonium-239	44.5	47.2	35.3 - 56.9	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Strontium-90	170	162	102 - 221	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Uranium-234	18.5	20.1	14.9 - 23.6	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Uranium-234	17.3	20.1	14.9 - 23.6	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Uranium-238	17.7	20	15.1 - 23.9	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Uranium-238	19.6	20	15.1 - 23.9	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Uranium-Total	37	41	29.9 - 48.6	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Uranium-Total	38.1	41	29.9 - 48.6	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	µg/Filter	Uranium (mass)	53.1	59.9	48.1 - 70.2	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	µg/Filter	Uranium (mass)	58.9	59.9	48.1 - 70.2	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Zinc-65	181	161	132 - 246	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Gross Alpha	99.8	79.8	41.7-131	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Filter	pCi/Filter	Gross Beta	59.5	42.6	25.8-64.4	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Americium-241	77.5	71	48.7 - 90.8	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Cesium-134	983	1010	763 - 1110	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Cesium-137	1030	1010	865 - 1150	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Cobalt-60	2200	2020	1740 - 2320	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Manganese-54	<7.43	<71.0	<71.0	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Plutonium-238	152	177	106 - 229	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Plutonium-239	150	182	113 - 224	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Strontium-90	1020	878	632 - 1090	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Uranium-234	105	98.9	75.3 - 113	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Uranium-234	93.9	98.9	75.3 - 113	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Uranium-238	90	98.1	76.0 - 115	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Uranium-238	98	98.1	76.0 - 115	Acceptable

ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Uranium-Total	199.12	202	158 - 230	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Uranium-Total	198	202	158 - 230	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	µg/L	Uranium (mass)	269	295	239 - 335	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	µg/L	Uranium (mass)	294	295	239 - 335	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Zinc-65	2230	1990	1770 - 2510	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Gross Alpha	63.3	71.6	26.1-98.7	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Gross Beta	57	51.1	25.6-70.3	Acceptable
ERA	4th/2023	11/20/23	MRAD-39	Water	pCi/L	Tritium	7820	8630	6500-10500	Acceptable

