2807 West County Road 75
Monticello, MN 55362

May 10, 2023

L-MT-23-020
10 CFR 50.36a
Tech Spec 5.6.2

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

2022 Annual Radioactive Effluent Release Report

Pursuant to 10 CFR 50.36a, "Technical specifications on effluents from nuclear power reactors," paragraph (a)(2), and in accordance with Monticello Nuclear Generating Plant (MNGP) Technical Specification (TS) Section 5.6.2. "Radiological Effluent Release Report," the Northern States Power Company (NSPM), a Minnesota corporation, d/b/a Xcel Energy, is submitting the following enclosure:

Enclosure 1 - Radioactive Effluent Release Report for January 1 -December 31, 2022

Summary of Commitments

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

Shawn C. Hafen
Plant Manager, Monticello Nuclear Generating Plant
Northern States Power Company – Minnesota

Enclosure

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

ENCLOSURE 1

2022 ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

JANUARY 1 – DECEMBER 31, 2022

39 Pages Follows

Xcel Energy®
RESPONSIBLE BY NATURE®

2022 Annual Radioactive Effluent Release Report

For Monticello Nuclear Generating Plant

For the period covering January 1, 2022 through December 31, 2022

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EXECUTIVE SUMMARY

Monticello Nuclear Generating Plant (MNGP) is a Boiling Water Reactor (BWR) located in central Minnesota. The plant releases small quantities of radioactive materials in gaseous form and does not make routine releases of radioactive liquids. Radioactive material in the environment due to plant operations remains below detectible levels, as discussed in the Annual Radiological Environmental Operating Report (AREOR) for MNGP. Technical Specifications limit the quantities of radioactive material that may be released, based on calculated radiation doses or dose rates. Dose to Members of the Public due to radioactive materials released from the plant is limited by Appendix I of 10 CFR 50 and by 40 CFR 190. Operational doses to the public during 2022 were calculated to be very small compared to the limits required by regulation and compared to other sources of radiation dose and pose no health hazard. Below is a brief summary of the significant sections of the report.

DOSE ASSESSMENT FOR OPERATION OF MNGP IN 2022

The Critical Receptor for MNGP has remained the same since 2014, located at 1.20 miles SSE. The Critical Receptor was a Child with dose due to Ground Plane, Inhalation and Vegetable Ingestion pathways. The maximum Annual Organ Dose calculated for this receptor was 0.0477 mrem to the Thyroid. This annual dose is a small fraction of the 10 CFR 50, Appendix I guideline of 15 mrem to the Maximum Organ.

Maximum Gaseous Site Boundary Air Doses were calculated to be 0.00384 mrad gamma and 0.00244 mrad beta. These doses are also small compared to the 10 CFR 50, Appendix I guidelines for air dose of 10 mrad gamma and 20 mrad beta.

Effluent-related dose to individuals due to their activities inside the site boundary was found to be highest for a hypothetical worker in the subyard or Site Admin Building working 40 hours/week. The maximum organ dose due to gaseous effluents was found to be 0.0208 mrem Thyroid, after taking into account occupancy time.

The Likely Most-Exposed Individual due to all Uranium Fuel Cycle Operations for demonstration of compliance with 40 CFR 190 was determined to be the same as the Critical Receptor identified above. The doses received were calculated to be 0.0129 mrem Whole Body, 0.0496 mrem Thyroid, and 0.0324 mrem Bone (Max Organ other than Thyroid) using Ground Plane, Plume (noble gas), Inhalation and Vegetable Ingestion pathways. The assessment looked at Radiological Environmental Monitoring Program (REMP) Thermoluminescent Dosimeters (TLDs) and found that no Facility Related Dose was detected at any REMP TLD locations for MNGP in 2022.

ENVIRONMENTAL MONITORING

REMP results for 2022 did not detect radioactive material due to plant operation in offsite samples. This confirms that impact on the environment and the public due to plant effluents remains very low, consistent with the small dose values reported in the Dose Assessment section.

Two areas of particular interest with regard to environmental monitoring for the present report are TLD and groundwater monitoring. TLD results were analyzed using methodology based on ANSI/HPS N13.37-2014 and found to indicate no Facility Related Dose at, or beyond, the site boundary. This result indicates that direct radiation due to operating the plant or the Independent Spent Fuel Storage Installation (ISFSI) is not contributing measurable dose to people living near the site.

Groundwater monitoring of onsite wells found that one monitoring well location (MW-9A) indicated tritium concentrations above those observed in rainwater captured onsite. A leak from a pipe within a penetration between the Reactor and Turbine Buildings has resulted in a significant change in the concentration in MW-9A. The highest groundwater tritium activity for 2022 (4,220,000 ± 6,720 pCi/l) was found in MW-9A; this activity exceeded the ODCM reporting limit of 30,000 pCi/l for non-drinking water samples. The migration of the plume resulted in the concentration of MW-12A also exceeding the ODCM reporting limit on 12/27/22 with a concentration of 37,200 pCi/l, however, this number was determined by Monticello's onsite laboratory, not the certified vendor laboratory and is considered unofficial. Tritium was also detected in one sample from MW-10, with a concentration of 284 ± 143 pCi/l. Tritium activities identified in all other wells were less than 300 pCi/l and no discharge of tritium to the general environment is reported. No gamma emitting isotopes were identified in vendor monthly and quarterly groundwater samples. 7 samples had a concentration above the certified vendor laboratory's minimum detectable concentration (MDC) but were below MNGP ODCM required Lower Limits of Detection (LLD.) Gamma Nuclides were identified by the site's laboratory in MW-9A during the leak troubleshooting; these nuclides were I-131, I-133, I-135, Xe-133, and Xe-135. Iodine-131 exceeded the reporting level given in ODCM-07.01 for non-drinking water samples of 20 pCi/l on 12/2/2022 and reached a peak concentration of 61.6 pCi/l. These short-lived gamma species were not detected once the leak was corrected.

INTRODUCTION

While many of readers of this report will be very familiar with the scientific, design, and operational principles of nuclear power generation, the sections below provide a brief introduction for the reader that may not have a background in the nuclear industry.

ABOUT NUCLEAR POWER

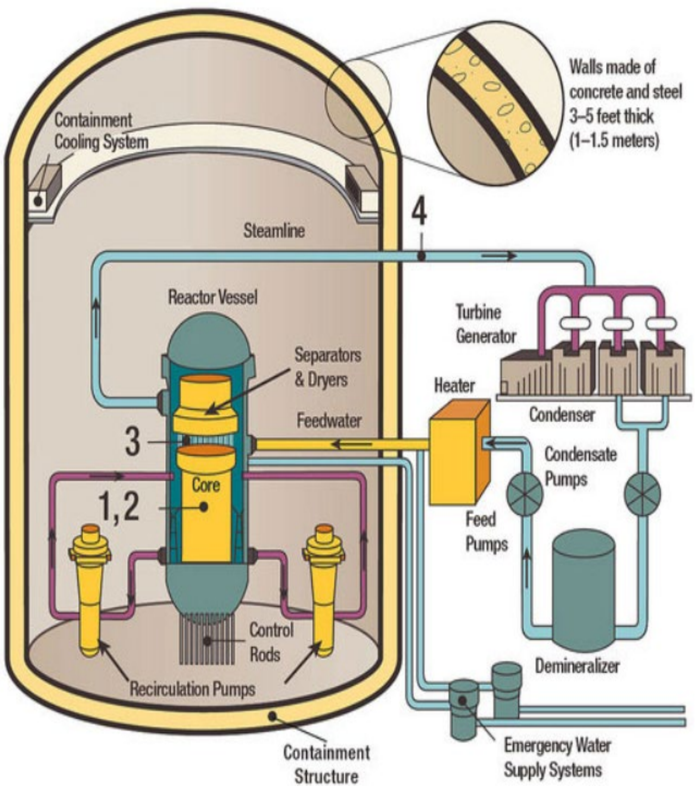

FIGURE 1: TYPICAL BOILING WATER REACTOR (BWR) DESIGN. (US NRC, REF. [11])

Commercial nuclear power plants are generally classified as either Boiling Water Reactors (BWRs) or Pressurized Water Reactors (PWRs), based on their design. Monticello Nuclear Generating Plant is classified as a BWR and the discussion below will focus on that technology.

Electricity is generated by a BWR similarly to the way that electricity is generated at other conventional types of power plants, such as those driven by coal or natural gas. Water is boiled to generate steam, the steam turns a turbine that is attached to a generator and the steam is condensed back into water to be returned to the boiler. Figure 1 shows a schematic representation for a typical BWR. What makes nuclear power different from these other types of power plants is that the heat is generated by fission and decay reactions occurring within and around the core containing fissionable uranium (U-235).

Nuclear fission occurs when certain nuclides (primarily U-233, U-235, or Pu-239) absorb a neutron and break into several smaller nuclides (called fission products) as well as some additional neutrons. Among the fission products are noble gases, Krypton (Kr) and Xenon (Xe), which must be removed along with other non-condensable gases (due to air leaks) from the condenser in order to maintain a working vacuum to pull steam across the turbine. Figure 2 shows an example of a fission reaction of U-235; of note in the diagram are two fission products (Ba-139 and Kr-95), two additional neutrons produced, and 200 MeV of energy released.

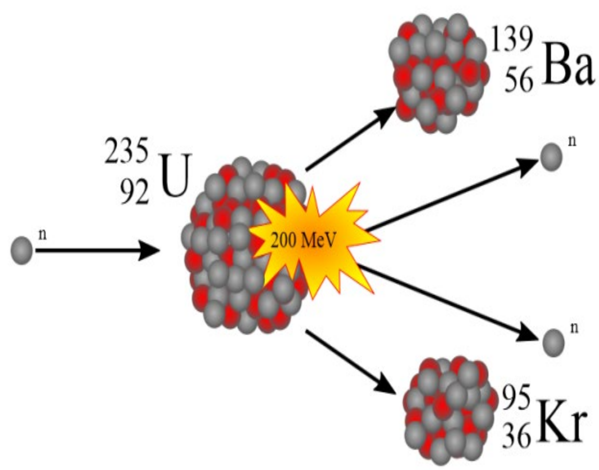

FIGURE 2: EXAMPLE OF A FISSION REACTION. (WIKIMEDIA COMMONS, REF. [12])

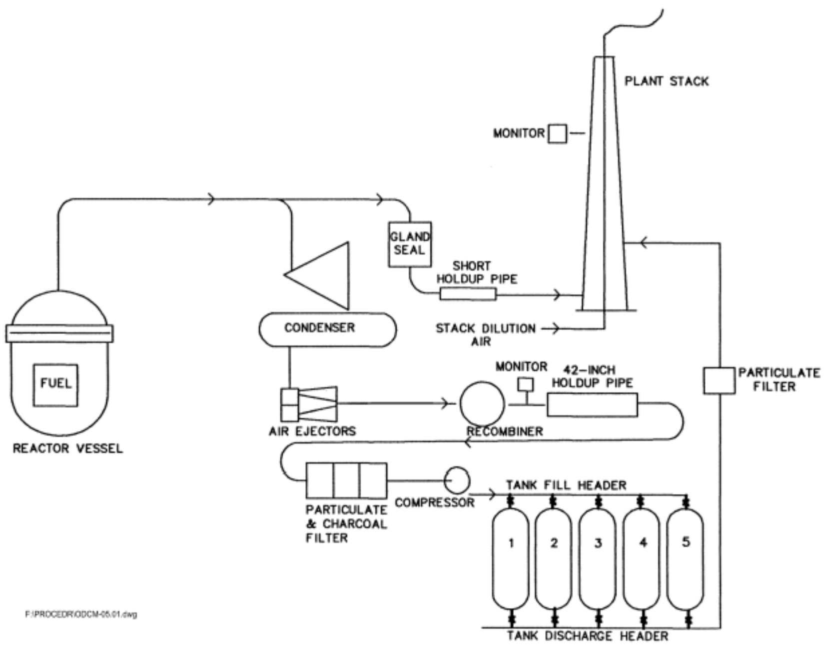

FIGURE 3: GASEOUS RADWASTE TREATMENT SYSTEM AT MNGP.

At MNGP, the non-condensable gases are treated with the Gaseous Radwaste Treatment System; this system reduces the amount of radioactive material released to the environment by holding gases from the main condenser in compressed gas tanks for a minimum of 50 hours to allow for decay of shorter-lived isotopes. The treated gases are released through the 100-meter Plant Stack. The Plant Stack provides additional dilution time for activity in the plume to dissipate prior to reaching the ground level where people could be exposed to the radioactive material that it contains. The Gaseous Radwaste Treatment System includes filtration to reduce particulate and iodine activity that is released; however, because filters are not perfectly efficient, small quantities of particulate, iodine and tritium activity are also released through the Plant Stack. Figure 3 provides a schematic representation of the Gaseous Radwaste Treatment System at MNGP.

ABOUT RADIATION DOSE

Ionizing radiation, including alpha, beta, and gamma radiation from radioactive decay, has sufficient energy to break chemical bonds in tissues and result in damage to tissue or genetic material. The amount of ionization that will be generated by a given exposure to ionizing radiation is quantified as dose. The units for dose are generally given in millirem (mrem) in the US.

The National Council on Radiation Protection (NCRP) has evaluated the population dose for the US and determined that the average individual is exposed to approximately 620 mrem per year (Ref. [1]). There are many sources of radiation dose, ranging from natural background sources to medical

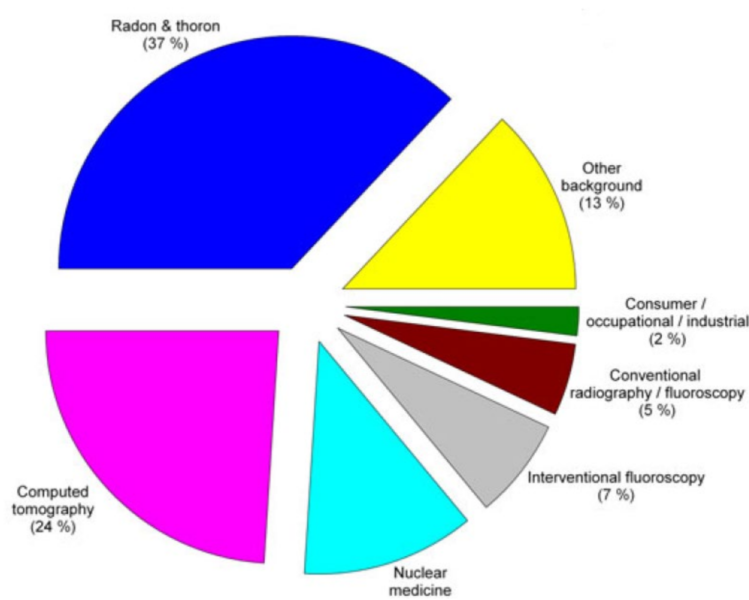

FIGURE 4: US POPULATION DOSE DISTRIBUTION FOR MAJOR SOURCES OF EXPOSURE. (NCRP REPORT 160, REF. [1])

procedures, air travel, and industrial processes. Approximately half (310 mrem) of the average exposure is due to natural sources of radiation including exposure to Radon, cosmic radiation, and internal radiation and terrestrial due to naturally occurring radionuclides. The remaining 310 mrem of exposure is due to man-made sources of exposure, with the most significant contributors being medical (48%) due to radiation used in various types of medical scans and treatments. Of the remaining 2% of dose, most is due to consumer activities such as air travel, smoking cigarettes, and building materials. A small fraction of this 2% is due to industrial activities including generation of nuclear power.

Readers who are curious about common sources and effects of radiation dose that they may encounter can find excellent sources of information from the Health Physics Society, including the Radiation Fact Sheets (http://hps.org/hpspublications/radiationfactsheets.html), and from the US Nuclear Regulatory Commission website (http://www.nrc.gov/about-nrc/radiation.html). The Personal Annual Radiation Dose Calculator on the NRC website can be particularly interesting to look at (http://www.nrc.gov/about-nrc/radiation/around-us/calculator.html). When the facts are examined, it becomes apparent that the dose to the public due to routine nuclear plant operations is very small when compared to common background and medical sources of radiation exposure.

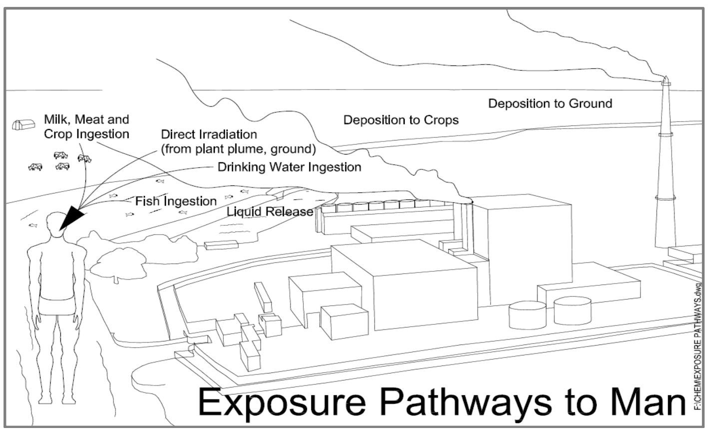

FIGURE 5: POTENTIAL EXPOSURE PATHWAYS TO MEMBERS OF THE PUBLIC DUE TO OPERATION OF MNGP.

ABOUT DOSE CALCULATION

Concentrations of radioactive material in the environment resulting from the operation of MNGP are very small and it is not possible to determine doses directly using measured activities of environmental samples. To overcome this, Dose Calculations based on measured activities of effluent streams are used to model the dose impact for Members of the Public due to plant operation and effluents. There are several mechanisms that can result in dose to Members of the Public, including: Ingestion of radionuclides in food or water; Inhalation of radionuclides in air; Immersion in a plume of noble gases; and Direct Radiation from the ground, the plant or from an elevated plume (See Figure 5).

The MNGP Offsite Dose Calculation Manual (ODCM) specifies the methodology used to obtain the doses in the Dose Assessment section of this report. The methodology in the ODCM is based on NRC Regulatory Guide 1.109 (Ref. [2]) and NUREG-0133 (Ref. [3]). Doses are calculated by determining what the nuclide concentration will be in air, on the ground or in food products based on plant effluent releases. Release points are continuously monitored to quantify what concentrations of nuclides are being released, then meteorological data is used to determine how much of the released activity will be present at a given location outside of the plant either deposited onto the ground or in gaseous form. Intake patterns and nuclide bio-concentration factors are used to determine how much activity will be transferred into animal milk or meat. Finally, human ingestion factors and dose factors are used to determine how much activity will be consumed and how much dose the consumer will receive. Inhalation dose is calculated by determining the concentration of nuclides and how much air is breathed by the individual.

Each year MNGP performs a Land Use Census to determine what potential dose pathways currently exist within a five-mile radius around the plant, the area most affected by plant operations. The Annual Land Use Census identifies the locations of vegetable gardens, nearest residences, milk animals and meat animals. The data from the census is used to determine who is likely to receive the highest radiation dose as a result of plant operation.

There is uncertainty in dose calculation results due to modeling atmospheric dispersion of material released and bioaccumulation factors, as well as assumptions associated with consumption and land-use patterns. Even with these sources of uncertainty, the calculations do provide a reasonable estimate of the order of magnitude of the exposure. Conservative assumptions are made in the calculation inputs, including the amounts of various foods and water consumed and the amount of air inhaled, such that the actual dose received is likely lower than the calculated dose. Even with the built in conservatism, doses calculated for the highest hypothetical exposed individual due to plant operation (on the order of less than 1 mrem) are a very small fraction of the annual dose that is received due to other sources that are not related to plant operation (about 620 mrem). The calculated doses due to plant effluents, along with REMP results indicating no identified radioactive material due to plant operations, serve to provide assurance that MNGP is not having a negative impact on the environment or people living near the plant.

DOSE ASSESSMENT FOR OPERATION OF MNGP DURING THE 2022 CALENDAR YEAR

Below is an assessment of radiation dose due to operation of MNGP during the period of January 1, 2022 through December 31, 2022. The doses calculated represent a small fraction of the dose limits contained in 40 CFR 190 and Appendix I of 10 CFR 50.

CRITICAL RECEPTOR

The Land Use Census for MNGP identifies real exposure pathways for radioactive effluents based on Ingestion (including Gardens, Milk Animals, and Meat Animals), Inhalation and Direct Radiation Exposure (Residence Locations). Inhalation and Direct Radiation Exposure are assumed to exist at all locations, while Ingestion Pathways are assumed only where vegetable gardens, milk animals, or meat animals are actively used for consumption. For any given location and pathway, all age groups are assumed to be present and consume conservative quantities of food products, water, and inhaled air (based on Table E-5 of Regulatory Guide 1.109, Ref. [2]). The person that is identified as having the largest potential exposure is called the Critical Receptor.

For 2022, the Critical Receptor identified by the MNGP Land Use Census remained the same location identified in the previous Land Use Census. This Critical Receptor is used for determination of compliance with the dose limits of 10 CFR 50, Appendix I.

TABLE 1: CRITICAL RECEPTOR 2022.

SECTOR	**SSE**
DISTANCE	**1.2 miles**
PATHWAYS	**Ground Plane, Inhalation, and Vegetable**
Age Group	**Child**
Organ	**Thyroid**

OFFSITE DOSE DUE TO GASEOUS RELEASES

Critical Receptor dose results below were calculated using the 2022 effluent source term from Table 10 and Table 11. The Critical Receptor doses include dose from C-14 released between May 1 and September 30, in accordance with the methodology in the MNGP ODCM; this is because only C-14 released during the growing season will be incorporated into food products that contribute to the calculated dose for the Ingestion pathways. Dose due to noble gases released from the Plant Stack and Reactor Building Vent (RBV) release points have been determined for the SSE site boundary location.

The calculated quarterly and annual doses remain a small percentage of the Guidelines provided in Appendix I to 10 CFR 50.

TABLE 2: CRITICAL RECEPTOR ORGAN DOSE

Max Organ	Period	Dose*	10 CFR 50, Appendix I Design Objective	% of Guideline
Thyroid	Q1	0.00743 mrem	7.5 mrem/quarter	0.10%
Thyroid	Q2	0.0133 mrem		0.18%
Bone	Q3	0.0183 mrem		0.24%
Thyroid	Q4	0.0121 mrem		0.16%
Thyroid	**Annual**	**0.0477 mrem**	**15 mrem/year**	**0.32%**

**Includes dose from Iodines, Particulates, Tritium, and Carbon-14.*

TABLE 3: AIR DOSE DUE TO NOBLE GASES AT THE MAXIMUM SITE BOUNDARY LOCATION

Exposure Type	Period	Exposure*	10 CFR 50, Appendix I Design Objective	% of Guideline
Gamma Air Dose	Q1	0.00235 mrad	5 mrad/quarter	0.05%
	Q2	0.000504 mrad		0.01%
	Q3	0.000492 mrad		0.01%
	Q4	0.000487 mrad		0.01%
	Annual	**0.00384 mrad**	**10 mrad/year**	**0.04%**
Beta Air Dose	Q1	0.000877 mrad	10 mrad/quarter	0.01%
	Q2	0.000463 mrad		0.0046%
	Q3	0.000437 mrad		0.0044%
	Q4	0.000463 mrad		0.0046%
	Annual	**0.00224 mrad**	**20 mrad/year**	**0.01%**

**Includes dose due to Noble Gases only.*

OFFSITE DOSE DUE TO LIQUID RELEASES

MNGP did not make any liquid releases during 2022.