FIGURE 1

COBALT-60 PERFORMANCE EVALUATION RESULTS AND % BIAS

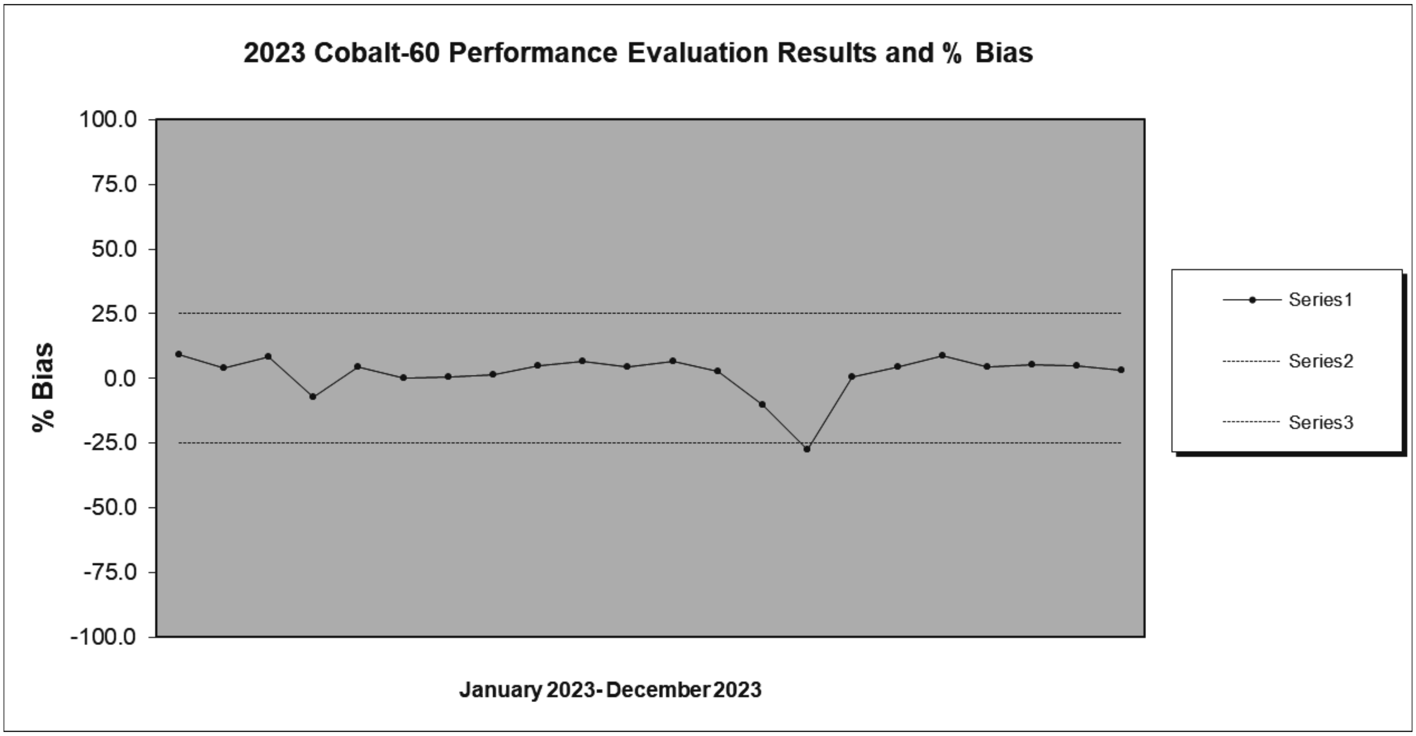


FIGURE 2

CESIUM-137 PERFORMANCE EVALUATION RESULTS AND % BIAS

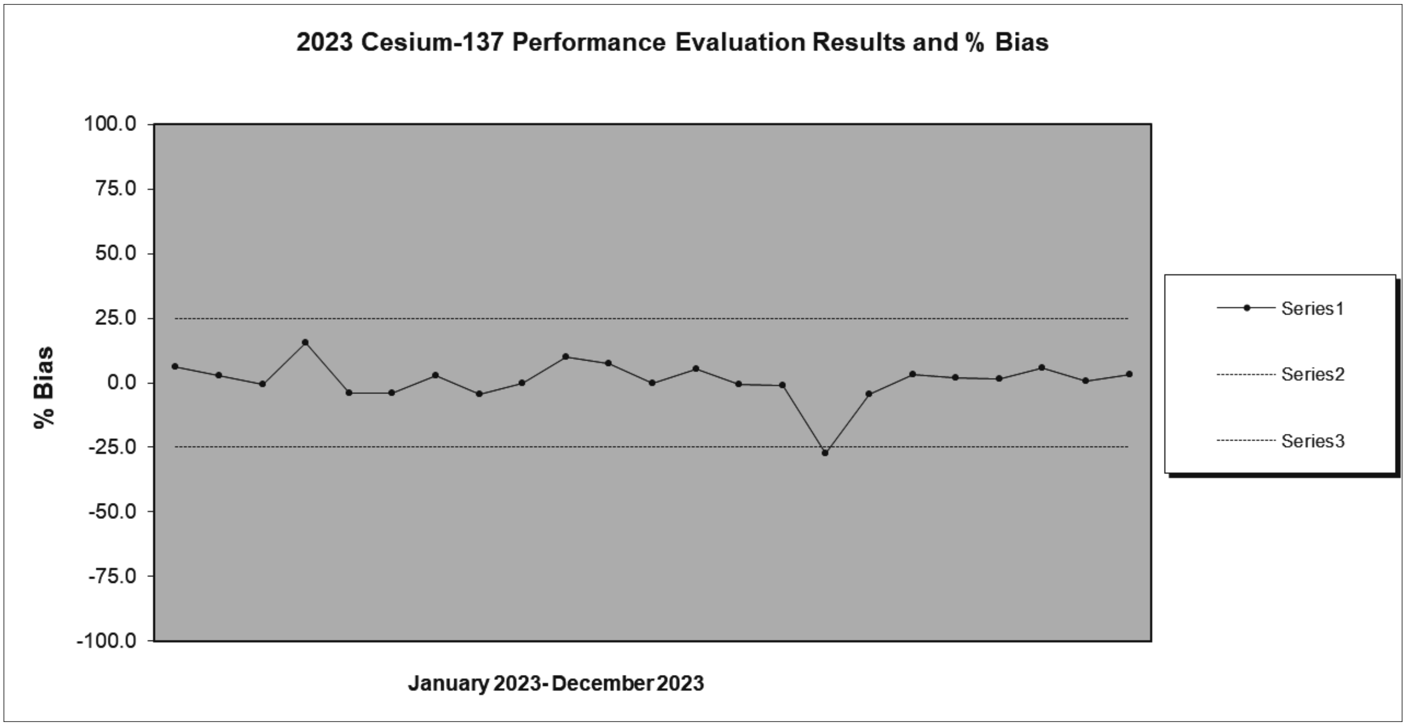


FIGURE 3

TRITIUM PERFORMANCE EVALUATION RESULTS AND % BIAS

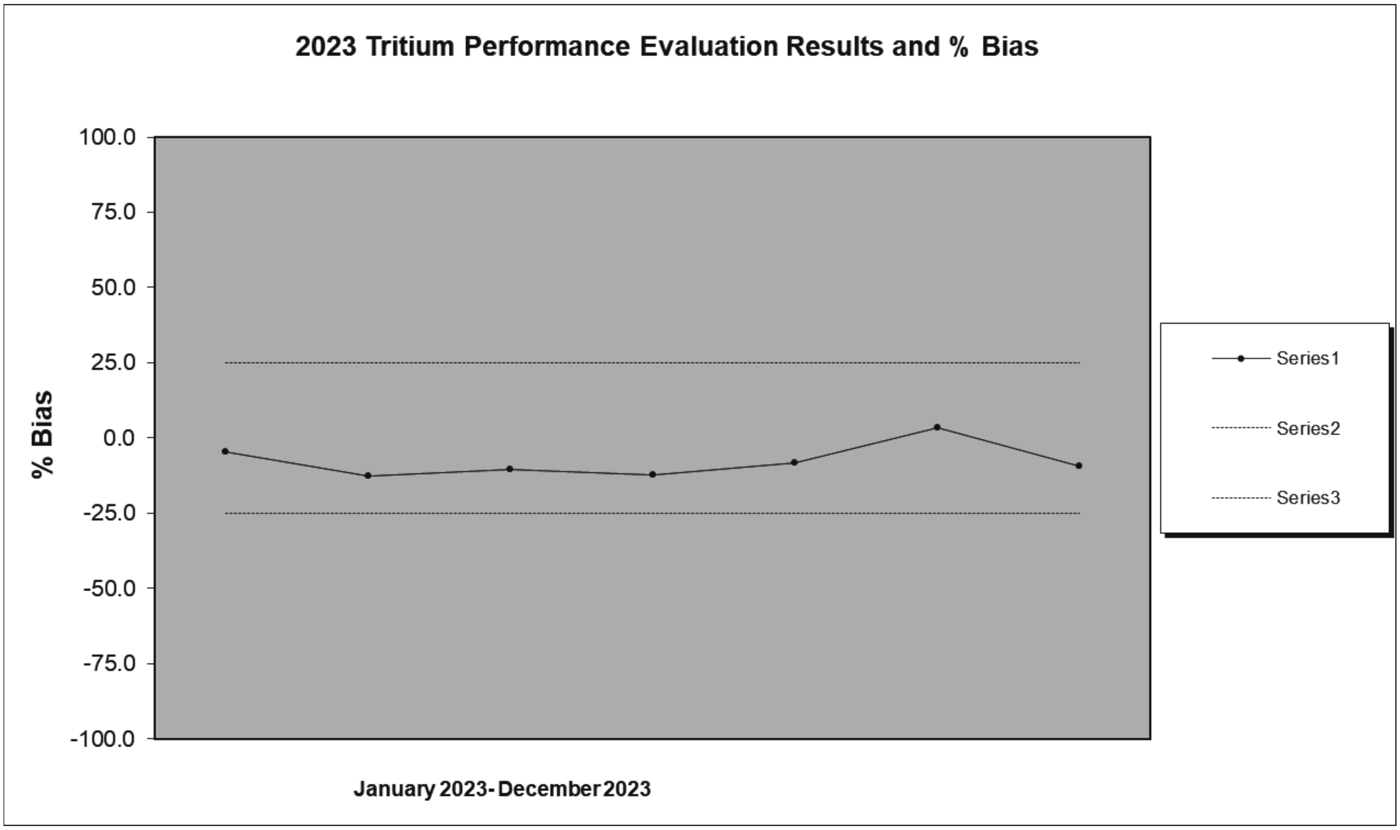


FIGURE 4

STRONTIUM-90 PERFORMANCE EVALUATION RESULTS AND % BIAS

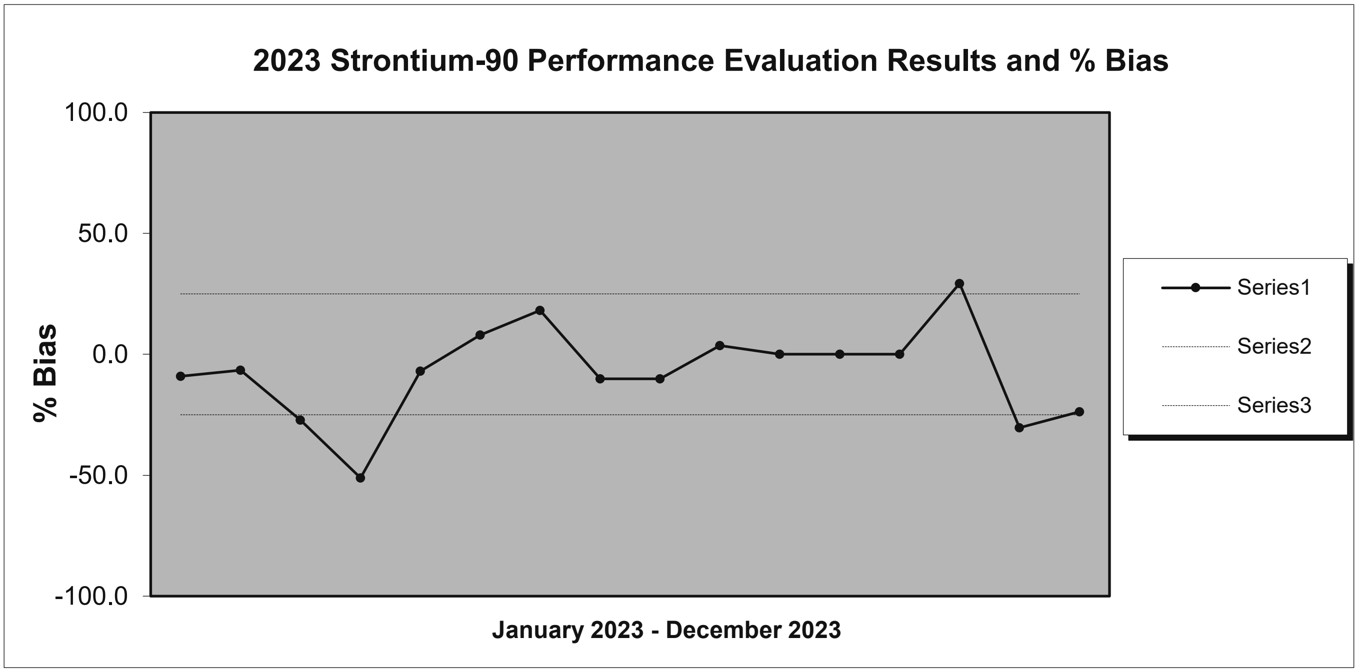


FIGURE 5

GROSS ALPHA PERFORMANCE EVALUATION RESULTS AND % BIAS

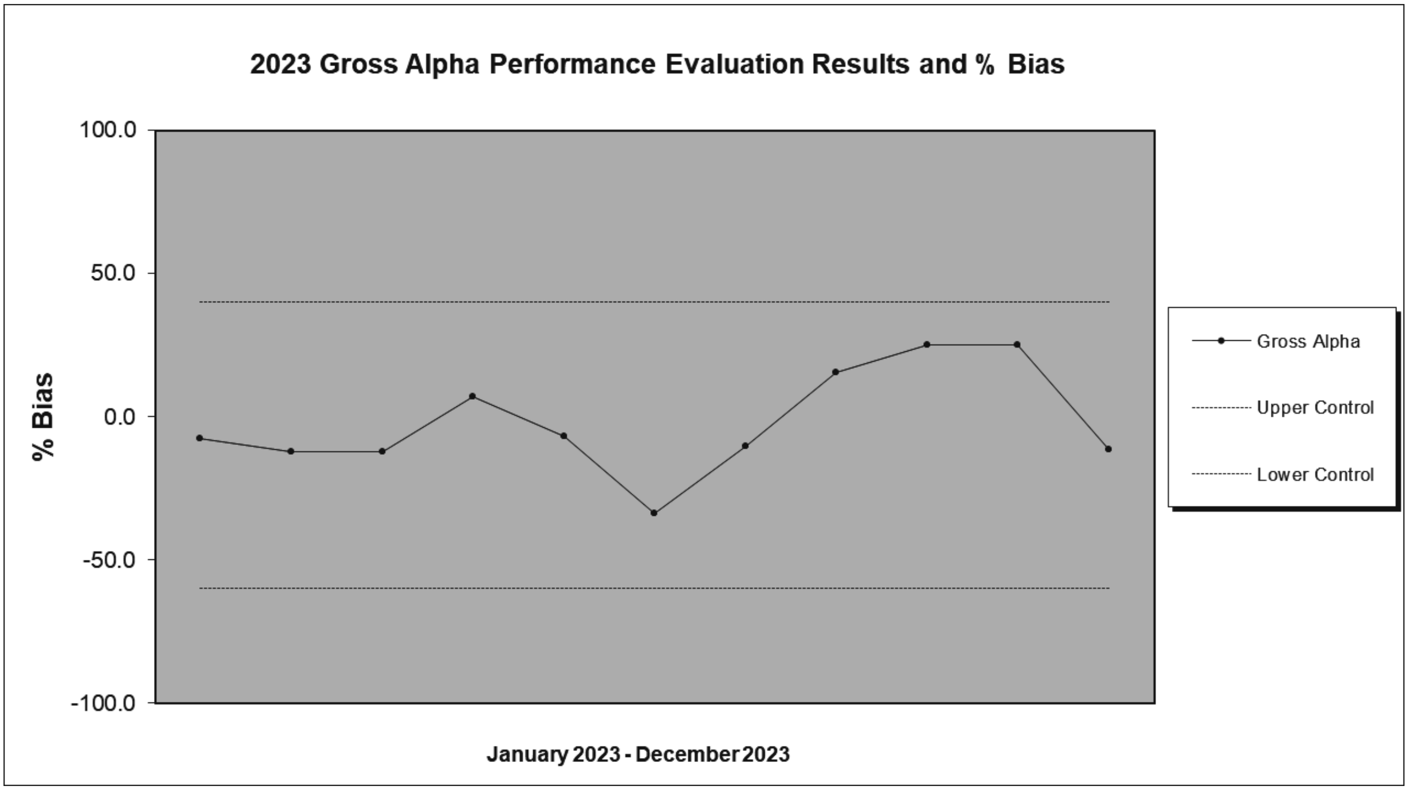


FIGURE 6

GROSS BETA PERFORMANCE EVALUATION RESULTS AND % BIAS

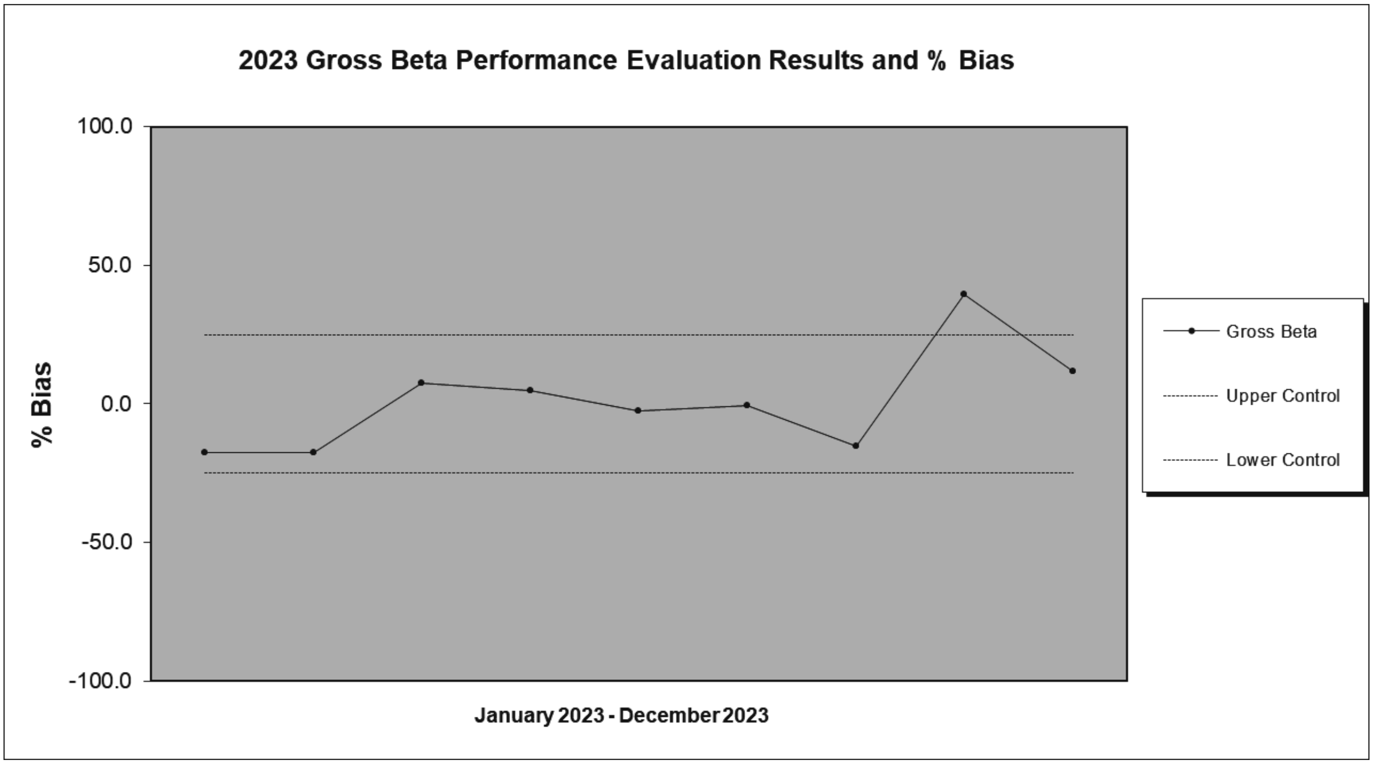


FIGURE 7

IODINE-131 PERFORMANCE EVALUATION RESULTS AND % BIAS

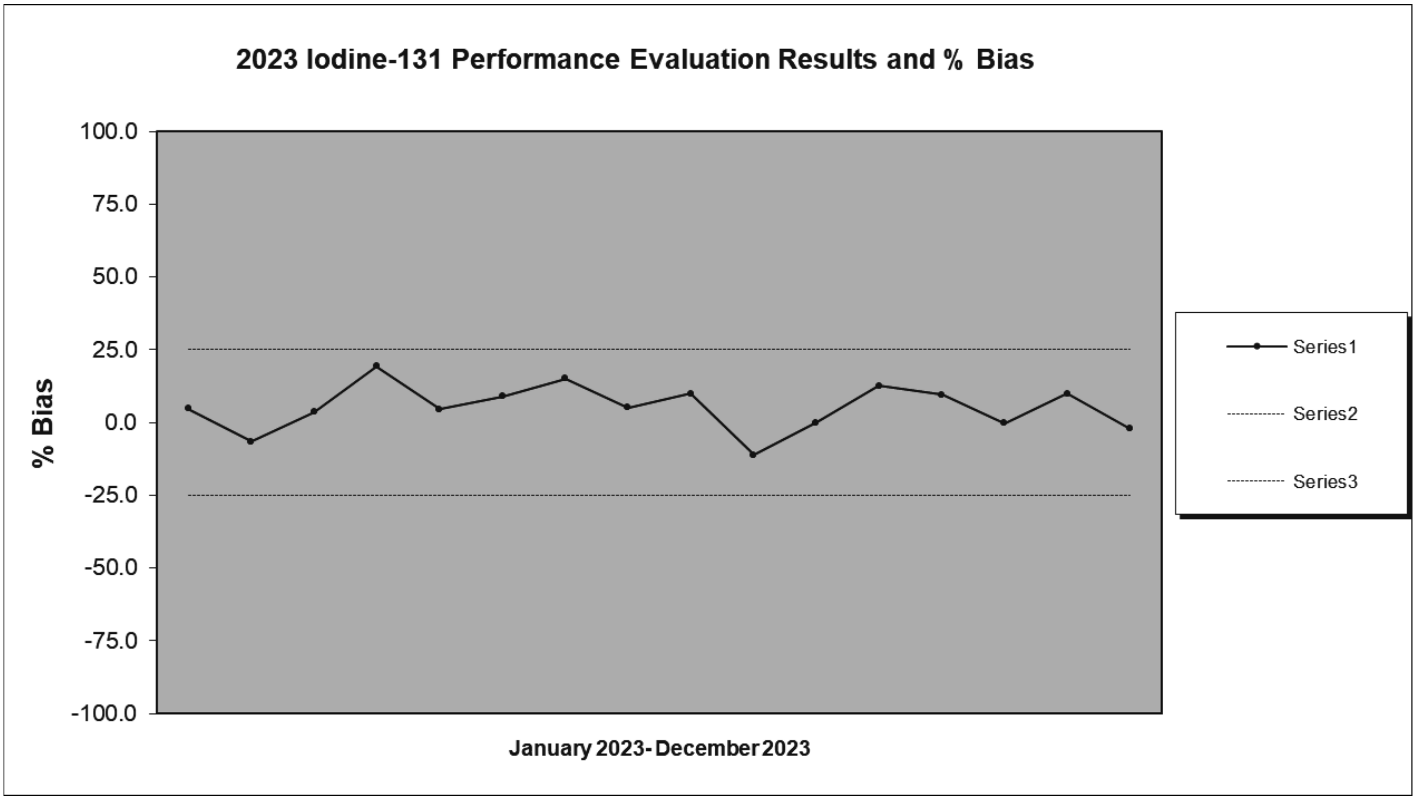


FIGURE 8

AMERICIUM-241 PERFORMANCE EVALUATION RESULTS AND % BIAS

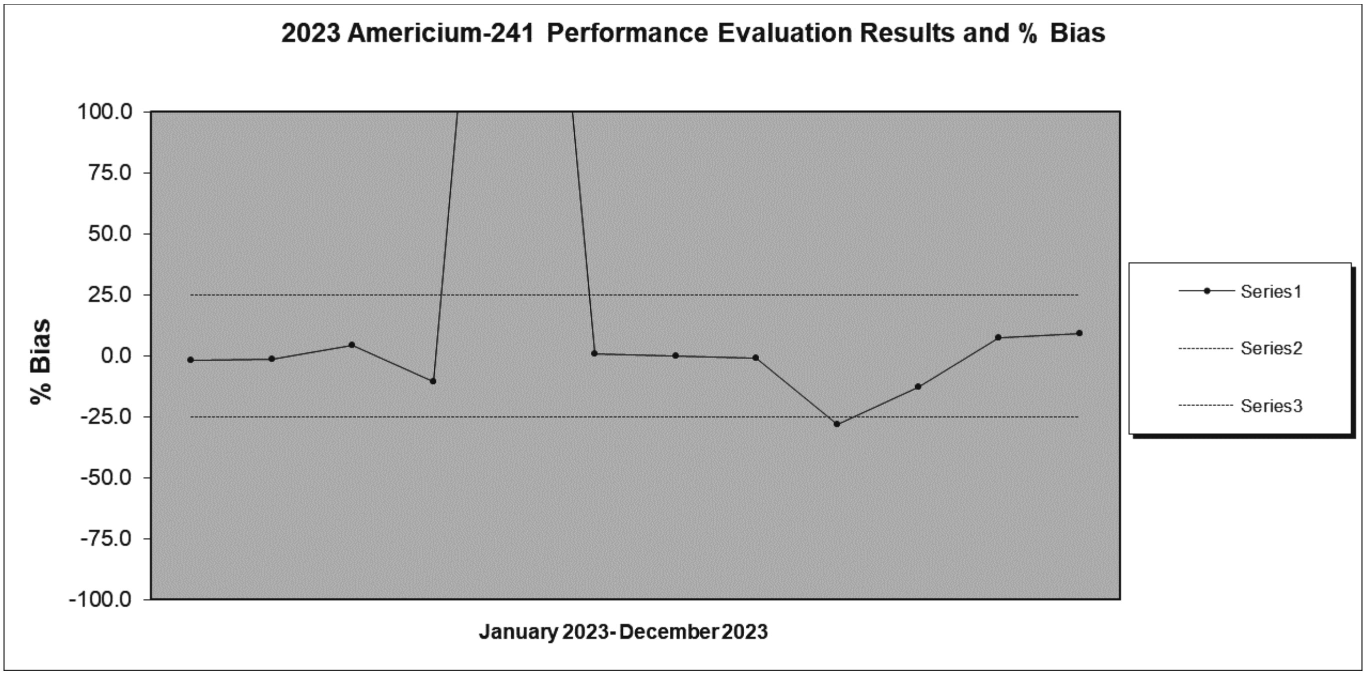


FIGURE 9

PLUTONIUM-238 PERFORMANCE EVALUATION RESULTS AND % BIAS

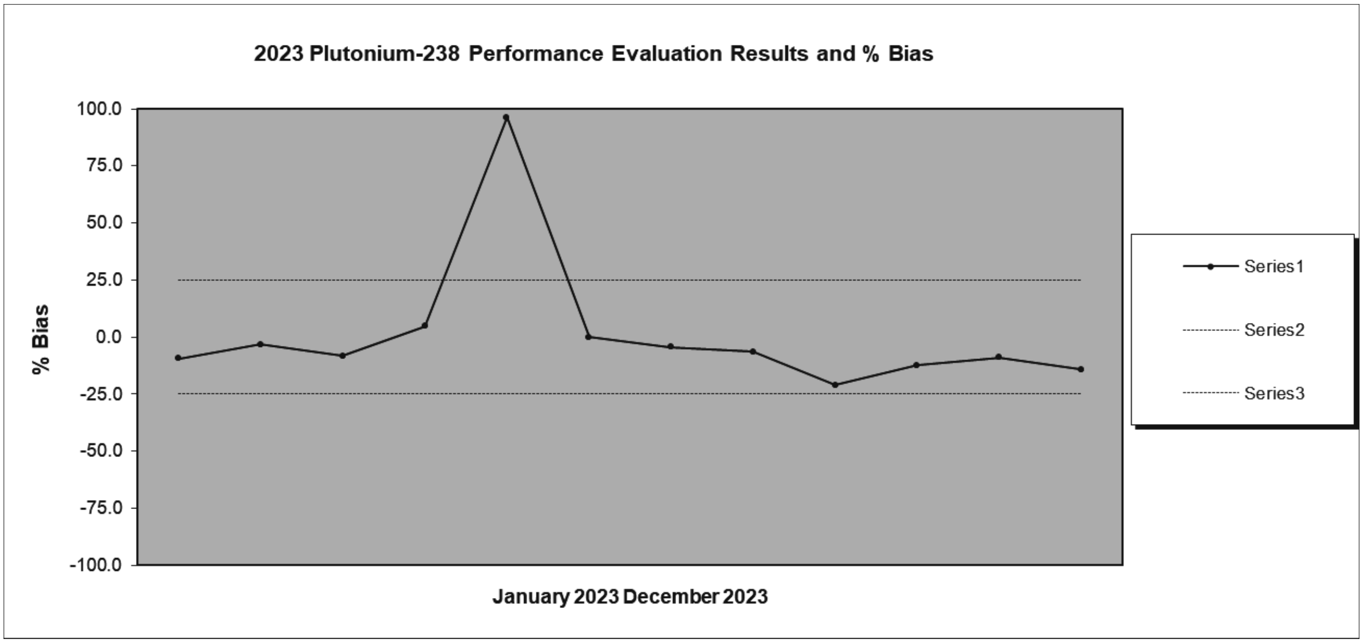


TABLE 6

REMP INTRA-LABORATORY DATA SUMMARY: BIAS AND PRECISION BY MATRIX

	Bias Criteria (+ / - 25%		**Precision Criteria (Note 1)**	
2023	**WITHIN CRITERIA**	**OUTSIDE CRITERIA**	**WITHIN CRITERIA**	**OUTSIDE CRITERIA**
AIR CHARCOAL				
Gamma Iodine 131 RAD A-013	1358	0	1954	0
Carbon-14 (Ascarite/Soda Lime Filter per Liter)	121	0	121	0
LIQUID				
Tritium	988	8	1333	0
FILTER				
Gamma Spec Filter	140	2	296	0
Gross A & B	1357	13	1026	0
LIQUID				
Iodine-131	0	0	323	0
MILK				
Gas Flow Sr 2nd count	157	8	200	0
Gamma Iodine-131	27	0	433	0
Gamma Spec Liquid RAD A-013 with Ba, La	140	0	466	0
LIQUID				
Gamma Spec Liquid RAD A-013 with Ba, La	309	11	729	0
DRINKING WATER				
Gross Alpha Non Vol Beta	354	1	361	0
Iodine-131	0	0	173	0
LIQUID				
Gross Alpha Non Vol Beta	147	4	327	0
Gas Flow Sr 2nd count	63	0	70	0
TISSUE				
Gamma Spec Solid RAD A-013	154	0	161	0
DRINKING WATER				
Gas Flow Total Strontium	91	0	93	0