TABLE 4: LIQUID EFFLUENT DOSE

Organ	Dose	10 CFR 50, Appendix I Design Objective	% of Guideline
Whole Body	0 mrem	3 mrem	0.00%
Max Organ	0 mrem	10 mrem	0.00%

DOSE TO INDIVIDUALS DUE TO THEIR ACTIVITIES INSIDE THE SITE BOUNDARY

This section evaluates dose to non-occupationally exposed workers that may be onsite for various reasons. Groups of concern include cleaning contractors at the Receiving Warehouse and Site Administrative Building, and Xcel Energy Company Transmission and Distribution (T&D) crews working in the subyard. These workers are considered not to be occupationally exposed because the work activities are only remotely related to plant-operational activities. Use of a very conservative assumption of 40 hours/week spent inside the site boundary by these groups conservatively represents the most-exposed individual.

The annual whole body, skin and organ dose was computed using the 2022 source term using the noble gas dose calculation methodology provided in the ODCM. Elevated finite plume dose factors for the site boundary were used for Plant Stack noble gas total body doses; these dose factors provide a good approximation of the elevated finite plume dose factors that would be determined at the location of interest. The highest calculated organ dose to non-occupationally exposed workers within the site boundary due to plant effluent releases was determined to be 0.0208 mrem Thyroid for workers in the subyard or Site Administration Building. This computed dose includes a reduction by the factor of 40/168 to account for limited occupancy factor for these individuals. The calculated doses due to gaseous effluents for Whole Body, Thyroid and Skin for non-rad workers onsite are presented in Table 5.

TABLE 5: MAXIMUM EFFLUENT DOSE TO INDIVIDUALS DUE TO THEIR ACTIVITIES INSIDE SITE BOUNDARY

Organ	Dose*
Whole Body	0.00871 mrem
Thyroid	0.0208 mrem
Max Other Organ (Kidney)	0.00883 mrem

**Includes doses due to Gaseous Effluent Releases of Noble Gases, Iodines, Particulates, and Tritium. Pathways calculated were Inhalation and Direct Radiation due to Elevated Plume and Ground-Plane Deposition.*

DOSE TO THE LIKELY MOST-EXPOSED MEMBER OF THE PUBLIC (40 CFR 190)

Compliance with 40 CFR 190, Environmental Radiation Protection Standards for Nuclear Power Operations, requires controlling dose to any member of the public due to all radiation sources from the uranium fuel cycle below 25 mrem to the whole body, 75 mrem to the thyroid and 25 mrem to any other organ. These limits apply to dose in the general environment outside of the site boundary due to effluents in addition to other sources of dose from the uranium fuel cycle that impact members of the public. In the case of Monticello Nuclear Generating Plant, no other nearby uranium fuel cycle sources are present and only doses due to effluents, direct radiation from the reactor and steam turbines and direct radiation due to the ISFSI are included in the assessment.

In order to determine the maximum exposed individual, it is necessary to determine whether direct radiation dose due to plant operations has been detected outside of the site boundary. MNGP has analyzed the 2022 REMP TLD data using methodology based on ANSI/HPS N13.37-2014 (Ref. [4]) and has found that direct radiation dose was not detected for any REMP TLD during 2022. Attachment B summarizes the REMP TLD data for 2022. See Direct Radiation Dose below on pg. 13 for more information on REMP TLDs.

Therefore, the Likely Most-Exposed Member of the Public would be the Critical Receptor identified in the 2022 Land Use Census. Doses due to Iodines, Tritium, Carbon-14, Particulates with > 8-day half-life, and Noble Gases were summed to determine total dose due to gaseous effluents, and the results are reported in Table 6.

TABLE 6: TOTAL DOSE DUE TO ALL URANIUM FUEL CYCLE SOURCES (40 CFR 190)

Dose Type	Organ	Dose	40 CFR 190 Limits	% of Limit
Direct Radiation Dose*	All	Not detected	-	0.00%
Noble Gases	Whole Body Skin	0.00201 mrem 0.00445 mrem	- -	0.01% 0.02%
Particulates, Iodines, Tritium and Carbon-14	Whole Body Thyroid Max Other Organ (Bone)	0.0109 mrem 0.0476 mrem 0.0304 mrem	- - -	0.04% 0.06% 0.12%
Total Dose **	**Whole Body** **Thyroid** **Max Other Organ (Bone)**	**0.0129 mrem** **0.0496 mrem** **0.0324 mrem**	**25 mrem** **75 mrem** **25 mrem**	**0.05%** **0.07%** **0.13%**

** Based on REMP TLD Results, as discussed in the Environmental Monitoring Section below.*
*** For the Critical Receptor identified in* Table 1*, above. Because Direct (TLD) dose is 0.0, then this represents the likely most-exposed individual. Doses in **bold** include contributions due to Iodines, Particulates, Tritium, Carbon-14, and Noble Gases.*

SUPPLEMENTAL INFORMATION

ABNORMAL RELEASES/DISCHARGES

No Abnormal Releases or Discharges occurred at MNGP during 2022.

ENVIRONMENTAL MONITORING

The REMP at MNGP provides additional assurance that there are no significant dose or environmental impacts due to operation of the plant. The MNGP ODCM specifies REMP requirements, including TLD samples for direct radiation exposure, Water Samples (Surface, Ground, and Drinking Water sources), Air sampling for Particulate and Iodine radionuclides, Vegetation and Milk sampling, and sampling of Shoreline Sediments, Fish and Invertebrates. REMP sampling continues to indicate that radionuclides in the environment due to operation of MNGP remain below detectable levels. Complete results and analyses for MNGP REMP Sampling in 2022 are available in the 2022 AREOR for MNGP (Ref. [5]).

CHANGES IN LAND USE AND NON-OBTAINABLE MILK OR VEGETABLE SAMPLES

A single milk cow was located at 3.25 miles in the NNE sector during the 2022 Land Use Census. This location included milk, meat, and garden ingestion pathways. Discussion with the animal's owner indicated that the cow provides enough milk for their use, but not enough extra to reliably obtain the 1-2 gallons per sample period required for analysis. They also added that the animal was not milked from June through September due to a calf being born. Due to the relatively low deposition parameter, the calculated dose at this location remains lower than the dose at the critical receptor. ODCM-07.01 (based on NUREG-1302 (Ref. [6])) states that milk samples are required for three locations within 1 mile or three locations where calculated doses are greater than 1 mrem/year. As stated above the location is greater than 1 mile away and the low dispersion parameter has total calculated dose to infant thyroid by all pathways at 0.0146 mrem, thus a milk sample is not required.

Milk samples were not available during 2022 due to the limited milk supply of the animal, as discussed above. All required compensatory vegetation sampling in lieu of milk sampling was performed, and samples were analyzed according to ODCM-07.01, Table 1.

Corn and Potato sampling was not required because no liquid discharges were made during the growing season. Additionally, the Land Use Census found that there are no water use permits for irrigation using water from the Mississippi River within 5 miles downstream of the plant.

DIRECT RADIATION DOSE MONITORING

TLDs are stationed around MNGP to measure the ambient gamma radiation field. Monitoring stations are placed near the site boundary and approximately five (5) miles from the reactor, in locations representing sixteen (16) compass sectors. Other locations are chosen to measure the radiation field at places of special interest such as nearby residences, meeting places and population centers. Control sites are located farther than ten (10) miles from the site, in areas that will not be affected by plant operations.

In order to reliably determine whether direct radiation dose due to plant operation has been detected at or beyond the site boundary, Monticello has analyzed REMP TLD's using methodology based on ANSI/HPS N13.37-2014 (Reference [4]), starting with the 2015 ARERR. This methodology uses the historical average background TLD dose for each location and the Minimum Differential Dose (MDD) based on the performance of the TLD system to determine if a statistically significant dose due to plant operation has been detected. A table summarizing the 2022 TLD analysis is presented in Attachment B (pg. 28). Complete results for the REMP TLDs are also reported in the AREOR.

Historically, the site used guidance from NUREG-0543, METHODS FOR DEMONSTRATING LWR COMPLIANCE WITH THE EPA URANIUM FUEL CYCLE STANDARD (40 CFR PART 190), which states in Section IV, "As long as a nuclear plant site operates at a level below the Appendix I reporting requirements, no extra analysis is required to demonstrate compliance with 40 CFR Part 190". This statement remains true, assuming that there are no potentially significant sources of direct radiation dose. With the inclusion of spent fuel storage onsite (ISFSI), it is necessary to verify that direct radiation does not reach a level that would cause the total dose to exceed the 40 CFR 190 limits. Hence, the more reliable ANSI/HPS methodology was implemented in order to determine direct radiation dose moving forward.

The ISFSI at Monticello Nuclear Generating Plant was constructed west of the plant in 2007. The initial loading campaign was completed in 2008 with 10 Horizontal Storage Modules (HSM's) loaded with spent fuel. In 2013 an additional five HSM's were loaded with spent fuel. In 2016 one additional HSM was loaded. In 2018 an ISFSI campaign loaded an additional 14 HSM's, bringing the total number of stored modules to 30.

GROUNDWATER PROTECTION PROGRAM (GWPP)

Onsite groundwater is monitored at MNGP in accordance with the guidance presented in NEI 07-07 (Reference [7]). This initiative was developed by NEI and nuclear industry stakeholders to address a gap in industry guidance and practices for monitoring groundwater and responding to inadvertent releases of radioactive material with the potential to contaminate groundwater. The initiative sets forth voluntary requirements for evaluating and monitoring Systems, Structures and Components (SSCs) with a high risk of contaminating groundwater. Additionally, the guidance specifies reporting requirements for onsite groundwater sample results that exceed REMP reporting thresholds and that all onsite groundwater results are reported in either the ARERR (Effluent) or AREOR (REMP) reports.

The current groundwater monitoring program includes 19 wells at 15 different locations. Four of the locations include a "nested" configuration, where one sample is taken at the level of the water table (GWPP locations ending with an A) while a second sample can be taken from deeper water (GWPP locations ending with a B). A map of groundwater sample locations is provided in Attachment C (pg. 29). Additional groundwater monitoring wells were started in 2022 but were not developed within the reporting period.

The wells are sampled at different frequencies depending on how likely they are to include non-natural activity; Table 7 summarizes the current sampling frequencies for groundwater monitoring wells at MNGP. Wells that have historically read only at background levels and are unlikely to become contaminated are monitored once annually for tritium and gamma-emitting nuclides. Wells that have historically indicated tritium near background levels but are more likely to include activity from leaks or spills are monitored quarterly for tritium and gamma-emitting nuclides. The remaining wells are monitored more frequently to ensure that high-risk SSCs are adequately monitored and that existing activity is characterized with sufficient resolution; these wells are monitored monthly for tritium and quarterly for gamma-emitting nuclides. Several wells are considered sentinel wells that would indicate if radioactive material were migrating offsite into the Mississippi River; these wells are indicated in **bold** in Table 7, below.

TABLE 7: GROUNDWATER MONITORING WELL SAMPLING FREQUENCIES.

Tritium Sampling Frequency	Number of Monitoring Wells	Groundwater Monitoring Well Identities*
Quarterly	11	MW-1, **MW-2**, **MW-3**, **MW-4**, MW-9B, MW-11, MW-12A, MW-12B, **MW-14**, **MW-15A**, **MW-15B**
Monthly	4	MW-9A, MW-10, MW-13A, MW-13B
Annual	4	MW-5, MW-6, MW-7, MW-8

** Locations in **BOLD** typeface are considered sentinel wells.*

Water depths are determined at all 19 wells on a monthly basis and the data is used to determine static water levels. It has been noted that groundwater generally flows toward the river, but there are fluctuations in the gradient and periods of flow reversal have been observed when river level is particularly high.

Additional sampling performed under the guidance of the GWPP includes sampling water from storm drains. These samples periodically indicate elevated tritium activities due to recapture of tritium from gaseous effluents. Rain and snow samples taken onsite indicate that tritium is commonly detected in rain water at concentrations historically ranging from approximately 200 pCi/l to nearly 1,000 pCi/l. The highest detected concentrations of tritium in rain and snow samples around MNGP have approached 2,000 pCi/l. In 2022, the concentration of tritium in rain and snow Samples ranged between <189 to 675 pCi/l, with an average of 280 pCi/l.

Historically, Monitoring Well MW-9A has indicated elevated tritium levels that have varied seasonally since 2009. It is understood that there is likely a plume of water containing tritium under the Turbine Building that moved tritium activity into, and out from, the monitoring well depending upon the hydraulic gradient at the time of sampling; the plume was considered to be stagnant under the turbine building, based on results from surrounding wells. Evidence indicates that the activity in the plume originated from process water containing tritium that migrated through the Turbine Building concrete basemat. Sources of tritium to the Turbine Building basemat were thoroughly evaluated in the Corrective Action Program and all potential contributors were corrected during the 2011 refueling outage. Corrective actions taken included lining sumps and discontinuing use of embedded piping that were identified as potential sources of the tritium found in the plume.

In the 2022 reporting period, MW-9A peak and average tritium values increased significantly. This was due to a leak in a pipe within a penetration between the Reactor and Turbine Buildings that allowed tritium into the plume that is sampled by MW-9A. The elevated tritium was first identified on 11/21/22 during regularly scheduled monitoring well sampling. The value of 3,600,000 pCi/l exceeded the ODCM reporting limit of 30,000 pCi/l for a non-drinking water sample. Sampling frequency continued daily after the identification of the concentration spike. The ensuing sample on 11/22/22 resulted in a tritium concentration of 4,220,000 pCi/l. After this reporting period, the leak was identified, the leaking pipe was replaced, and a remediation plan has been implemented; this will be discussed in detail in the 2023 report. Increased well sampling has continued to monitor the plume and prevent a release to the public.

Results for 2022 indicate that monitoring well MW-9A contained tritium activities ranging from <160 pCi/l to 4,220,000 ± 6,720 pCi/l; a comparison of peak, average, and the range of tritium concentrations by year in MW-9A is presented in Table 8 and Figure 6, below. The annual averages below include MDA values for cases where activity was <MDA.

On 12/26/22 Tritium was identified in MW-12A at a concentration of 12,900 pCi/l. On 12/27/22 the tritium in MW-12A reached 32,700 pCi/l which exceeded the ODCM reporting limit of 30,000 pCi/l for non-drinking water samples. The highest value within the reporting period was 84,200 pCi/l on 12/30/22. These values are from Monticello's laboratory and not the site's certified vendor laboratory and are unofficial. Tritium has not been identified in other wells above historical levels.

Tritium is also regularly identified in samples from MW-10. Levels of tritium activity in this well are more consistent throughout the year and at a significantly lower level than the levels of activity observed in MW-9A. During 2022, one sample from MW-10 was identified as having tritium above background with a concentration of 284 ± 143 pCi/l.

All other monitoring wells indicated activities that were less than 300 pCi/l.

TABLE 8: ANNUAL TRITIUM ACTIVITY TRENDS MW-9A FROM 2009-2022.

Year	Peak H-3 Activity MW-9A (pCi/l)	Average H-3 Activity MW-9A (pCi/l)
2009	21,727	9,117
2010	21,127	4,549
2011	2,317	549
2012	770	306
2013	15,124	4,147
2014	5,911	2,522
2015	6,493	1,679
2016	6,559	2,423
2017	5,306	1,553
2018	4,400	1,252
2019	5,850	1,805
2020	1,660	713
2021	8,220	2,185
2022	4,220,000	851,329

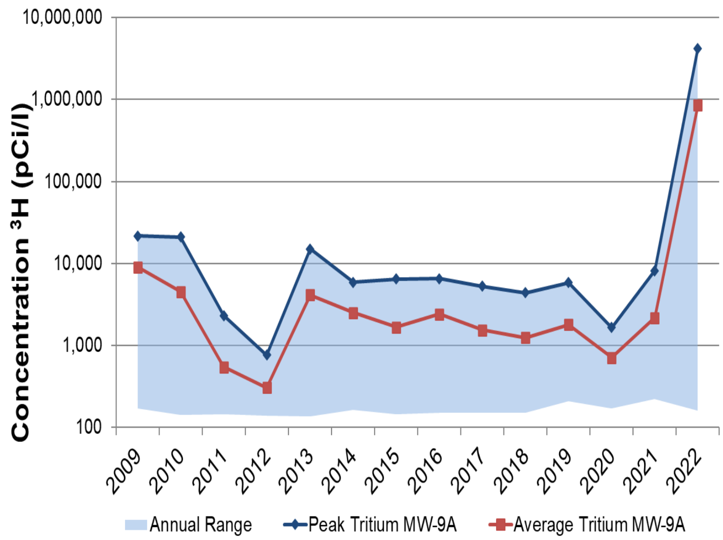

FIGURE 6: ANNUAL TRITIUM ACTIVITY TRENDS MW-9A FROM 2009-2022.

No gamma emitting isotopes were identified in groundwater samples in monthly or quarterly vendor samples during the 2022 reporting period. 7 samples were identified with concentrations above the vendor certified laboratory minimum detectable concentration but were below MNGP's ODCM Lower Limit of Detection (LLD.) During the MW-9A troubleshooting response, samples from Monticello's onsite laboratory detected Iodine-131, Iodine-133, Iodine-135, Xenon-133, and Xenon-135 in MW-9A. The 12/2/2022 MW-9 sample identified I-131 at a concentration of 20.1 pCi/l which exceeded the ODCM-07.01 reporting limit for non-drinking water samples. The highest I-131 concentration seen in MW-9A, per Monticello's onsite laboratory, was 61.6 pCi/l on 12/20/2022. These short-lived gamma species were not detected after the leak was corrected. No other monitoring wells had gamma species identified. All tritium results were obtained as required. The full 2022 onsite groundwater well monitoring results are presented in Attachment D (pg. 31).

The LLD for groundwater monitoring of tritium at MNGP during 2022 was less than 300 pCi/l, in accordance with station processes and procedures; this LLD is far below the required REMP LLD (2,000 pCi/l) and very far below the REMP reporting threshold for water samples (20,000 pCi/l). The site has chosen to use this low LLD in order to quickly identify and characterize any potential contamination sources. The LLD as reported represents the activity at which there is a 95% chance that a sample containing that level of activity would be characterized as detected with only a 5% chance that the sample would be characterized as a blank.

The Xcel Energy Groundwater Monitoring Program (Ref. [8]) has established a Baseline Threshold Level for tritium, defined as the 95% Confidence Level determined using Student's t and a statistical mean of ten or more sample results; at this level a sample would be considered to be statistically different from background, based on analytical results. For wells that consistently indicate near or below LLD, the Baseline Threshold Level is 400 pCi/l. The program also provides an Action Level of 3-times the Baseline Threshold Level, or 1200 pCi/l for these wells; at this level, additional action is taken to evaluate the cause of the change in activity and work through the Corrective Action process to address the concern. No statistically significant concentrations of tritium were identified in sentinel wells in 2022; therefore, no tritium discharge to the environment is reported.

RADIOACTIVE SOLID WASTE DISPOSAL

During 2022, a total of 8,250 Ci of Solid, Low-Level Radioactive waste was shipped offsite for disposal, which contained Class A and Class C waste. A total of 9 shipments were made to four locations. Tables summarizing types and quantities of waste shipped are included in Attachment A, Table 14.

EFFLUENT RADIATION MONITORS OUT OF SERVICE FOR GREATER THAN 30 DAYS

There were no effluent radiation monitors with fewer than the required number of channels Functional for greater than 30 days during 2022.

CHANGES TO THE ODCM

The ODCM was not revised in 2022.

CHANGES TO THE PROCESS CONTROL PROGRAM (PCP)

The Process Control Program (PCP) was not updated during 2022.

CORRECTIONS TO PREVIOUS ARERRS

There are no corrections to previous ARERRs in 2022.

REFERENCES

[1] "NCRP Report No. 160: Ionizing Radiation Exposure of the Population of the United States," National Council on Radiation Protection and Measurements, Bethesda, MD, 2009.

[2] "Regulatory Guide 1.109, Rev. 1: Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50, Appendix I," U.S. Nuclear Regulatory Commission, Washington, D.C., 1977.

[3] W. C. Burke and F. J. Congel, "NUREG-0133: Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants," US Nuclear Regulatory Comission, Washington D.C., 1978.

[4] "ANSI/HPS N13.37-2014: Environmental Dosimetry - Criteria for System Design and Implementation," Health Physics Society, McLean, VA, 2014.

[5] Arcadis, "2022 Annual Radiological Environmental Operating Report for Monticello Nuclear Generating Plant," Xcel Energy, Monticello, MN, 2023.

[6] W. W. Meinke and T. H. Essig, "NUREG-1302: Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Boiling Water Reactors," U.S. Nuclear Regulatory Commission, Washington, D.C., 1991.

[7] "NEI 07-07: Industry Ground Water Protection Initiative - Final Guidance Document, Rev. 1," Nuclear Energy Institute, Washington, DC, 2019.

[8] "FP-CY-GWPP-01, "Fleet Groundwater Protection Program"," Xcel Energy (internal procedure), Minneapolis, MN, 2022.

[9] J. Braegelmann and W. A. Carlson, "2019 Annual Groundwater Monitoring Report - Monticello Nuclear Generating Plant," Carlson McCain, Inc., Lino Lakes, MN, 2020.

[10] "Offsite Dose Calculation Manual for Monticello Nuclear Generating Plant," Xcel Energy, Monticello, MN.

[11] "Boiling Water Reactors (BWRs)," 15 January 2015. [Online]. Available: http://www.nrc.gov/reactors/bwrs.html. [Accessed 11 April 2016].

[12] Stefan-XP, "Wikimedia Commons," 23 November 2009. [Online]. Available: https://commons.wikimedia.org/w/index.php?curid=8540436. [Accessed 16 April 2016].

ATTACHMENT A: 2022 ARERR RELEASE SUMMARY TABLES

Covering the Operating Period of Jan – Dec 2022

Facility: Monticello Nuclear Generating Plant

Licensee: Xcel Energy

License Number: DPR-22

1. Regulatory Limits

a. Fission and activation gases:
   1. **Quarterly** dose at or beyond the site boundary
      5 mrad gamma radiation
      10 mrad beta radiation
   2. **Annual** dose at or beyond the site boundary
      10 mrad gamma radiation
      20 mrad beta radiation

b. Iodine-131, Iodine-133, Tritium and Particulates, half-lives >8 days:
   1. **Quarterly**
      7.5 mrem to any organ
   2. **Annual**
      15 mrem to any organ

c. Liquid Effluents:
   1. **Quarterly:**
      1.5 mrem total body
      5 mrem to any organ
   2. **Annual:**
      3 mrem total body
      10 mrem to any organ

2. Maximum Permissible Concentrations

a. Fission and Activation Gases:
   10 CFR 20, Appendix B, Table 2, Column 1

b. Iodine-131, Iodine-133, Tritium and Particulates, half-lives >8 days:
   10 CFR 20, Appendix B, Table 2, Column 1

c. Liquid effluents:
   10 times 10 CFR 20, Appendix B, Table 2, Column 2
   2.0E-4 µCi/ml for dissolved and entrained gases

3. Average Energy

(Not Applicable)

4. Measurements and Approximations of Total Radioactivity

a. **Noble Gases:**

Gross noble gas activity released from Reactor Building Vent and Plant Stack exhaust streams is continuously monitored for variation in release rate. Weekly gamma isotopic analysis is performed on grab samples from exhaust streams. Releases from the Plant Stack are modeled to account for varying noble gas concentrations due to decay tank releases; this methodology was implemented at the site in January 2018 in order to improve the accuracy of noble gas release and dose estimates. The uncertainty estimate for noble gas releases was increased to ±50% in 2019; this accounts for the estimated uncertainty in the noble gas release model along with other uncertainties associated with sampling and counting. 75% of the noble gases released in 2019 consist of Xe-137, Xe-133, and Xe-135; these gases are affected by increased uncertainty due to low concentration (Xe-137), wide variation in concentration (Xe-133) and periodic increases in activity (Xe-135).

b. **Iodines in Gaseous Effluent:**

Continuous sampling using charcoal cartridges with isokinetic sample flow drawn from Reactor Building Vent and Plant Stack exhaust streams. Weekly gamma isotopic analysis.

c. **Particulates in Gaseous Effluent:**

Continuous sampling using particulate filters with isokinetic sample flow drawn from Reactor Building Vent and Plant Stack exhaust streams. Weekly analysis for gamma isotopic and gross alpha. Gross alpha samples are decayed for approximately 9 days prior to analysis to allow for decay of natural activity. Quarterly composites are analyzed for Sr-89 and Sr-90.

d. **Tritium in Gaseous Effluent:**

Monthly grab samples from Reactor Building Vent and Plant Stack exhaust streams followed by liquid scintillation counting.

e. **Liquid Effluents**

Tank sample analyzed prior to each planned release and continuous monitoring of gross activity during planned release.