LSC Iron-55	89	0	72	0
Gamma Spec Liquid RAD A-013 with Ba, La	138	2	219	0
LIQUID				
Gamma Spec Liquid RAD A-013 with Iodine	92	0	333	0
DRINKING WATER				
Gamma Iodine-131	84	0	66	0
VEGETATION				

Gamma Spec Solid RAD A-013 with Iodine	257	4	347	0
DRINKING WATER				
LSC Nickel 63	82	0	72	0
SOLID				
Tritium	5	0	0	0
DRINKING WATER				
Tritium	158	0	156	0
MILK				
Gas Flow Total Strontium	55	0	64	0
LIQUID				
Gas Flow Total Strontium	88	0	81	0
SOLID				
Gamma Spec Solid RAD A-013	50	1	55	0
DRINKING WATER				
Gamma Spec Liquid RAD A-013 with Iodine	0	0	30	0
LIQUID				
LSC Iron-55	46	0	63	0
LSC Nickel 63	54	0	64	0
Gamma Iodine-131	0	0	4	0
FILTER				
Gas Flow Sr 2nd Count	18	0	18	0
TISSUE				
Gas Flow Sr 2nd count	51	2	53	0
SOLID				
Gamma Spec Solid RAD A-013 with Iodine	102	11	156	0
VEGETATION				
Gamma Spec Solid RAD A-013	29	0	29	0
TISSUE				
Gamma Spec Solid RAD A-013 with Iodine	44	0	39	0
Gas Flow Total Strontium	23	0	23	0
SOLID				
Gas Flow Sr 2nd count	14	0	28	0
VEGETATION				
Carbon-14	4	0	4	0
SOLID				
Gas Flow Total Strontium	11	0	11	0
LSC Iron-55	15	0	15	0
LSC Nickel 63	15	0	15	0
VEGETATION				
Gas Flow Sr 2nd count	21	0	21	0
TISSUE				
Tritium	3	0	3	0

SOLID				
Carbon-14	7	0	7	0
TOTAL	**6961**		**10114**	

Note 1: The RPD must be 20 percent or less, if both samples are greater than 5 times the MDC. If both results are less than 5 times MDC, then the RPD must be equal to or less than 100%. If one result is above the MDC and the other is below the MDC, then the RPD can be calculated using the MDC for the result of the one below the MDC. The RPD must be 100% or less. In the situation where both results are above the MDC but one result is greater than 5 times the MDC and the other is less than 5 times the MDC, the RPD must be less than or equal to 20%. If both results are below MDC, then the limits on % RPD are not applicable.