5. Batch Releases

a. **Liquid**

1.	Number of batch Releases	0	
2.	Total time period for batch releases	0	min
3.	Maximum time period for a batch release	0	min
4.	Average time period for a batch release	0	min
5.	Minimum time period for a batch release	0	min
6.	Average river flow during release	N/A	cfm

b. **Gaseous**

1.	Number of batch Releases	2	
2.	Total time period for batch releases	1685.0	min
3.	Maximum time period for a batch release	1324.0	min
4.	Average time period for a batch release	842.5	min
5.	Minimum time period for a batch release	361.0	min

6. Abnormal Releases

a. **Liquid**

1.	Number of releases:	0	
2.	Total activity released:	0.00E+00	Ci

b. **Gaseous**

1.	Number of releases:	0	
2.	Total activity released:	0	Ci

Table 9: Gaseous Effluents – Summation of All Releases (RG-1.21 Table 1A)

Type of Effluent	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Est. Total Error, %
A. Fission & Activation Gases						
1. Total Release	Curies	1.28E+02	3.33E+01	2.58E+01	2.74E+01	5.00E+01
2. Average Release Rate for Period	µCi/sec	1.64E+01	4.24E+00	3.24E+00	3.44E+00	
3. Percent of Applicable Limit	%	4.71E-02	1.01E-02	9.84E-03	9.74E-03	
B. Iodines						
1. Total Iodine-131	Curies	6.57E-04	9.71E-04	1.06E-03	1.05E-03	3.20E+01
2. Average Release Rate for Period	µCi/sec	8.45E-05	1.24E-04	1.33E-04	1.32E-04	
3. Percent of Applicable Limit	%	6.57E-02	9.71E-02	1.06E-01	1.05E-01	
C. Particulates						
1. Total Particulates (Half-lives > 8 days)	Curies	1.15E-04	9.19E-05	8.75E-05	1.10E-04	4.00E+01
2. Average Release Rate for Period	µCi/sec	1.48E-05	1.17E-05	1.10E-05	1.39E-05	
3. Percent of Applicable Limit	%	4.70E-03	3.51E-03	2.63E-03	2.54E-03	
4. Gross Alpha Activity	Curies	4.64E-07	1.75E-07	3.90E-07	2.98E-07	5.00E+01
D. Tritium						
1. Total Release	Curies	6.66E+00	7.49E+00	7.41E+00	5.45E+00	3.30E+01
2. Average Release Rate for Period	µCi/sec	8.57E-01	9.52E-01	9.32E-01	6.86E-01	
3. Percent of Applicable Limit	%	1.55E-02	1.69E-02	1.61E-02	1.23E-02	
E. Carbon-14						
1. Total Release	Curies	1.80E+00	1.91E+00	2.07E+00	2.27E+00	N/A

Table 10: Gaseous Effluents - Elevated Releases (RG-1.21 Table 1B)

		Continuous Mode				Batch Mode			
Nuclides Released	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4
1. Fission and Activation Gases									
Ar-41	Curies	2.28E+00	1.57E-02	0.00E+00	1.96E-02	1.19E-02	0.00E+00	0.00E+00	0.00E+00
Kr-85M	Curies	5.30E+00	0.00E+00	7.78E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Kr-87	Curies	6.14E+00	0.00E+00	6.91E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Kr-88	Curies	1.24E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xe-133	Curies	3.96E+01	1.54E+01	9.00E+00	8.70E+00	2.94E-03	0.00E+00	0.00E+00	0.00E+00
Xe-133m	Curies	2.37E+00	2.24E-01	3.15E-01	1.76E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xe-135	Curies	4.71E+01	1.35E+00	1.24E+00	1.10E+00	4.75E-03	0.00E+00	0.00E+00	0.00E+00
Xe-135m	Curies	2.63E+00	3.09E+00	2.87E+00	2.89E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xe-137	Curies	4.07E+00	7.63E+00	6.65E+00	8.82E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xe-138	Curies	5.28E+00	4.90E+00	4.84E+00	4.97E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total for Period	Curies	1.27E+02	3.26E+01	2.50E+01	2.67E+01	1.96E-02	0.00E+00	0.00E+00	0.00E+00
2. Iodines									
I-131	Curies	3.71E-04	4.90E-04	6.16E-04	4.39E-04	9.45E-09	0.00E+00	0.00E+00	0.00E+00
I-132	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.74E-08	0.00E+00	0.00E+00	0.00E+00
I-133	Curies	2.71E-03	3.65E-03	4.64E-03	3.12E-03	6.43E-08	0.00E+00	0.00E+00	0.00E+00
I-134	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.12E-08	0.00E+00	0.00E+00	0.00E+00
I-135	Curies	4.58E-03	6.34E-03	7.04E-03	4.67E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total for Period	Curies	7.67E-03	1.05E-02	1.23E-02	8.22E-03	1.72E-07	0.00E+00	0.00E+00	0.00E+00
3. Particulates									
Ba-140	Curies	3.59E-05	3.70E-05	4.36E-05	2.73E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-58	Curies	1.02E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-60	Curies	1.17E-06	1.79E-06	5.42E-07	2.69E-07	4.14E-08	0.00E+00	0.00E+00	0.00E+00
Cr-51	Curies	9.88E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-137	Curies	1.07E-06	1.21E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mn-54	Curies	1.33E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Os-191	Curies	2.70E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	Curies	5.07E-05	1.13E-05	9.26E-06	6.75E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-90	Curies	0.00E+00	2.61E-07	9.86E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total for Period	Curies	9.28E-05	6.24E-05	5.34E-05	3.43E-05	4.14E-08	0.00E+00	0.00E+00	0.00E+00
4. Tritium									
H-3	Curies	7.82E-01	1.07E+00	1.33E+00	7.79E-01	7.42E-03	0.00E+00	0.00E+00	0.00E+00
5. Carbon-14									
C-14	Curies	1.80E+00	1.91E+00	2.07E+00	2.27E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 11: Gaseous Effluents – Reactor Building Vent Releases (RG-1.21 Table 1C)

		Continuous Mode				Batch Mode			
Nuclides Released	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4
1. Fission and Activation Gases									
Xe-135	Curies	7.46E-01	7.27E-01	7.65E-01	6.72E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total for Period	Curies	7.46E-01	7.27E-01	7.65E-01	6.72E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2. Iodines									
I-131	Curies	2.86E-04	4.81E-04	4.43E-04	6.07E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	Curies	2.69E-03	4.48E-03	4.12E-03	5.45E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	Curies	3.15E-03	6.97E-03	7.32E-03	9.71E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total for Period	Curies	6.12E-03	1.19E-02	1.19E-02	1.58E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Particulates									
Ba-140	Curies	0.00E+00	9.46E-06	8.38E-06	5.17E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-60	Curies	4.05E-06	4.01E-06	1.13E-05	6.25E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-137	Curies	1.79E-05	1.60E-05	1.44E-05	1.79E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-90	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total for Period	Curies	2.19E-05	2.95E-05	3.41E-05	7.58E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4. Tritium									
H-3	Curies	5.87E+00	6.41E+00	6.08E+00	4.68E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5. Carbon-14									
C-14	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 12: Liquid Effluents - Summation of All Releases (RG-1.21 Table 2A)

Type of Effluent	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Est. Total Error, %
A. Fission & Activation Products						
1. Total Release (not including Tritium, Gases, and Alpha)	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.50E+01
2. Average Diluted Concentration During Period	µCi/ml	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
3. Percent of Applicable Limit	%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
B. Tritium						
1. Total Release	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.50E+01
2. Average Diluted Concentration During Period	µCi/ml	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
3. Percent of Applicable Limit	%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
C. Dissolved and Entrained Gases						
1. Total Release	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.50E+01
2. Average Diluted Concentration During Period	µCi/sec	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
3. Percent of Applicable Limit	%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
D. Gross Alpha Radioactivity						
1. Total Release	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.50E+01
E. Waste Volume Released (Pre-Dilution)	Liters	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.50E+01
F. Volume of Dilution Water Used	Liters	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.50E+01

Table 13: Liquid Effluents (RG-1.21 Table 2B)

		Continuous Mode				Batch Mode			
Nuclides Released	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4
Total for Period	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 14: Solid Waste and Irradiated Fuel Shipments (RG-1.21 Table 3)

A. Solid Waste Shipped Offsite for Burial or Disposal

1. Type of waste	Waste Class	Unit	1/1/2022 – 12/31/2022	Est. Total Error, %	Major Nuclides for this waste type:
a. Spent Resins, Filters, and Evaporator Bottoms	A	ft^3 m^3 Ci	7.38E+02 2.09E+01 4.77E+02	2.50E+01	H-3, C-14, Mn-54, Fe-55, Co-58, Co-60, Ni-63, Zn-65, Sr-90, Tc-99, I-129, I-131, Cs-137, Pu-238, Pu-239, Pu-241, Am-241, Cm-242, Cm-243
b. Dry Active Waste (DAW)	A	ft^3 m^3 Ci	3.97E+03 1.12E+02 1.79E-01	2.50E+01	H-3, C-14, Mn-54, Fe-55, Co-58, Co-60, Ni-63, Zn-65, Sr-90, Tc-99, I-129, Cs-137, Pu-238, Pu-239, Pu-241, Am-241, Cm-242, Cm-243
c. Irradiated Components	A	ft^3 m^3 Ci	3.99E+01 1.13E+00 1.19E+01	2.50E+01	H-3, C-14, Mn-54, Fe-55, Co-60, Ni-59, Ni-63, Sr-90, Nb-94, Tc-99, I-129, Cs-137, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Cm-242, Cm-243, Cm-244
	C	ft^3 m^3 Ci	4.57E+00 1.29E-01 7.76E+03	2.50E+01	H-3, C-14, Mn-54, Fe-55, Co-60, Ni-59, Ni-63, Sr-90, Nb-94, Tc-99, I-129, Cs-137, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Cm-242, Cm-243, Cm-244
c. Other Wastes	A	ft^3 m^3 Ci	5.40+01 1.53E+00 5.25E-04	2.50E+01	H-3, C-14, Mn-54, Fe-55, Co-60, Ni-63, Zn-65, Tc-99, I-129, Cs-137, Am-241
Sum of All Low-Level Waste Shipped from the Site	**All**	**ft^3** **m^3** **Ci**	**4.80E+03** **1.36E+02** **8.25E+03**	**2.50E+01**	**H-3, C-14, Mn-54, Fe-55, Co-58, Co-60, Ni-59, Ni-63, Zn-65, Sr-90, Nb-94, Tc-99, I-129, I-131, Cs-137, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Cm-242, Cm-243, Cm-244**