TABLE 7

ALL RADIOLOGICAL INTRA-LABORATORY DATA SUMMARY: BIAS AND PRECISION BY MATRIX:

	Bias Criteria (+ / - 25%		Precision Criteria (Note 1)	
2023	**WITHIN CRITERIA**	**OUTSIDE CRITERIA**	**WITHIN CRITERIA**	**OUTSIDE CRITERIA**
LIQUID				
ICP-MS Technetium-99 in Water	112	0	118	4
SOLID				
Technetium-99	2893	35	3412	0
LIQUID				
ICP-MS Uranium-233, 234 Prep in Liquid	95	0	147	0
FILTER				
Gross A & B (Americium Calibration) Liquid	459	7	603	0
Gas Flow Sr-90	11	0	296	0
TISSUE				
Alpha Spec Plutonium	155	2	169	0
LIQUID				
Plutonium	405	0	503	2
VEGETATION				
Gas Flow Strontium 90	139	1	117	0
FILTER				
LSC Plutonium 241 Filter per Liter	11	0	137	0
Alpha Spec Am243	55	11	138	2
ICP-MS Uranium-235, 236, 238 in Filter	60	0	83	0
DRINKING WATER				
Iodine-131	0	0	51	18
FILTER				
Gas Flow Total Radium	0	0	19	0
LIQUID				
LSC Sulfur 35	70	0	70	0
FILTER				
Alpha Spec Polonium	0	0	93	2
TISSUE				
Gross Alpha/Beta	27	1	28	0
Gas Flow Total Strontium	23	0	23	0
SOLID				
LSC Promethium 147	120	3	140	0
MILK				
Alpha Spec Uranium	3	0	3	0
Alpha Spec Neptunium	3	0	3	0
Technetium-99	3	0	0	0

SOLID				
Alpha Spec Neptunium (pCi/Sample)	5	0	5	0
DRINKING WATER				
Gas Flow Strontium 90	6	0	6	0
LIQUID				
Iodine-131	8	0	9	2
SOLID				
Carbon-14 by Pyrolysis	0	0	5	0
LSC Chlorine-36 in Solids	0	0	13	0
VEGETATION				
Gas Flow Strontium 90	17	0	12	0
FILTER				
LSC Phosphorus-32	0	0	42	0
SOLID				
Gas Flow Total Radium	4	0	4	0
LIQUID				
Alpha Spec Plutonium	1860	20	2331	0
SOLID				
Alpha Spec Plutonium	3161	33	3234	4
DRINKING WATER				
Tritium in Drinking Water by EPA 906.0	297	0	319	8
FILTER				
Gamma Iodine-129	6	0	341	0
SOLID				
Alpha Spec Am241 Curium	2850	17	3003	0
LIQUID				
Gamma Nickel 59 RAD A-022	118	5	201	2
SOLID				
Tritium	75	0	142	2
FILTER				
Tritium	581	3	1432	2
SOLID				
Gross Alpha Beta Soil Leach	298	0	302	0
ICP-MS Uranium-234, 235, 236, 238 Prep in Solid	557	0	539	0
ICP-MS Uranium-235, 236, 238 in Solid	324	7	335	5
FILTER				
Gamma Spec Filter	624	32	785	0
SOLID				
LSC Selenium 79	209	7	301	4
FILTER				
Alpha Spec Plutonium	250	22	593	2
Gas Flow Sr 2nd Count	38	2	202	0
TISSUE				
Alpha Spec Uranium	138	2	155	0

FILTER				
Alpha Spec Thorium	32	0	254	0
LIQUID				
Alpha Spec Radium 226	140	0	117	0
FILTER				
GFC Chlorine-36 in Filters	0	0	29	0
TISSUE				
Lucas Cell Radium 226	32	0	32	0
FILTER				
ICP-MS Tc-99 Prep in Filter	0	0	19	0
MILK				
Gas Flow Sr 2nd count	157	8	200	0
VEGETATION				
Alpha Spec Plutonium	127	0	106	0
FILTER				
Alpha Spec Radium 226	10	0	38	0
TISSUE				
Carbon-14	7	0	7	0
AIR CHARCOAL				
Carbon-14 (Ascarite/Soda Lime Filter per Liter)	121	0	121	0
FILTER				
LSC Iron-55	37	0	69	0
MILK				
Carbon-14	7	0	21	0
DRINKING WATER				
Alpha Spec Uranium	11	0	11	0
TISSUE				
Gamma Iodine-129	3	0	3	0
Gamma Nickel 59 RAD A-022	3	0	3	0
LIQUID				
Gas Flow Strontium 89 & 90	16	2	14	4
SOLID				
Technetium-99	14	0	14	0
LIQUID				
Gamma Iodine-131	0	0	4	0
Alpha Spec Am241 Curium	1702	10	2018	0
Gamma Spec Liquid RAD A-013 with Iodine	463	23	777	0
SOLID				
Gas Flow Strontium 90	2727	47	2905	4
FILTER				
Gross Alpha/Beta	73	0	280	0
SOLID				
Alpha Spec Thorium	4031	340	4434	0
FILTER				

Direct Count-Gross Alpha/Beta	820	31	10	0
Tritium	405	0	534	0
TISSUE				
Alpha Spec Am241 Curium	146	2	167	0
SOLID				
ICP-MS Uranium-234, 235, 236, 238 in Solid	1178	23	1129	0
FILTER				
Alpha Spec Neptunium	248	2	500	0
SOLID				
Gamma Nickel 59 RAD A-022	953	18	1098	0
VEGETATION				
Gamma Spec Solid RAD A-013 with Iodine	257	4	347	0
FILTER				
Alphaspec Pu Filter per Liter	37	0	316	0
SOLID				
Alpha Spec Uranium	258	15	290	0
FILTER				
Carbon-14	65	0	139	0
SOLID				
ICP-MS Uranium-235, 236, 238 Prep in Solid	296	0	339	0
DRINKING WATER				
Gas Flow Total Alpha Radium	67	0	67	0
LIQUID				
Chlorine-36 in Liquids	79	0	118	0
FILTER				
Gas Flow Pb-210	0	0	95	0
TISSUE				
Gas Flow Strontium 90	107	2	165	2
VEGETATION				
Alpha Spec Thorium	51	1	53	0
TISSUE				
Alpha Spec Neptunium	50	0	36	0
FILTER				
ICP-MS Uranium-233, 234 Prep in Filter	30	0	59	0
ICP-MS Uranium-235, 236, 238 Prep in Filter	60	0	89	0
AIR CHARCOAL				
Gamma Spec Filter RAD A-013	170	63	53	0
DRINKING WATER				
Gamma Spec Drinking Water RAD A-013	160	0	216	6
FILTER				
Nickel-63	0	0	109	0

DRINKING WATER				
Gamma Spec Liquid RAD A-013 with Ba, La	138	2	219	0
Gas Flow Strontium 89 & 90	41	0	55	18
LSC Nickel 63	82	0	72	0
FILTER				
Alpha Spec Polonium,(Filter/Liter)	4	0	15	0
SOLID				
Gross Alpha/Beta (Americium Calibration) Solid	16	0	24	0
LIQUID				
Alpha Spec Total U RAD A-011	105	2	114	0
LSC Radon 222	137	0	133	0
AIR CHARCOAL				
Gamma Spec Charcoal	41	0	41	0
Carbon-14	38	0	40	0
VEGETATION				
Alpha Spec Uranium	11	0	11	0
LIQUID				
LSC, Rapid Strontium 89 and 90	30	0	30	0
Gross Alpha Co-precipitation	10	0	37	0
SOLID				
Alpha Spec Total Uranium	14	0	14	0
TISSUE				
Alpha Spec Plutonium	13	0	20	1
VEGETATION				
Alpha Spec Neptunium	27	0	27	0
DRINKING WATER				
Gamma Iodine-129	16	0	12	0
FILTER				
LSC Promethium 147	0	0	17	0
GFC Chlorine-36 in Filters PL	0	0	23	0
LIQUID				
LSC Phosphorus-32	5	0	5	0
SOLID				
Alpha Spec Plutonium	5	0	5	0
ICP-MS Technetium-99 Prep in Soil	19	0	12	0
ICP-MS Technetium-99 in Soil	19	0	12	0
VEGETATION				
Alpha Spec Plutonium	3	1	11	0
SOLID				
Alpha Spec Neptunium	2847	3	3076	18
Gamma Spec Solid RAD A-013	8722	795	9445	0
Alpha Spec Uranium	4311	269	4596	2
FILTER				
LSC, Rapid Strontium 89 and 90	351	4	407	0

SOLID				
Gross Alpha/Beta	2376	120	2661	10
LIQUID				
Alpha/Beta (Americium Calibration) Drinking Water	151	8	129	0
Gamma Spec Liquid RAD A-013	3322	82	3355	0
FILTER				
Alpha Spec Am241Curium	325	13	1049	0
Alpha Spec Plutonium	148	1	802	0
SOLID				
Alpha Spec Plutonium	1191	47	1306	0
LIQUID				
ICP-MS Uranium-234, 235, 236, 238 in Liquid	584	0	558	2
FILTER				
LSC Iron-55	300	0	353	0
SOLID				
Gas Flow Radium 228	776	18	834	0
DRINKING WATER				
ECLS-R-GA NJ 48 Hr Rapid Gross Alpha	112	2	89	2
FILTER				
Alpha Spec Thorium	158	0	466	0
SOLID				
GFC Chlorine-36 in Solids	207	4	248	0
LIQUID				
ICP-MS Uranium-234, 235, 236, 238 Prep in Liquid	290	0	289	0
Alpha Spec Am243	124	0	177	0
FILTER				
Alphaspec Am241 Curium Filter per Liter	15	0	374	0
SOLID				
ICP-MS Uranium-233, 234 in Solid	284	0	327	0
Alpha Spec Radium 226	302	12	401	2
FILTER				
LSC Nickel 63	94	0	153	0
SOLID				
LSC Iron-55	870	9	957	0
FILTER				
Gamma Nickel 59 RAD A-022	321	5	436	2
LIQUID				
Chlorine-36 in Liquids	98	0	104	0
FILTER				
Alpha Spec Uranium	22	2	147	0
LIQUID				
Gamma Iodine-129	751	12	867	2

MILK				
Gamma Iodine-129	31	0	29	2
TISSUE				
Technetium-99	40	0	26	0
FILTER				
Alpha Spec Californium FPL	0	0	52	0
TISSUE				
Tritium	122	0	134	0
VEGETATION				
Carbon-14	11	0	21	0
FILTER				
Technetium-99	35	0	165	0
SOLID				
LSC Sulfur 35	17	0	17	0
FILTER				
Lucas Cell Ra-226	6	2	206	0
VEGETATION				
Technetium-99	21	0	18	0
Gas Flow Total Radium	10	0	15	0
DRINKING WATER				
Lucas Cell Radium 226	4	0	9	0
MILK				
Gamma Spec Liquid RAD A-013 with Iodine	18	0	16	0
Alpha Spec Am241 Curium	3	0	3	0
TISSUE				
Gas Flow Lead 210	3	0	3	0
LSC Nickel 63	3	0	3	0
MILK				
Tritium	0	0	7	0
SOLID				
Gross Alpha/Beta - Direct Count of Puck	0	0	7	0
Alpha Spec Am241 (pCi/Sample)	6	0	6	0
Alpha Spec Thorium	5	0	5	0
Tritium by Pyrolysis	4	0	9	0
LIQUID				
ICP-MS Technetium-99 Prep in Water	113	0	123	0
Gross Alpha Non Vol Beta	4539	179	5884	11
SOLID				
Tritium	2573	14	3110	5
LIQUID				
Tritium	6424	15	6594	2
Alpha Spec Neptunium	1096	3	1332	0
Gross Alpha Beta (Americium Calibration) Liquid	175	11	449	2

Gas Flow Strontium 90	2574	53	3237	8
Gas Flow Total Radium	1343	32	1405	0
Gas Flow Sr 2nd count	317	4	643	2
FILTER				
Gross A & B	1552	21	1441	0
SOLID				
Alpha Spec Am243	702	38	816	0
LIQUID				
Lucas Cell Radium-226	144	0	141	0
FILTER				
LSC Plutonium Filter	262	0	540	4
LSC Nickel 63	320	7	404	2
Lucas Cell Radium-226	12	0	48	0
Gamma Iodine 129	85	0	72	0
LIQUID				
Gamma Spec Liquid RAD A-013 with Ba, La	309	11	733	0
SOLID				
Gas Flow Lead 210	548	2	586	0
VEGETATION				
Gamma Spec Solid RAD A-013	189	8	165	0
AIR CHARCOAL				
Gamma Iodine 131 RAD A-013	1358	0	1954	0
VEGETATION				
Alpha Spec Uranium	146	10	149	0
SOLID				
Alpha Spec Polonium Solid	110	14	160	0
LIQUID				
Gas Flow Strontium 90	59	0	75	0
FILTER				
Alphaspec Np Filter per Liter	11	0	84	0
DRINKING WATER				
LSC Radon 222	229	0	233	0
FILTER				
LSC Selenium 79	0	0	13	0
Gross Alpha Beta (Flame, Unflame)	0	0	46	0
DRINKING WATER				
Gas Flow Total Strontium	91	0	93	0
MILK				
Gamma Iodine 131 RAD A-013	0	0	114	0
FILTER				
Gamma Spec Charcoal	75	0	75	0
LIQUID				
LSC Promethium 147	86	2	147	0
Alpha Spec Plutonium	147	7	201	0

SOLID				
Gross Alpha/Beta (Am/Cs Calibration) Solid	48	6	55	0
Alpha Spec Polonium Solid	77	3	80	0
FILTER				
Alpha Spec Radium,Filter/Liter	3	0	7	0
VEGETATION				
Gas Flow Lead 210	15	0	15	0
LIQUID				
Gas Flow Strontium 90	4	0	4	0
TISSUE				
Alpha Spec Uranium	10	0	18	0
MILK				
Gamma Spec Liquid RAD A-013	26	0	82	0
Alpha Spec Plutonium	3	0	3	0
VEGETATION				
Organically Bound Tritium	7	0	7	0
SOLID				
Gross Alpha Non Vol Beta	7	0	7	0
LIQUID				
Alpha Spec Thorium	1397	13	2149	2
LSC Iron-55	379	2	733	3
LSC Selenium 79	279	0	306	0
SOLID				
Gamma Spec Solid RAD A-013 with Iodine	102	11	156	0
Gamma Iodine-129	796	0	1036	0
Gas Flow Total Strontium	565	2	654	0
Carbon-14	1675	7	2240	0
Lucas Cell Radium 226	1065	31	1148	0
DRINKING WATER				
Gross Alpha Non Vol Beta	1017	11	1055	16
TISSUE				
Gamma Spec Solid RAD A-013	488	23	521	0
Gamma Spec Solid RAD A-013 with Iodine	44	0	39	0
SOLID				
ICP-MS Uranium-233, 234 Prep in Solid	299	0	349	0
TISSUE				
Alpha Spec Thorium	21	0	21	0
FILTER				
ICP-MS Uranium-233, 234 in Filter	30	0	53	0
LIQUID				
Gas Flow Lead 210	273	4	318	0
ECLS-R-GA NJ 48 Hr Rapid Gross Alpha	83	7	47	0

DRINKING WATER				
LSC Iron-55	89	0	72	0
Gas Flow Radium 228	16	0	16	0
Alpha/Beta (Americium Calibration) Drinking Water	47	2	49	0
VEGETATION				
Alpha Spec Am241 Curium	75	0	74	0
FILTER				
ICP-MS Uranium-234, 235, 236, 238 Prep in Filter	18	0	79	0
DRINKING WATER				
Iodine-131	0	0	173	0
SOLID				
Gas Flow Sr 2nd count	78	6	109	0
VEGETATION				
Tritium	49	0	49	0
DRINKING WATER				
Gamma Iodine-131	84	0	66	0
VEGETATION				
Gross Alpha/Beta	41	2	39	0
TISSUE				
Gas Flow Radium 228	13	0	28	0
FILTER				
Gas Flow Radium 228	6	0	35	0
Total Activity in Filter,	0	0	133	0
LIQUID				
Tritium in Drinking Water by EPA 906.0	68	0	70	4
TISSUE				
Alpha Spec Polonium Solid	4	0	4	0
SOLID				
Gross Alpha Beta (F,U)	89	0	89	0
Gamma Spec Ra226 RAD A-013	114	4	118	0
FILTER				
LSC Sulfur 35	0	0	72	12
VEGETATION				
Alpha Spec Am241 (pCi/Sample)	4	0	11	0
FILTER				
Gas Flow Strontium 90	96	0	580	0
LIQUID				
Iodine-131	0	0	326	0
SOLID				
LSC Nickel 63	1511	12	1724	4
DRINKING WATER				
Tritium	166	0	164	0
LIQUID				
Carbon-14	973	7	1230	0

ICP-MS Uranium-233, 234 in Liquid	94	0	137	7
ICP-MS Uranium-235, 236, 238 Prep in Liquid	130	0	192	0
ICP-MS Uranium-235, 236, 238 in Liquid	143	0	185	6
Gas Flow Radium 228	3130	121	3707	0
FILTER				
Technetium-99	38	0	744	0
LIQUID				
Gross Alpha Beta (Flame, Unflame)	1137	11	1149	4
AIR CHARCOAL				
Gamma Iodine-129	152	2	154	0
FILTER				
Gas Flow Total Strontium	12	0	12	0
LIQUID				
Gas Flow Radium 228	159	2	162	0
Alpha Spec Polonium	86	0	86	0
MILK				
Gas Flow Total Strontium	55	0	64	0
DRINKING WATER				
Lucas Cell Radium-226	561	0	800	6
Gas Flow Radium 228	639	2	662	6
FILTER				
ICP-MS Uranium-234, 235, 236, 238 in Filter	36	0	158	0
DRINKING WATER				
Gas Flow Strontium 90	231	0	245	16
SOLID				
LSC, Rapid Strontium 89 and 90	310	0	310	0
VEGETATION				
Tritium	38	0	41	0
LIQUID				
Radium 226 + 228 Sum (Result and TPU only)	124	0	171	0
AIR CHARCOAL				
Gamma Iodine 129	36	0	36	0
FILTER				
Gas Flow Ra-228	6	2	103	0
SOLID				
Total Activity,	21	0	21	0
LIQUID				
Gross Alpha/Beta	0	0	3	0
Gamma Spec Drinking Water RAD A-013	7	0	7	0
VEGETATION				
Gas Flow Sr 2nd count	21	0	21	0
FILTER				

Filter Prep	56	0	0	0
TISSUE				
LSC Plutonium	7	0	7	0
FILTER				
Gas Flow Lead 210	13	0	28	0
LIQUID				
Gamma Iodine 131 RAD A-013	15	0	22	0
SOLID				
Gamma Spec Solid RAD A-013 (pCi/Sample)	26	3	29	0
Gas Flow Strontium 90	9	0	9	0
LIQUID				
Alpha Spec Uranium	3206	229	4128	0
LSC Nickel 63	615	5	971	0
FILTER				
Carbon-14	31	2	384	4
LIQUID				
Gas Flow Total Strontium	630	9	655	4
FILTER				
Gamma Spec Filter RAD A-013	1253	125	1513	0
LIQUID				
Technetium-99	3676	11	3476	0
FILTER				
Alpha Spec Uranium	181	14	852	0
SOLID				
LSC Plutonium	1521	3	1706	8
FILTER				
Gamma Spec Filter RAD A-013 Direct Count	8	0	46	0
LIQUID				
Lucas Cell Radium 226	2306	53	2964	6
MILK				
Gamma Spec Liquid RAD A-013 with Ba, La	140	0	466	0
Gamma Iodine-131	27	0	433	0
FILTER				
Alpha Spec U	29	0	473	0
LIQUID				
Gas Flow Total Alpha Radium	49	2	49	2
TISSUE				
Gas Flow Sr 2nd count	55	2	57	0
FILTER				
Alpha Spec Plutonium	56	0	77	0
ICP-MS Tc-99 in Filter	0	0	19	0
LIQUID				
LSC Calcium 45	55	0	55	0

FILTER				
Carbon-14 Direct Count	0	0	172	0
SOLID				
ICP-MS U-234, 235, 236, 238 Prep per sample	40	0	40	0
Tritium	169	0	162	0
MILK				
Gas Flow Strontium 90	34	0	52	0
FILTER				
Gamma I-131, filter	18	0	18	0
DRINKING WATER				
Gamma Spec Liquid RAD A-013	14	0	14	0
Gamma Spec Liquid RAD A-013 with Iodine	0	0	30	0
TISSUE				
Alpha Spec Am243	6	0	6	0
FILTER				
Alpha Spec Californium	0	0	3	0
SOLID				
LSC Calcium 45	0	0	3	0
VEGETATION				
Gamma Iodine-129	4	0	4	0
DRINKING WATER				
Alpha Spec Polonium	5	0	5	0
VEGETATION				
Gamma Spec Solid RAD A-013 (pCi/Sample)	11	0	11	0
AIR CHARCOAL				
Tritium	3	0	3	0
VEGETATION				
Alpha Spec Uranium	2	2	11	0
LIQUID				
Total Activity,	3	0	3	0
TOTAL	**120667**		**148781**	

Note 1: The RPD must be 20 percent or less, if both samples are greater than 5 times the MDC. If both results are less than 5 times MDC, then the RPD must be equal to or less than 100%. If one result is above the MDC and the other is below the MDC, then the RPD can be calculated using the MDC for the result of the one below the MDC. The RPD must be 100% or less. In the situation where both results are above the MDC but one result is greater than 5 times the MDC and the other is less than 5 times the MDC, the RPD must be less than or equal to 20%. If both results are below MDC, then the limits on % RPD are not applicable.

TABLE 8

2023 CORRECTIVE ACTION REPORT SUMMARY

CORRECTIVE ACTION & PE FAILURE	DISPOSITION

Summary of RAD-132 Drinking Water Study Unacceptable Ratings

Sample ID	Parm	Reported Value	Reference Value	Acceptance Range	
Gamma	Zinc-65	126 pCi/L	105 pCi/L	94.5-125 pCi/L	
Naturals	Radium-226	9.98 pCi/L	8.26 pCi/L	6.21-9.71 pCi/L	
Tritium	Tritium	18000 pCi/L	21600 pCi/L	18900-23800 pCi/L	
Iodine	Iodine-131	16.8 pCi/L	27.0 pCi/L	22.4-31.8 pCi/L	

Containment Actions, if any:

Upon receipt of the PT report, an investigation was initiated by the Quality Department and a Corrective Action (CARR) team assembled. The team consisted of representatives from the affected laboratories. The sample preparation and analytical processes were reviewed. This included review of reagents and standards used in the sample preparation steps, calibration records, process control samples, and interviews with the analysts.