2. Estimate of major nuclide composition (by type of waste)

Type of waste	Nuclide Name	Abundance, % (1.0% cutoff)	Activity (Ci)
a. Spent Resins, Filters, and Evaporator Bottoms	Mn-54	5.72%	2.73E+01
	Fe-55	38.91%	1.86E+02
	Co-58	1.66%	7.90E+00
	Co-60	45.87%	2.19E+02
	Zn-65	5.7%	2.72E+01
b. Dry Active Waste (DAW)	Mn-54	5.92%	1.06E-02
	Fe-55	19.99%	3.57E-02
	Co-58	2.09%	3.73E-03
	Co-60	62.34%	1.11E-01
	Zn-65	1.5%	2.72E-03
	Cs-137	2.82%	5.04E-03
c. Irradiated Components	**Class A**		
	Fe-55	38.04%	4.52E+00
	Co-60	58.25%	6.92E+00
	Ni-63	2.03%	2.42E-01
	Class C		
	Mn-54	1.8%	1.40E+02
	Fe-55	53.47%	4.15E+03
	Co-60	38.01%	2.95E+03
	Ni-63	6.52%	5.06E+02
	Zn-65	2.03%	7.11E-07
d. Other Wastes	Mn-54	5.25%	2.76E-05
	Fe-55	13.24%	6.95E-05
	Co-60	77.84%	4.09E-04
	Zn-65	2.27%	1.19E-05

Table 14: Solid Waste and Irradiated Fuel Shipments (Continued)

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
1	Hittman Transport Services	Energy Solutions (Erwin Resin Solutions) Erwin ResinSolutions Erwin, TX
1	Hittman Transport Services	Energy Solutions LLC CWF Clive Disposal Site Clive, UT
1	Hittman Transport Services	Waste Control Specialists LLC Compact Waste Facility Andrews, TX
3	Interstate Ventures, Inc.	Waste Control Specialists LLC Compact Waste Facility Andrews, TX
3	Xcel Energy Trucking	UniTech Services Group Oak Ridge Service Center Oak Ridge, TN

B. Irradiated Fuel Shipments (Disposition)

There were no shipments of irradiated fuel from MNGP in 2022.

ATTACHMENT B: 2022 REMP TLD DOSE INFORMATION

TABLE 15: 2022 REMP TLD DOSE RESULTS.

Dose Determination for Monticello Nuclear Generating Plant Operations in 2022.

		Quarterly Baseline, B_Q (mrem)		Normalized Quarterly Monitoring Data, M_Q (mrem per standard quarter)				QuarterlyFacility Dose, $F_Q = M_Q - B_Q$ (mrem)				Annual Baseline, B_A (mrem)	Annual Monitoring Data, M_A (mrem)	Annual Facility Dose, $F_A = M_A - B_A$ (mrem)
		Q1	Q2-Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4			
Inner Ring	M01A	13.2	15.1	13.9	14.8	15.4	16.5	ND	ND	ND	ND	58.5	60.5	ND
Inner Ring	M02A	14.2	16.1	13.8	14.3	14.7	16.4	ND	ND	ND	ND	62.6	59.2	ND
Inner Ring	M03A	13.9	15.7	12.7	14.1	14.1	15.6	ND	ND	ND	ND	61.0	56.4	ND
Inner Ring	M04A	13.1	15.6	12.5	12.9	13.7	14.9	ND	ND	ND	ND	59.8	54.0	ND
Inner Ring	M05A	13.2	15.9	12.8	13.4	14.6	14.6	ND	ND	ND	ND	60.8	55.5	ND
Inner Ring	M06A	14.1	16.1	13.7	14.8	15.2	16.0	ND	ND	ND	ND	62.4	59.6	ND
Inner Ring	M07A	13.9	15.9	12.8	14.2	14.9	15.5	ND	ND	ND	ND	61.4	57.5	ND
Inner Ring	M08A	13.9	15.8	12.9	14.3	14.9	15.9	ND	ND	ND	ND	61.5	57.9	ND
Inner Ring	M09A	14.3	15.8	13.5	14.1	15.9	15.9	ND	ND	ND	ND	61.5	59.4	ND
Inner Ring	M10A	14.3	16.4	12.5	14.4	14.5	16.1	ND	ND	ND	ND	63.4	57.4	ND
Inner Ring	M11A	15.4	16.9	13.9	15.2	15.9	16.3	ND	ND	ND	ND	66.0	61.3	ND
Inner Ring	M12A	15.5	17.1	13.2	14.3	15.6	*	ND	ND	ND	*	66.5	57.6	ND
Inner Ring	M13A	13.6	14.6	13.6	14.2	13.9	15.9	ND	ND	ND	ND	57.3	57.7	ND
Inner Ring	M14A	14.3	16.3	13.3	14.3	14.7	16.6	ND	ND	ND	ND	63.4	58.9	ND
Outer Ring	M01B	14.3	15.4	12.3	12.9	13.5	15.1	ND	ND	ND	ND	60.7	53.8	ND
Outer Ring	M02B	14.6	15.4	14.2	13.5	13.5	15.6	ND	ND	ND	ND	60.8	56.9	ND
Outer Ring	M03B	12.2	12.9	11.8	11.2	12.6	14.0	ND	ND	ND	ND	50.9	49.6	ND
Outer Ring	M04B	12.9	14.4	12.4	12.7	12.7	15.0	ND	ND	ND	ND	56.1	52.9	ND
Outer Ring	M05B	14.6	16.0	13.3	13.1	13.7	16.0	ND	ND	ND	ND	62.5	56.2	ND
Outer Ring	M06B	12.8	15.4	11.7	13.4	14.0	14.2	ND	ND	ND	ND	58.8	53.4	ND
Outer Ring	M07B	15.3	16.1	13.4	14.1	15.4	16.3	ND	ND	ND	ND	63.5	59.1	ND
Outer Ring	M08B	13.6	14.8	12.7	13.2	13.7	15.2	ND	ND	ND	ND	58.0	54.7	ND
Outer Ring	M09B	14.2	16.7	13.3	15.1	*	16.5	ND	ND	*	ND	64.3	59.8	ND
Outer Ring	M10B	14.5	16.0	12.6	14.5	13.5	15.5	ND	ND	ND	ND	62.5	56.2	ND
Outer Ring	M11B	13.9	16.0	13.6	14.9	15.4	15.9	ND	ND	ND	ND	61.8	59.8	ND
Outer Ring	M12B	13.5	15.6	13.4	14.1	14.4	16.1	ND	ND	ND	ND	60.3	58.0	ND
Outer Ring	M13B	13.5	14.4	13.5	14.1	14.8	16.2	ND	ND	ND	ND	56.6	58.7	ND
Outer Ring	M14B	13.4	15.5	14.1	15.1	15.7	15.9	ND	ND	ND	ND	59.9	60.8	ND
Outer Ring	M15B	13.5	15.0	12.7	13.7	13.6	14.7	ND	ND	ND	ND	58.4	54.7	ND
Outer Ring	M16B	13.0	13.5	13.9	14.0	13.2	15.6	ND	ND	ND	ND	53.4	56.7	ND
Spec. Interest	M01S	12.1	13.3	12.1	12.1	12.8	15.2	ND	ND	ND	ND	51.7	52.2	ND
Spec. Interest	M02S	11.5	12.7	12.0	12.0	12.4	14.3	ND	ND	ND	ND	49.7	50.8	ND
Spec. Interest	M03S	13.6	15.3	13.7	13.8	14.8	16.2	ND	ND	ND	ND	59.4	58.4	ND
Spec. Interest	M04S	14.3	15.8	13.5	13.9	15.3	15.0	ND	ND	ND	ND	61.7	57.7	ND
Spec. Interest	M05S	14.1	15.3	13.2	13.7	14.0	16.1	ND	ND	ND	ND	60.1	57.0	ND
Spec. Interest	M06S	15.9	16.9	14.7	14.5	15.3	17.0	ND	ND	ND	ND	66.6	61.3	ND
Control	M01C	14.0	14.8	11.9	13.4	13.5	15.2	ND	ND	ND	ND	58.4	53.8	ND
Control	M02C	14.0	15.6	12.2	12.2	12.7	15.0	ND	ND	ND	ND	60.9	52.0	ND
Control	M03C	15.3	16.3	13.1	14.1	15.6	16.3	ND	ND	ND	ND	64.3	59.2	ND
Control	M04C	14.1	14.8	12.6	12.3	13.5	14.2	ND	ND	ND	ND	58.7	52.7	ND

MDD_Q	4.7
MDD_A	11.2

ND = Not Detected, where $M_Q \leq (B_Q + MDD_Q)$ or $M_A \leq (B_A + MDD_A)$ for quarterly and annual data, respectively.
* = TLD missing in the field.

MDD_Q and MDD_A were determined using ten years of REMP TLD Data from 2001 through 2010. (See ANSI/HPS N13.37-2014 (Ref. [4]) for details on the methodology for determining facility related dose using REMP TLDs.)

ATTACHMENT C: GROUND WATER MONITORING WELL LOCATIONS

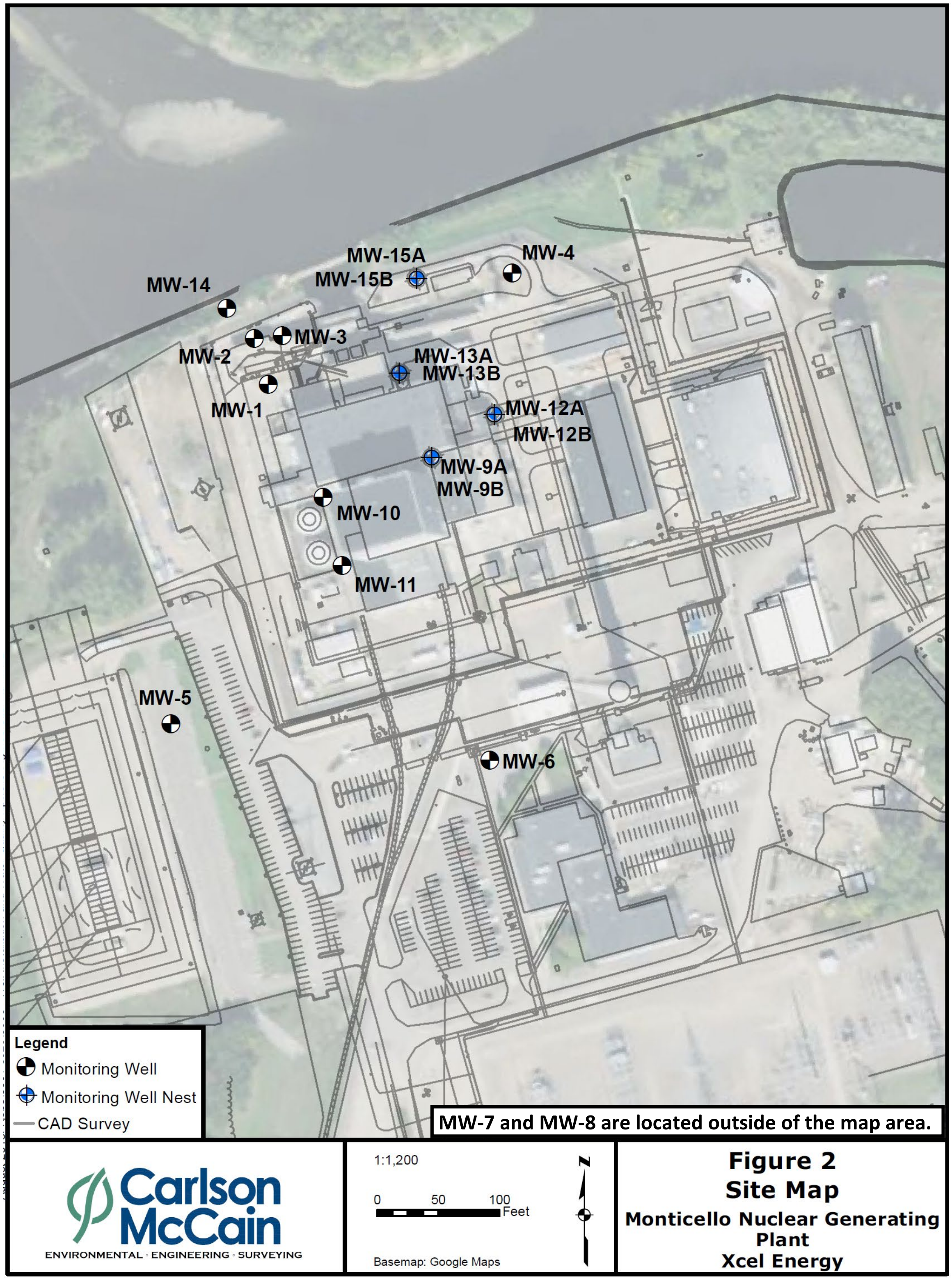

FIGURE 7: MNGP GROUNDWATER MONITORING WELL LOCATIONS (REF. [9]).