The investigation determined that the laboratory met all quality control criteria specified in the method. Additionally, all internal procedures and policies were performed as required. These failures were tracked through GEL's internal non-conformance system.

Root Causes:

Gamma: The laboratory reviewed the data of the original analysis, and no anomalies were noted. A review of the sample preparation processes and data set did not reveal any errors or possible contributors to the high bias. All other analysts reported by this method were within the acceptance limits concluding that the unacceptable result is due to an unknown error.

Radium-226: The data for this analysis has been reviewed and no anomalies were noted. The review of the sample prep and analysis process did not reveal any gross errors or possible contributors to the result. It is possible that an unknown systematic error must have occurred during the precipitation steps of the procedure resulting in the high bias.

Tritium: All data and laboratory processes were evaluated, and no errors were found. The Laboratory has concluded that this low bias was an isolated occurrence and that the overall process is within control.

Iodine-131: The laboratory has reviewed the data and found no errors. All batch QC samples met batch acceptability criteria. The laboratory will continue to investigate all steps of the analytical process including the standardization of the carrier reagent as a possible contributor to the low bias.

CORRECTIVE ACTION
&
PE FAILURE

DISPOSITION

Sample ID	Parm	Reported Value	Reference Value	Acceptance Range
MAPEP-23-MaS48	Am-241	4.14 Bq/kg	0.9 Bq/kg	Sensitivity Evaluation
MAPEP-23-MaW48	Ra-226	0.531 Bq/L	0.759 Bq/L	0.5313-0.987 Bq/L

Containment Actions, if any:

Upon receipt of the PT report, an investigation was initiated by the Quality Department and a Corrective Action (CARR) team assembled. The team consisted of representatives from the affected laboratories. The sample preparation and analytical processes were reviewed. This included review of reagents and standards used in the sample preparation steps, calibration records, process control samples, and interviews with the analysts.

The investigation determined that the laboratory met all quality control criteria specified in each method. Additionally, all internal procedures and policies were performed as required. These failures were tracked through GEL's internal non-conformance system.

Root Cause(s):

	Am-241: The original sample preparations were recounted and had the same results. The sample preparations were cleaned up to make certain this was not a chemistry separation issue. The cleaned-up results were lower, but statistically equivalent to the original counts. These cleanups were counted on lower shelf detectors, had higher uncertainty which would have passed the sensitivity test. The most likely culprit for this failure is the extremely low TPU achieved by the laboratory. An assessment of the TPU is ongoing to determine if there is a low bias. If low bias is discovered, additional factors will be included. The laboratory also noted that the uncertainty value for the reference value is not included in the assessment of the results. **Ra-226**: After a review of the data, the laboratory retransferred the batch to verify the activity. The results from the original batch were slightly higher and were within the acceptance limits of the study. The low bias could be due to the small volume/low count rate. The laboratory will evaluate counting the sample longer to decrease the uncertainty and increase total counts.

CORRECTIVE ACTION & PE FAILURE	DISPOSITION

Sample ID	Parm	Reported Value	Reference Value	Acceptance Range	
E13890 Milk	Sr-90	6.21 pCi/L	12.7 pCi/L	7.62-15.88	

Containment Actions, if any:

Upon receipt of the PT report, an investigation was initiated by the Quality Department and a Corrective Action (CARR) team assembled. The team consisted of representatives from the affected laboratory. The sample preparation and analytical processes were reviewed. This included review of reagents and standards used in the sample preparation steps, calibration records, process control samples, and interviews with the analysts.

The investigation determined that the laboratory met all quality control criteria specified in the method. Additionally, all internal procedures and policies were performed as required. These failures were tracked through GEL's internal non-conformance system.

Root Cause(s):

The laboratory reviewed the data for this analysis and no errors were found. It was noted that both the Strontium and Yttrium carriers recovered greater than is typically seen for this method which could cause a potential low bias in the results. Due to the Sr-89 result being within acceptance limits, it is also suspected that an undetermined error occurred during the second separation resulting in a low Y-90 recovery.

Summary of RAD-134 Drinking Water Study Unacceptable Ratings

Sample ID	Parm	Reported Value	Reference Value	Acceptance Range
Gamma Emitters	Ba-133	75.7 pCi/L	66.5 pCi/L	55.4-73.2 pCi/L
Strontium 89/90	Sr-89 (905.0 Mod)	61.8 pCi/L	51.2 pCi/L	40.4-58.7 pCi/L
	Sr-89 (905.0)	59.6 pCi/L	51.2 pCi/L	40.4-58.7 pCi/L
	Sr-90 (905.0)	58.2 pCi/L	45.0 pCi/L	33.2-51.6 pCi/L
Iodine-131	I-131 (by gamma)	29.1 pCi/L	24.4 pCi/L	20.2-28.9 pCi/L

Containment Actions, if any:

Upon receipt of the PT report, an investigation was initiated by the Quality Department and a Corrective Action (CARR) team assembled. The team consisted of representatives from the affected laboratories. The sample preparation and analytical processes were reviewed. This included review of reagents and standards used in the sample preparation steps, calibration records, process control samples, and interviews with the analysts.

The investigation determined that the laboratory met all quality control criteria specified in the method. Additionally, all internal procedures and policies were performed as required. These failures were tracked through GEL's internal non-conformance system.

10. Root Cause(s):

Gamma: The data was reviewed and no errors were found. The result recovered at 114% of the reference

	value which is within the laboratory's acceptance criteria for LCS recovery. The batch Duplicate result was with the acceptance range of the study and met batch replication criteria with the sample result. Historical performance evaluation results do not indicate a high bias for this parameter. Additionally, a contributing factor is how long the samples were counted. The laboratory's SOP indicates drinking water samples are typically counted for 4 hrs. This results in an uncertainty associated with the result that approaches the acceptable range. **Strontium 89/90:** The data for the drinking water PT analysis has been reviewed and no anomalies were noted. The Strontium-89 results recovered at 118% (905.0 Mod) and 116% (905.0) which is within the laboratory's acceptance criteria for LCS recovery. The sample was analyzed in duplicate for each method, and the duplicate results were within the acceptance range of the study. While the Stontium-90 LCS for the batch met recovery requirements, the recovery was higher than is typically recovered for these methods . The two gravimetrical yields that are determined in the drinking water

method were reviewed. It was noted that the yields were closer to the lower end of the acceptance range. It is possible that the yield recoveries contributed to bias in the results. For the failed Strontium-90, it was noted also that the first prep of the sample needed to be reanalyzed due to low yields. A smaller sample volume was used in the reanalysis, and this may have contributed to variation in the results and greater uncertainty in the measurement.

<u>Iodine-131:</u> The laboratory has reviewed the data for this analysis and no errors were found. The result recovered at 119% of the reference value which is within the laboratory's acceptance criteria for LCS recovery. The Duplicate in the analysis batch was within the acceptance range of the study and met replication criteria with the sample result. Review of historical results for I-131 performance evaluation samples by this method does not indicate a high bias.

Summary of MRAD-39 Study Unacceptable Ratings

Sample ID	Parm	Reported Value	Reference Value	Acceptance Range
MRAD Soil	Cs-137 Co-60	1290 pCi/kg 5760 pCi/kg	1780 pCi/kg 7960 pCi/kg	1350-2250 pCi/kg 6270-9830 pCi/kg

Containment Actions, if any:

Upon receipt of the PT report, an investigation was initiated by the Quality Department and a Corrective Action (CARR) team assembled. The team consisted of representatives from the affected

	laboratory. The sample preparation and analytical processes were reviewed. This included review of reagents and standards used in the sample preparation steps, calibration records, process control samples, and interviews with the analysts. The investigation determined that the laboratory met all quality control criteria specified in the method. Additionally, all internal procedures and policies were performed as required. These failures were tracked through GEL's internal non-conformance system.

APPENDIX B

Environmental Dosimetry Company

Annual Quality Assurance Status Report

January – December 2023

ENVIRONMENTAL DOSIMETRY COMPANY

ANNUAL QUALITY ASSURANCE STATUS REPORT

January - December 2023

Prepared By: Date: 3/14/24

Approved By: Date: 3/14/24

Environmental Dosimetry Company
10 Ashton Lane
Sterling, MA 01564

TABLE OF CONTENTS

LIST OF TABLES

EXECUTIVE SUMMARY

Routine quality control (QC) testing was performed for dosimeters issued by the Environmental Dosimetry Company (EDC) .

During this annual period100% (72/72) of the individual dosimeters, evaluated against the EDC internal performance acceptance criteria (high-energy photons only), met the criterion for accuracy and 100% (72/72) met the criterion for precision (Table 1). In addition, 100% (12/12) of the dosimeter sets evaluated against the internal tolerance limits met EDC acceptance criteria (Table 2) and 100% of independent testing passed the performance criteria (Table 3). Trending graphs, which evaluate performance statistic for high-energy photon irradiations and co-located stations are given in Appendix A.

One internal assessment and one external audit were performed in 2023.There were no findings.

I. INTRODUCTION

The TLD systems at the Environmental Dosimetry Company (EDC) are calibrated and operated to ensure consistent and accurate evaluation of TLDs. The quality of the dosimetric results reported to EDC clients is ensured by in-house performance testing and independent performance testing by EDC clients, and both internal and client directed program assessments.

The purpose of the dosimetry quality assurance program is to provide performance documentation of the routine processing of EDC dosimeters. Performance testing provides a statistical measure of the bias and precision of dosimetry processing against a reliable standard, which in turn points out any trends or performance changes. Two programs are used:

A. QC Program

Dosimetry quality control tests are performed on EDC Panasonic 814 Environmental dosimeters. These tests include: (1) the in-house testing program coordinated by the EDC QA Officer and (2) independent test perform by EDC clients. In-house test are performed using six pairs of 814 dosimeters, a pair is reported as an individual result and six pairs are reported as the mean result. Results of these tests are described in this report.

Excluded from this report are instrumentation checks. Although instrumentation checks represent an important aspect of the quality assurance program, they are not included as process checks in this report. Instrumentation checks represent between 5-10% of the TLDs processed.

B. QA Program

An internal assessment of dosimetry activities is conducted annually by the Quality Assurance Officer (Reference 1). The purpose of the assessment is to review procedures, results, materials or components to identify opportunities to improve or enhance processes and/or services.

II. PERFORMANCE EVALUATION CRITERIA

A. Acceptance Criteria for Internal Evaluations

1. Bias

For each dosimeter tested, the measure of bias is the percent deviation of the reported result relative to the delivered exposure. The percent deviation relative to the delivered exposure is calculated as follows:

$$\frac{\left(H_i' - H_i\right)}{H_i}100$$

where:

H_i' = the corresponding reported exposure for the i^{th} dosimeter (i.e., the reported exposure)

H_i = the exposure delivered to the i^{th} irradiated dosimeter (i.e., the delivered exposure)

2. Mean Bias

For each group of test dosimeters, the mean bias is the average percent deviation of the reported result relative to the delivered exposure. The mean percent deviation relative to the delivered exposure is calculated as follows:

$$\sum\left(\frac{(H_i' - H_i)}{H_i}\right)100\left(\frac{1}{n}\right)$$

where:

H_i' = the corresponding reported exposure for the i^{th} dosimeter (i.e., the reported exposure)

H_i = the exposure delivered to the i^{th} irradiated test dosimeter (i.e., the delivered exposure)

n = the number of dosimeters in the test group

Precision

For a group of test dosimeters irradiated to a given exposure, the measure of precision is the percent deviation of individual results relative to the mean reported exposure. At least two values are required for the determination of precision. The measure of precision for the i^{th} dosimeter is:

$$\left(\frac{(H_i' - \bar{H})}{\bar{H}}\right)100$$

where:

H_i' = the reported exposure for the i^{th} dosimeter (i.e., the reported exposure)

$\bar{H}$ = the mean reported exposure; i.e., $\bar{H} = \sum H_i'\left(\frac{1}{n}\right)$

n = the number of dosimeters in the test group

3. EDC Internal Tolerance Limits

All evaluation criteria are taken from the "EDC Quality System Manual," (Reference 2). These criteria are only applied to individual test dosimeters irradiated with high-energy photons (Cs-137) and are as follows for Panasonic Environmental dosimeters: ± 15% for bias and ± 12.8% for precision.

B. QC Investigation Criteria and Result Reporting

EDC Quality System Manual (Reference 2) specifies when an investigation is required due to a QC analysis that has failed the EDC bias criteria. The criteria are as follows:

1. No investigation is necessary when an individual QC result falls outside the QC performance criteria for accuracy.
2. Investigations are initiated when the mean of a QC processing batch is outside the performance criterion for bias.

C. Reporting of Environmental Dosimetry Results to EDC Customers

1. All results are to be reported in a timely fashion.
2. If the QA Officer determines that an investigation is required for a process, the results shall be issued as normal unless if the QC results prompting the investigation have a mean bias from the known of greater than ±20%, then the results shall be issued with a note indicating that they may be updated in the future, pending resolution of a QA issue.
3. Environmental dosimetry results do not require updating if the investigation has shown that the mean bias between the original results and the corrected results, based on applicable correction factors from the investigation, does not exceed ±15%.

III. DATA SUMMARY FOR ISSUANCE PERIOD JANUARY-DECEMBER 2023

A. General Discussion

Results of performance tests conducted are summarized and discussed in the following sections. Summaries of the performance tests for the reporting period are given in Tables 1 through 3 and Figures 1 through 4.

Table 1 provides a summary of individual dosimeter results evaluated against the EDC internal acceptance criteria for high-energy photons only. During this period100% (72/72) of the individual dosimeters, evaluated against these criteria, met the tolerance limits for accuracy and 100% (72/72) met the criterion for precision. A graphical interpretation is provided in Figures 1 and 2.

Table 2 provides the bias and standard deviation results for each group (N=6) of dosimeters evaluated against the internal tolerance criteria. Overall,100% (12/12) of the dosimeter sets, evaluated against the internal tolerance performance criteria, met these criteria. A graphical interpretation is provided in Figure 3.

Table 3 presents the independent blind spike results for dosimeters processed during this annual period. All results passed the performance acceptance criterion. Figure 4 is a graphical interpretation of Seabrook Station blind co-located station results.

B. Result Trending

One of the main benefits of performing quality control tests on a routine basis is to identify trends or performance changes. The results of the Panasonic environmental dosimeter performance tests are presented in Appendix A. The results are evaluated against each of the performance criteria listed in Section II, namely: individual dosimeter accuracy, individual dosimeter precision, and mean bias.

All of the results presented in Appendix A are plotted sequentially by processing date.

IV. STATUS OF EDC CONDITION REPORTS (CR)

No condition reports were issued during this annual period.

V. STATUS OF AUDITS/ASSESSMENTS

1. Internal

EDC Internal Quality Assurance Assessment was conducted during the fourth quarter 2023. There were no findings identified.

2. External

DTE Energy Audit 23-001 was conducted on April 25-26, 2023. There were no findings identified.

VI. PROCEDURES AND MANUALS REVISED DURING JANUARY - DECEMBER 2023

No procedures or manuals were revised in 2023.

VII. CONCLUSION AND RECOMMENDATIONS

The quality control evaluations continue to indicate the dosimetry processing programs at the EDC satisfy the criteria specified in the Quality System Manual. The EDC demonstrated the ability to meet all applicable acceptance criteria.

VIII. REFERENCES

1. EDC Quality Control and Audit Assessment Schedule, 2023.
2. EDC Manual 1, Quality System Manual, Rev. 4, September 28, 2020.

TABLE 1

PERCENTAGE OF INDIVIDUAL DOSIMETERS THAT PASSED EDC INTERNAL CRITERIA JANUARY – DECEMBER 2023(1), (2)

Dosimeter Type	Number Tested	% Passed Bias Criteria	% Passed Precision Criteria
Panasonic Environmental	72	100	100

(1)This table summarizes results of tests conducted by EDC.
(2)Environmental dosimeter results are free in air.

TABLE 2

MEAN DOSIMETER ANALYSES (N=6) JANUARY – DECEMBER 2023(1), (2)

Process Date	Exposure Level	Mean Bias %	Standard Deviation %	Tolerance Limit +/-15%
4/25/2023	107	0.8	1.1	Pass
5/2/2023	33	5.4	1.6	Pass
5/15/2023	56	5.1	1.3	Pass
7/23/2023	52	0.0	0.7	Pass
7/26/2023	33	2.8	2.6	Pass
8/14/2023	76	-3.0	1.5	Pass
11/4/2023	44	1.7	0.8	Pass
11/13/2023	64	-1.9	2.4	Pass
12/08/2023	83	2.7	1.0	Pass
01/30/2024	28	-0.7	1.6	Pass
02/04/2024	123	-2.7	1.6	Pass
02/8/2024	97	-1.1	1.2	Pass

(1)This table summarizes results of tests conducted by EDC for TLDs issued in 2023.
(2)Environmental dosimeter results are free in air.

TABLE 3
SUMMARY OF INDEPENDENT DOSIMETER TESTING JANUARY – DECEMBER 2023(1), (2)

Issuance Period	Client	Mean Bias %	Standard Deviation %	Pass / Fail
1st Qtr. 2023	Millstone	1.9	1.1	Pass
2nd Qtr.2023	Seabrook	0.6	1.3	Pass
3rd Qtr. 2023	Millstone	-3.8	1.4	Pass
3rd Qtr. 2023	SONGS	-14.8	1.5	Pass
4th Qtr.2023	Millstone	7.7	5.3	Pass
4th Qtr.2023	PSEG(PNNL) 48mR	2.9	2.9	Pass
4th Qtr.2023	PSEG(PNNL) 95mR	0.0	0.7	Pass
4th Qtr.2023	PSEG(PNNL) 143mR	1.2	1.3	Pass
4th Qtr.2023	PSEG(PNNL) 191mR	2.2	0.6	Pass
4th Qtr.2023	Seabrook	2.6	1.6	Pass

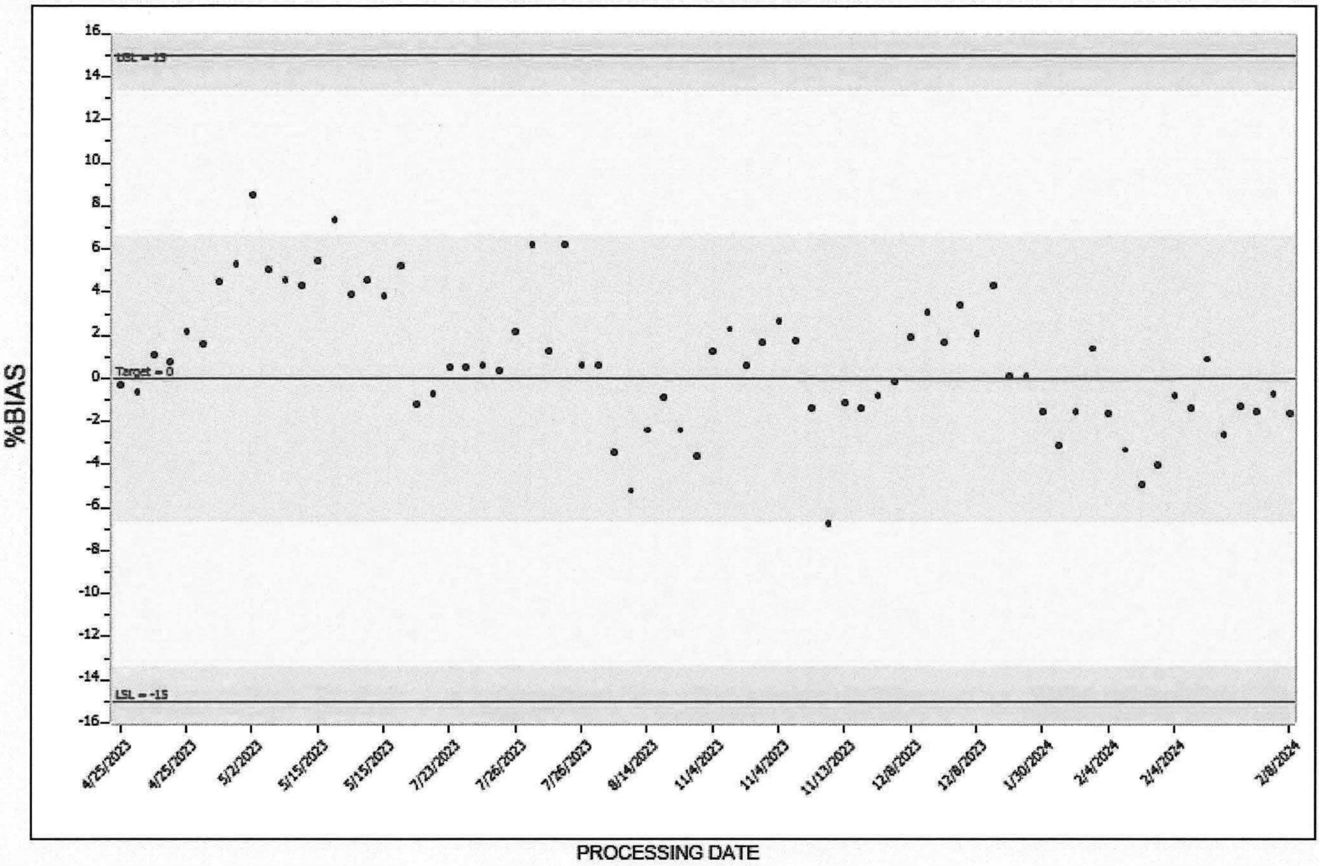
(1)Performance criteria are +/- 15%.
(2)Blind spike irradiations using Cs-137

APPENDIX A

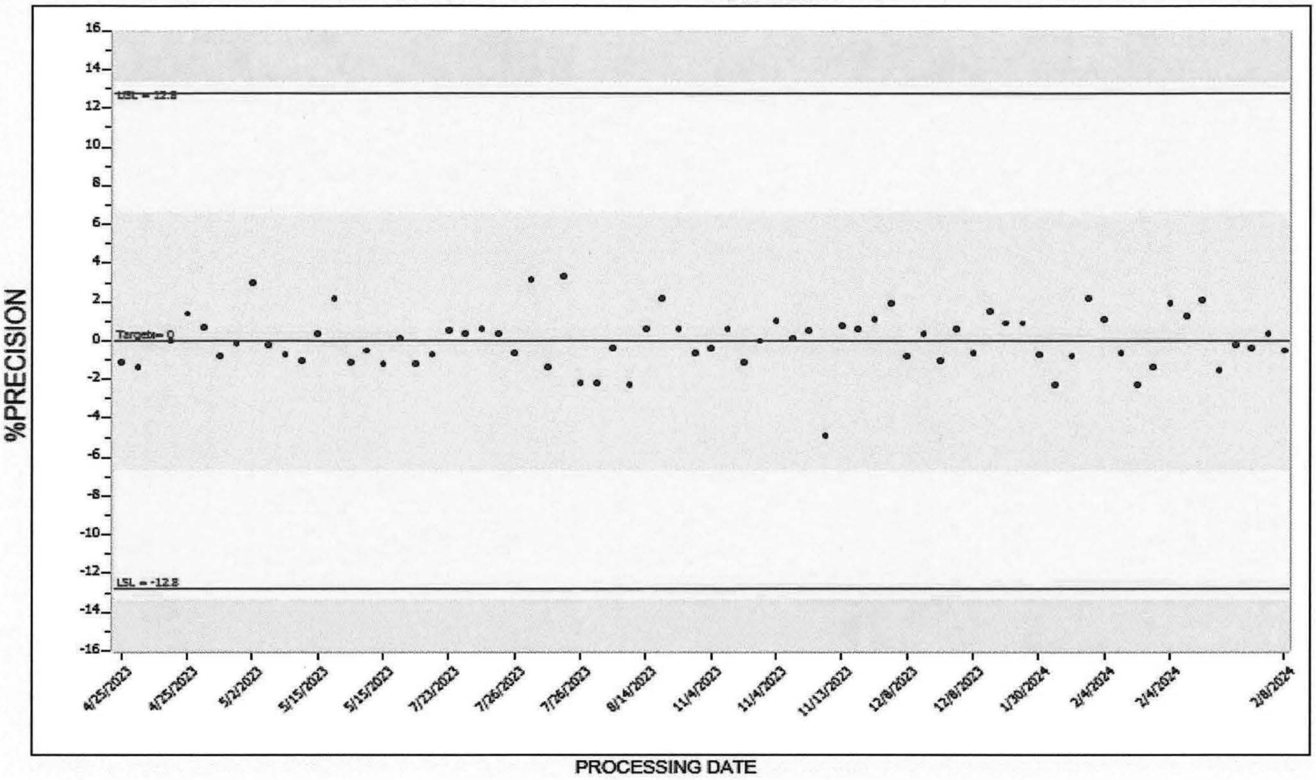
DOSIMETRY QUALITY CONTROL TRENDING GRAPHS