TABLE 16: MNGP MONITORING WELL LOCATIONS FROM FP-CY-GWPP-01. (REF. [8])

Well ID	Location		Unique Number	Date Installed	Screen Interval (ft)	Elevation (ft)		
	East	North				Surface	Top of Riser	Bottom of Well
MW-1	4847.19	10248.69	547747	8/10/94	902.37 – 912.37	930.39	930.19	902.37
MW-2	4843.43	10326.78	547748	8/10/94	897.46 – 907.46	921.82	923.82	897.46
MW-3	4889.37	10319.18	547749	8/10/94	901.19 – 911.19	919.91	921.91	901.19
MW-4	5281.42	10320.84	747055	10/08/07	899.1 – 909.1	925.40	927.86	898.70
MW-5	4549.88	9757.05	747056	9/06/07	902.1 – 912.1	943.00	942.75	901.70
MW-6	5035.29	9563.03	747057	9/07/07	900.3 – 910.3	930.70	933.24	899.90
MW-7	6205.26	9609.17	747058	9/05/07	898.5 – 908.5	920.00	922.49	898.10
MW-8	5393.93	8251.55	747059	9/05/07	900.5 – 910.5	931.50	934.00	900.10
MW-9	5074.19	10064.31	725274	9/04/09	901.2 – 911.2	927.87	927.58	901.20
MW-9B	5075.65	10054.35	772236	11/17/09	883.6 – 888.5	927.90	927.75	883.50
MW-10	4885.05	10045.62	725272	9/02/09	899.8 – 909.8	935.03	934.69	899.80
MW-11	4886.97	9931.96	725273	9/02/09	899.7 – 909.7	934.86	934.51	899.70
MW-12A	5191.46	10105.31	772328	10/29/09	898.7 – 908.7	931.80	932.14	898.70
MW-12B	5195.51	10106.27	772329	11/02/09	886.6 – 891.6	932.00	932.13	886.60
MW-13A	5059.49	10210.48	772330	10/29/09	897.9 – 907.9	931.20	933.82	897.90
MW-13B	5062.00	10212.53	772331	11/01/09	873.4 – 878.4	930.90	933.81	873.40
MW-14	4829.09	10402.98	778176	9/13/10	902.11 – 905.11	909.92	911.36	902.11
MW-15A	5126.35	10392.88	789990	6/25/2012	903.0 – 913.0	919	918.67	903
MW-15B	5131.93	10352.93	789991	6/25/2012	869.5 – 874.5	919.1	918.79	865.5

ATTACHMENT D: 2022 GROUNDWATER PROTECTION PROGRAM WELL DATA

TABLE 17: 2022 GROUNDWATER MONITORING DATA FOR MNGP

		Concentration (pCi/L)										
Lab ID	**Collect Date**	**^{3}H**	**^{54}Mn**	**^{58}Co**	**^{59}Fe**	**^{60}Co**	**^{65}Zn**	**^{95}Zr**	**^{95}Nb**	**^{134}Cs**	**^{137}Cs**	**^{140}Ba-^{140}La**
				Monitoring Well 1 (MW-1)								
574571001	3/21/2022	< 170	< 1.68	< 1.84	< 3.62	< 2.09	< 3.87	< 3.28	< 2.10	< 2.01	< 2.84	< 14.30
581402001	5/24/2022	< 201	< 1.50	< 1.44	< 3.10	< 1.40	< 2.92	< 2.72	< 1.56	< 1.67	< 3.07	< 11.60
591576001	8/25/2022	< 225	< 1.76	< 1.76	< 3.88	< 1.65	< 3.77	< 3.17	< 1.85	< 2.07	< 1.80	< 8.75
598963001	10/19/2022	< 210	< 1.36	< 1.28	< 3.10	< 1.68	< 2.94	< 2.76	< 1.68	< 1.49	< 1.46	< 11.70
				Monitoring Well 2 (MW-2)								
574571002	3/21/2022	< 191	< 1.69	< 1.71	< 3.86	< 1.89	< 3.33	< 2.91	< 1.81	< 1.75	< 1.79	< 13.00
581402002	5/24/2022	< 188	< 1.59	< 1.79	< 3.53	< 2.06	< 3.54	< 3.15	< 1.88	< 1.79	< 1.59	< 11.40
591576002	8/25/2022	< 236	< 1.63	< 1.66	< 3.75	< 2.07	< 3.49	< 2.84	< 1.95	< 1.84	< 1.96	< 8.67
598963002	10/19/2022	< 206	< 1.41	< 1.61	< 3.24	< 1.43	< 3.52	< 2.96	< 1.74	< 1.67	< 1.60	< 13.10
				Monitoring Well 3 (MW-3)								
574571003	3/21/2022	< 179	< 1.78	< 1.83	< 3.57	< 1.85	< 2.79	< 3.67	< 2.03	< 1.93	< 1.87	< 14.20
581402003	5/24/2022	< 187	< 1.82	< 1.94	< 4.44	< 1.38	< 4.10	< 3.91	< 2.17	< 2.31	< 1.99	< 13.60
591576003	8/25/2022	< 231	< 1.49	< 1.41	< 3.03	<15.00[a]	< 3.21	< 2.60	< 1.65	< 1.67	< 1.54	< 7.98
598963003	10/19/2022	< 203	< 1.58	< 1.89	< 3.41	< 1.60	< 3.79	< 3.03	< 1.95	< 1.99	< 1.96	< 14.50
				Monitoring Well 4 (MW-4)								
574571004	3/21/2022	< 175	< 1.65	< 1.79	< 3.74	< 1.85	< 3.55	< 3.53	< 1.87	< 1.82	< 1.75	< 12.50
581402004	5/24/2022	< 189	< 1.52	< 1.71	< 3.11	< 1.38	< 2.93	< 3.18	< 1.76	< 1.71	< 1.64	< 11.80
591576004	8/25/2022	< 223	< 1.58	< 1.63	< 2.71	< 1.68	< 3.15	< 2.54	< 1.65	< 1.86	< 1.64	< 8.65
598963004	10/19/2022	< 217	< 1.51	< 1.36	< 3.26	< 1.60	< 3.06	< 2.85	< 1.78	< 1.65	< 1.69	< 12.80
605350008	12/19/2022	< 206	< 1.31	< 1.38	< 2.97	< 1.44	< 2.74	< 2.27	< 1.47	< 1.48	< 1.53	< 7.94
				Monitoring Well 5 (MW-5)								
591576005	8/24/2022	< 237	< 1.28	< 1.21	< 2.53	< 1.55	< 2.46	< 2.45	< 1.18	< 1.33	< 1.26	< 6.43
				Monitoring Well 6 (MW-6)								
591576006	8/24/2022	< 239	< 1.31	< 1.39	< 2.63	< 1.19	<30.00[a]	< 2.53	< 1.43	< 1.52	< 1.51	< 6.99
				Monitoring Well 7 (MW-7)								
591576007	8/24/2022	< 232	< 1.67	< 1.63	< 3.65	< 1.83	< 3.45	< 3.11	< 1.90	< 1.99	< 1.93	< 9.42
				Monitoring Well 8 (MW-8)								
591576008	8/24/2022	< 229	< 1.52	< 1.43	< 3.21	< 1.69	< 3.16	< 2.43	< 1.47	< 1.50	< 1.43	< 7.87

[a]Sample was above vendor laboratory minimum detectable concentration (MDC) but below required LLDs.

TABLE 17: 2022 GROUNDWATER MONITORING DATA FOR MNGP. (CONTINUED).

Lab ID	Collect Date	^{3}H	^{54}Mn	^{58}Co	^{59}Fe	^{60}Co	^{65}Zn	^{95}Zr	^{95}Nb	^{134}Cs	^{137}Cs	^{140}Ba-^{140}La
Monitoring Well 9 (MW-9A)												
568984004	1/22/2022	< 259										
571664004	2/22/2022	< 160										
574571013	3/22/2022	< 186	< 1.42	< 1.76	< 3.66	< 1.77	< 3.36	< 3.06	< 1.82	< 1.84	< 1.65	< 12.60
578113004	4/20/2022	< 215										
581402014	5/24/2022	< 206	< 1.49	< 1.49	< 3.69	< 1.70	< 3.30	< 2.49	<1.57	< 1.53	< 1.49	< 11.60
585741001	6/21/2022	11300 ± 420										
587315001	7/19/2022	5480 ± 277										
592064001	8/25/2022	4410 ± 335	< 1.28	< 1.22	< 2.61	< 1.41	< 2.64	< 2.57	< 1.52	< 1.42	< 1.19	< 12.70
595269001	9/22/2022	3500 ± 244										
601517001	10/19/2022	1560 ± 170	< 1.31	< 1.64	< 4.18	< 1.45	< 2.73	< 3.09	< 2.01	< 1.36	< 1.37	< 39.30
602156001	11/21/2022	3600000 ± 68700	< 1.48	< 1.83	< 3.80	< 1.89	< 3.58	< 3.46	< 2.10	< 1.98	< 1.61	< 14.00
602188001	11/22/2022	4220000 ± 6720										
605391001	12/19/2022	3220000 ± 6260	< 1.21	< 1.17	< 2.53	< 1.48	< 2.62	< 2.23	< 1.41	< 1.23	< 1.32	< 7.58
Monitoring Well 9B (MW-9B)												
574571014	3/22/2022	< 181	< 1.53	< 1.58	< 3.74	< 1.53	< 3.19	< 3.12	< 1.93	< 1.89	< 1.58	< 13.40
581402015	5/24/2022	< 200	< 1.16	< 1.30	< 2.94	< 1.46	< 2.74	< 2.39	< 1.46	< 1.33	< 1.30	< 9.69
591576018	8/25/2022	< 148	< 1.67	< 2.01	< 3.18	< 1.79	< 3.46	< 3.23	< 1.74	<10.00[a]	< 1.85	< 9.44
601517002	10/19/2022	< 214	< 1.14	< 1.38	< 3.96	< 1.18	< 2.23	< 2.71	< 1.74	< 1.21	< 1.09	< 33.50
602156002	11/22/2022	26800 ± 549	< 1.71	< 1.65	< 3.49	< 1.62	< 3.46	< 3.32	< 1.83	< 1.78	< 1.67	< 13.90
605391002	12/19/2022	4090000 ± 7030	< 1.29	< 1.34	< 2.98	< 1.58	< 2.65	< 2.50	< 1.46	< 1.74	< 1.55	< 2.50
Monitoring Well 10 (MW-10)												
568984001	1/22/2022	< 263										
571664001	2/21/2022	< 177										
574571005	3/21/2022	< 170	< 1.84	< 2.17	< 3.99	< 2.14	< 4.14	< 3.79	< 2.13	< 2.17	< 1.93	< 13.60
578113001	4/21/2022	< 205										
581402005	5/24/2022	< 206	< 1.48	< 1.53	< 3.61	< 1.47	< 3.16	< 2.59	< 1.46	< 1.61	< 1.51	< 10.50
584172001	6/21/2022	< 247										
587192001	7/19/2022	< 237										
591576009	8/25/2022	< 235	< 1.43	< 1.50	< 3.36	<15.00[a]	< 2.87	< 2.59	< 1.65	< 1.49	< 1.45	< 8.27
595267001	9/26/2022	< 189										
598963005	10/20/2022	< 223	< 1.35	< 1.42	< 2.87	< 1.54	< 2.77	< 2.67	< 1.49	< 1.32	< 1.37	< 10.70
602156003	11/22/2022	284 ± 143	< 1.45	< 1.50	< 3.20	< 1.44	< 2.93	< 2.91	< 1.70	< 1.54	< 1.55	< 10.80
565553001	12/15/2022	< 224	< 1.38	< 1.62	< 3.20	< 1.62	< 3.17	< 2.47	< 1.51	< 1.55	< 1.38	< 7.89

[a]Sample was above vendor laboratory minimum detectable concentration (MDC) but below required LLDs.