ISSUE PERIOD JANAURY - DECEMBER 2023

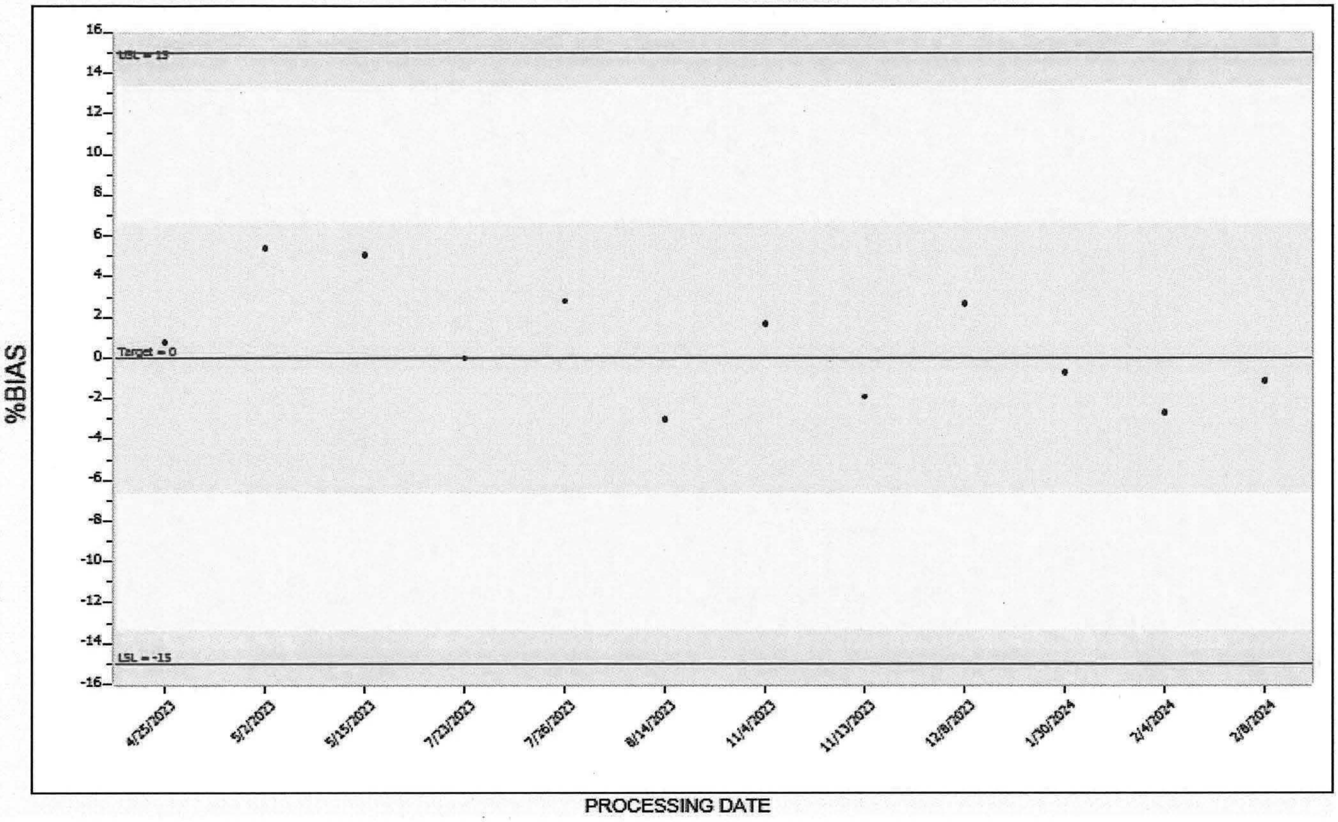
INDIVIDUAL ACCURACY ENVIRONMENTAL
FIGURE 1



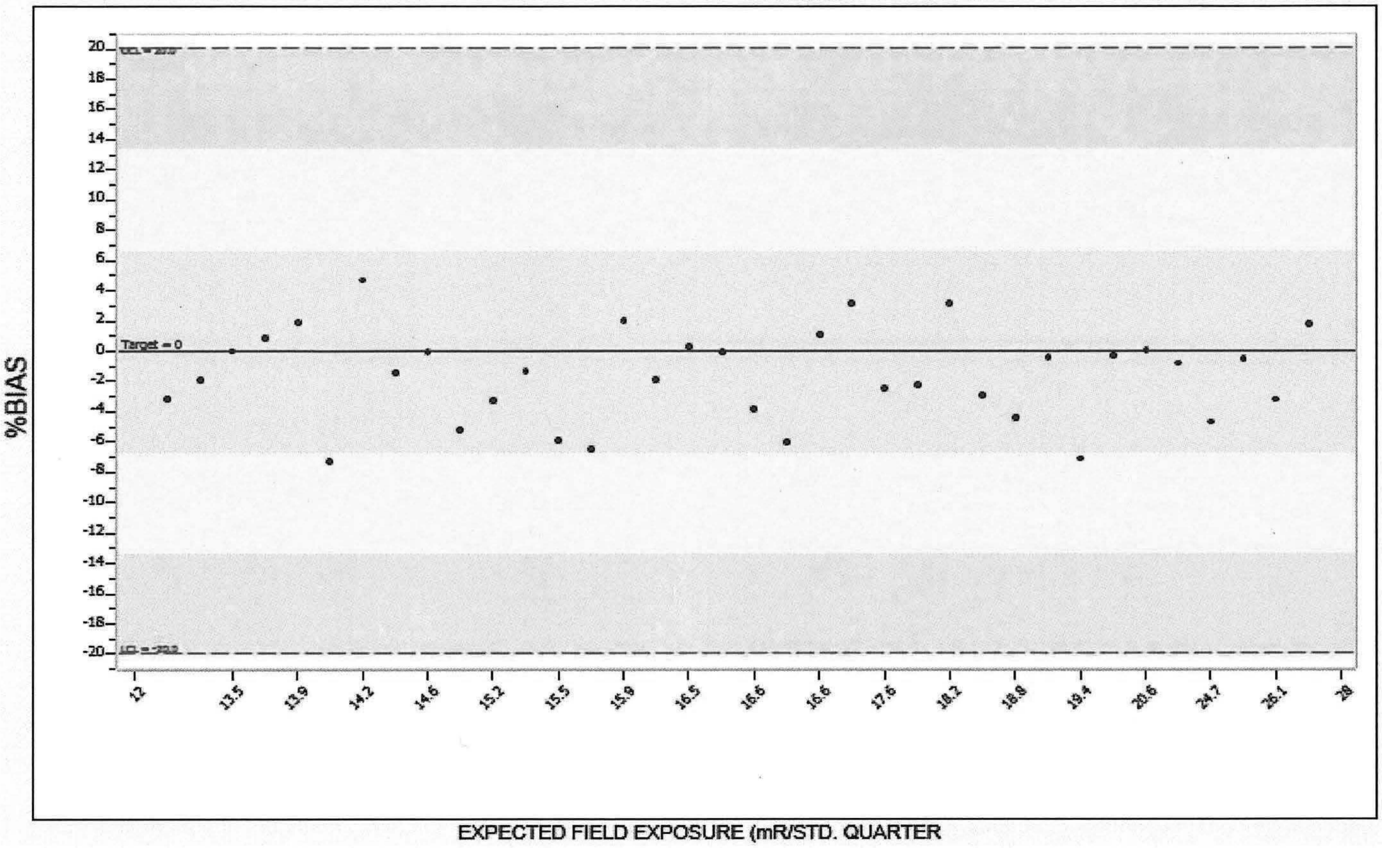
INDIVIDUAL PRECISION ENVIRONMENTAL
FIGURE 2



MEAN ACCURACY ENVIRONMENTAL
FIGURE 3



SEABROOK C0-LOCATE ACCURACY
FIGURE 4



ENCLOSURE 2

RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

2022 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM UPDATES

JANUARY 1 – DECEMBER 31, 2022

1 Pages Follow

4.8 Shoreline Sediment

Shoreline sediments were collected from three locations: upstream, downstream, and downstream-recreational. 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.

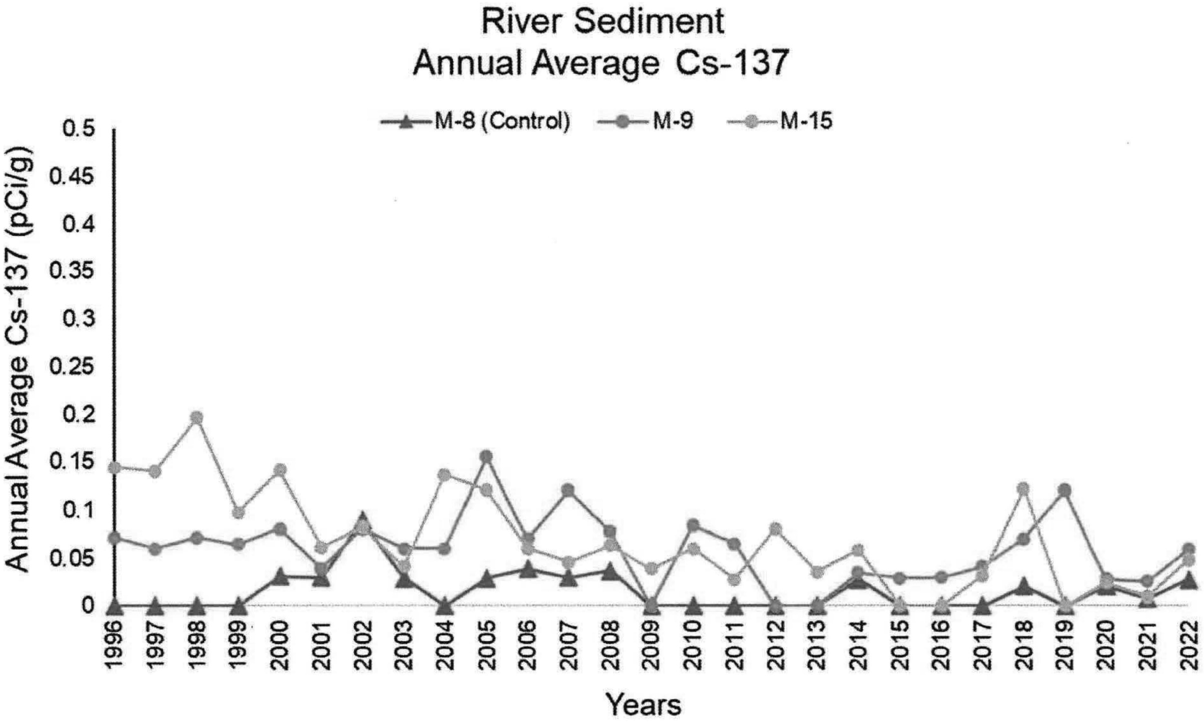


Figure 4.8-1: Graph of Historical Cesium-137 in River Sediment