TABLE 17: 2022 GROUNDWATER MONITORING DATA FOR MNGP**.** (CONTINUED).

Lab ID	Collect Date	^{3}H	^{54}Mn	^{58}Co	^{59}Fe	^{60}Co	^{65}Zn	^{95}Zr	^{95}Nb	^{134}Cs	^{137}Cs	^{140}Ba-^{140}La
Monitoring Well 11 (MW-11)												
574571006	3/21/2022	< 186	< 1.51	< 1.79	< 3.81	< 1.52	< 3.01	< 2.70	< 1.47	< 1.88	< 1.85	< 11.20
581402006	5/24/2022	< 195	< 1.24	< 1.36	< 2.83	< 1.35	< 2.86	< 2.55	< 1.47	< 1.46	< 1.39	< 9.07
591576010	8/25/2022	< 153	< 1.67	< 1.58	< 2.63	< 1.51	< 2.98	< 2.93	< 1.84	<10.00[a]	< 1.56	< 9.17
598963006	10/19/2022	< 225	< 1.24	< 1.39	< 2.77	< 1.29	< 3.02	< 2.62	< 1.36	< 1.47	< 1.24	< 11.60
Monitoring Well 12A (MW-12A)												
574571007	3/21/2022	< 171	< 1.44	< 1.57	< 3.02	< 1.56	< 2.86	< 2.86	< 1.64	< 1.58	< 1.53	< 11.00
581402007	5/24/2022	< 191	< 1.55	< 1.50	< 3.53	< 1.47	< 2.74	< 2.74	< 1.61	< 1.65	< 1.60	< 10.40
591576011	8/25/2022	< 143	< 1.18	< 1.31	< 2.63	< 1.29	< 2.23	< 2.23	< 1.48	< 1.49	<18.00[a]	< 6.99
598963007	10/19/2022	< 216	< 1.43	< 1.50	< 3.68	< 1.15	< 2.92	< 2.92	< 1.60	< 1.60	< 1.51	< 10.50
602144004	11/22/2022	< 226	< 1.73	< 1.99	< 4.12	< 1.98	< 3.40	< 3.40	< 2.00	< 1.94	< 2.10	< 14.60
605350006	12/19/2022	< 216	< 1.45	< 1.67	< 2.72	< 1.56	< 3.01	< 2.74	< 1.73	< 1.66	< 1.74	< 9.71
Monitoring Well 12B (MW-12B)												
574571008	3/21/2022	< 183	< 1.64	< 1.77	< 3.47	<1.56	< 2.90	< 3.30	< 1.86	< 1.82	< 3.63	< 13.20
581402008	5/24/2022	< 201	< 1.69	< 1.84	< 3.67	< 1.67	< 3.53	< 3.25	< 1.93	< 1.91	< 1.99	< 12.50
591576012	8/25/2022	< 161	< 1.30	< 1.38	< 3.14	< 1.52	< 2.88	< 2.56	< 1.43	< 1.47	< 1.50	< 7.60
598963008	10/19/2022	< 218	< 1.36	< 1.28	< 3.10	< 1.26	< 2.52	< 2.52	< 1.58	< 1.65	< 1.40	< 12.40
602144005	11/22/2022	< 223	< 1.41	< 1.47	< 3.27	< 1.35	< 2.49	< 2.66	< 1.52	< 1.61	< 1.39	< 12.00
605350007	12/19/2022	< 207	< 1.25	< 1.39	< 2.82	< 1.49	< 3.10	< 2.45	< 1.48	< 1.33	< 1.44	< 8.14
Monitoring Well 13A (MW-13A)												
568984002	1/22/2022	< 267										
571664002	2/21/2022	< 170										
574571009	3/21/2022	< 174	< 1.24	< 1.51	< 3.40	< 1.59	< 3.08	< 2.86	< 1.43	< 1.69	< 1.35	< 11.10
578113002	4/21/2022	< 218										
581402009	5/24/2022	< 206	< 2.03	< 1.92	< 3.67	< 1.91	< 3.66	< 3.50	< 2.27	< 2.11	< 2.48	< 13.90
584172002	6/21/2022	< 248										
587192002	7/19/2022	< 248										
591576013	8/25/2022	< 149	< 1.34	< 1.40	< 2.71	< 1.41	< 2.49	< 2.42	< 1.45	< 1.66	< 1.35	< 8.34
595267002	9/26/2022	< 206										
598963009	10/20/2022	< 223	< 1.33	< 1.48	< 3.43	< 1.37	< 2.56	< 2.45	< 1.47	< 1.40	< 1.34	< 10.40
602144001	11/22/2022	< 212	< 1.62	< 1.93	< 3.85	< 2.07	< 3.90	< 3.40	< 1.96	< 1.92	< 1.71	< 14.70
605350001	12/19/2022	< 187	<1.50	< 1.39	< 3.64	<1.61	<3.25	< 2.57	< 1.63	< 1.67	< 1.65	< 8.65

[a]Sample was above vendor laboratory minimum detectable concentration (MDC) but below required LLDs.

TABLE 17: 2022 GROUNDWATER MONITORING DATA FOR MNGP. (CONTINUED).

Lab ID	Collect Date	^{3}H	^{54}Mn	^{58}Co	^{59}Fe	^{60}Co	^{65}Zn	^{95}Zr	^{95}Nb	^{134}Cs	^{137}Cs	^{140}Ba-^{140}La
Monitoring Well 13B (MW-13B)												
568984003	1/22/2022	< 265										
571664003	2/21/2022	< 247										
574571010	3/21/2022	< 182	< 1.82	< 2.26	< 4.77	< 1.92	< 3.84	< 3.67	< 2.32	< 2.21	< 2.29	< 14.80
578113003	4/21/2022	< 211										
581402010	5/24/2022	< 187	< 1.67	< 1.68	< 4.06	< 1.84	< 3.28	< 3.23	< 1.99	< 1.82	< 1.72	< 13.30
584172003	6/21/2022	< 247										
587192003	7/19/2022	< 244										
591576014	8/25/2022	< 148	< 1.22	< 1.41	< 2.81	< 1.49	< 2.64	< 2.29	< 1.40	< 1.40	< 1.30	< 7.00
595267003	9/26/2022	< 208										
598963010	10/20/2022	< 203	< 1.71	< 1.82	< 3.76	< 1.84	< 3.85	< 3.55	< 1.91	< 1.81	< 1.84	< 14.70
602144002	11/22/2022	< 217	< 1.31	< 1.48	< 3.18	< 1.28	< 2.56	< 2.77	< 1.56	< 1.48	< 1.39	< 11.30
605350002	12/19/2022	< 213	< 1.81	< 1.51	< 3.50	< 1.61	< 4.20	< 3.45	< 2.06	< 1.85	< 1.77	< 9.26
Monitoring Well 14 (MW-14)												
578113005	4/20/2022	< 205	< 1.46	< 1.54	< 3.92	< 1.50	< 3.05	< 2.58	< 1.60	< 1.56	< 1.49	< 11.30
581402011	5/23/2022	< 197	< 1.90	< 2.15	< 3.86	< 2.09	< 3.97	< 3.82	< 2.01	< 2.12	< 1.91	< 15.60
591576015	8/22/2022	< 157	< 1.38	< 1.35	< 3.77	< 1.43	< 3.18	< 2.74	< 1.49	< 1.55	<18.00[a]	< 7.82
598963011	10/19/2022	< 219	< 1.61	< 1.71	< 3.27	< 1.43	< 2.91	< 3.09	< 1.88	< 1.63	< 1.65	< 13.70
Monitoring Well 15A (MW-15A)												
574571011	3/21/2022	< 184	< 1.85	< 1.88	< 5.10	< 1.63	< 3.01	< 2.63	< 1.59	< 1.68	< 1.43	< 10.30
581402012	5/24/2022	< 195	< 1.32	< 1.55	< 4.94	< 1.62	< 2.77	< 2.60	< 1.79	< 1.55	< 1.48	< 7.50
591576016	8/25/2022	< 146	< 1.39	< 1.44	< 2.93	< 1.91	< 4.32	< 3.02	< 1.98	< 1.91	< 1.99	< 14.00
598963012	10/19/2022	< 233	< 1.72	< 1.92	< 3.46	< 1.67	< 3.60	< 3.48	< 2.08	< 2.00	< 1.81	< 13.90
605350004	12/19/2022	< 202	< 1.57	< 1.91	< 3.49	< 1.76	< 3.26	< 2.68	< 1.94	< 1.85	< 2.00	< 9.82
Monitoring Well 15B (MW-15B)												
574571012	3/21/2022	< 227	< 1.43	< 1.44	< 3.27	< 1.66	< 3.08	< 2.92	< 1.59	< 1.67	< 1.43	< 12.00
581402013	5/24/2022	< 216	< 1.20	< 1.30	< 3.22	< 1.57	< 2.75	< 2.52	< 1.46	< 1.28	< 1.44	< 9.34
591576017	8/25/2022	< 221	< 2.06	< 2.03	< 3.07	< 2.58	< 4.51	< 4.12	< 2.26	< 2.49	< 2.22	< 11.50
598963013	10/19/2022	< 212	< 1.42	< 1.72	< 2.69	< 1.69	< 4.10	< 3.24	< 1.93	< 1.86	< 1.71	< 14.40
605350005	12/19/2022	< 200	< 1.41	< 1.53	< 3.23	< 1.49	< 2.84	< 2.52	< 1.50	< 1.40	< 1.36	< 8.11

[a]Sample was above vendor laboratory minimum detectable concentration (MDC) but below required LLDs.

TABLE 17: 2022 GROUNDWATER MONITORING DATA FOR MNGP. (CONTINUED).

Lab ID	Collect Date	^{3}H	^{54}Mn	^{58}Co	^{59}Fe	^{60}Co	^{65}Zn	^{95}Zr	^{95}Nb	^{134}Cs	^{137}Cs	^{140}Ba-^{140}La
Storm Drain (SD006)												
575370001	3/15/2022	525 ± 171	< 1.47	< 1.65	< 4.33	< 1.55	< 3.05	< 3.20	< 1.79	< 1.59	< 1.48	< 16.70
575370002	3/15/2022	675 ± 175 *	< 1.18	< 1.51	< 3.58	< 1.40	< 2.71	< 2.77	< 1.55	< 1.40	< 1.25	< 14.30
578113006	3/20/2022	9060 ± 558	< 1.23	<15.00[a]	< 4.19	< 1.49	< 2.63	< 3.40	< 1.94	< 1.36	< 1.26	< 53.30
587936001	7/26/2022	235 ± 167	< 1.31	< 1.22	< 3.20	< 2.62	< 2.50	< 2.38	< 1.51	< 1.49	< 1.37	< 12.30
601488001	11/8/2022	< 228	< 1.19	<1.32	< 2.67	< 1.17	< 2.17	< 2.32	< 1.27	< 1.32	< 1.23	< 12.00

***Duplicate sample; not used in calculating average.**
[a]Sample was above vendor laboratory minimum detectable concentration (MDC) but below required LLDs.