

Environmental Monitoring Report

2022 DATA – JANUARY 9, 2024

Environmental Monitoring Report

Minnesota Department of Health
Radioactive Materials Unit
PO Box 64975
St. Paul, MN 55164-0975
651-201-4400
health.ram@state.mn.us
www.health.state.mn.us

To obtain this information in a different format, call: 651-201-4400.

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The Minnesota Department of Health (MDH) maintains an environmental monitoring program for radioactivity around the two nuclear power generating plants in the state. The program is designed to provide an independent evaluation of the impact of the nuclear power generating plants to the environment and the public over a period of time. Data collected is used to verify compliance with appropriate standards, provide the public with reliable data regarding the environmental impact of the nuclear power generating plants, and establish trends. Annual reports are generated and available for public review. Sample data not included in the annual reports is available through the MDH Radioactive Materials Unit.

Monitoring for radioactivity began in Minnesota in response to nuclear weapons testing. A baseline for certain radionuclides has been established and current environmental monitoring continues to validate the natural background levels in Minnesota. Throughout the years, MDH's environmental monitoring program has transformed. Careful analysis of potential risks and data collected has led MDH to make alterations in its sampling program from time to time. Some collection points and sample mediums have been discontinued while others have been added.

The major components of MDH's environmental monitoring program are sample collection, data analysis, and interpretation. Samples collected around the Monticello and Prairie Island nuclear generating plants include air, surface water, and milk. Ambient gamma radiation doses are monitored through the use of optically stimulated luminescence dosimeters. Well water and community water samples are collected near the Prairie Island plant only.

Program Summary

In 2022, no sample results within the current environmental monitoring program areas were found to exceed any federal or state standards or guidelines.

Air Monitoring

Continuous air monitoring allows MDH to determine the level of radioactive contamination that could expose the public through inhalation. Air sampler particulate filters and cartridges are collected weekly or every other week and analyzed for radioactive particulates in the air.

In 2022, air samples were collected from three locations in Minnesota: one at each of the nuclear power generating plants and one in downtown St. Paul. The air samplers at the nuclear power generating plants are located downwind of the plants, based on predominant wind directions.

The location of the Prairie Island air sampler is near Lock and Dam No. 3, downstream from the Prairie Island Nuclear Generating Plant. The air sampler at Monticello is located near the Monticello Xcel Training Center, downstream from the Monticello Nuclear Power Generating Plant.

The St. Paul air sampler is located on the roof of the Freeman Building at 625 Robert Street North in St. Paul and is used as a standard for comparison.

Air sampler locations are shown in [Image 1](#) (Monticello) and [Image 2](#) (Prairie Island).

Air sample results for gross alpha, gross beta, and naturally occurring Beryllium-7 and Potassium-40 are shown in [Table 2](#) (Monticello), [Table 3](#) (Prairie Island), and [Table 4](#) (St. Paul).

Data Analysis

Data collected from the Prairie Island and Monticello air samplers are compared to data from the St. Paul sampler and historical data.

Gross alpha and gross beta levels were similar at all three locations and similar to air sample results from previous years.

Whenever applicable, naturally occurring Beryllium-7 and Potassium-40 are tracked as a means of quality control for accuracy of lab data. It is expected that these levels will remain somewhat constant throughout time.

Surface Water Monitoring

MDH samples the river water downstream from both power plants and compares the results to the historical data for changes that may have occurred due to releases from the power plant. MDH also compares the results to the EPA Safe Drinking Water Act (SDWA) standards for comparison, but these are not samples used by community water systems to show compliance with the SDWA.

Water sample locations are shown in [Image 1](#) (Monticello) and [Image 2](#) (Prairie Island).

Water sample results for gross alpha, gross beta, and select radionuclides of interest are shown in [Table 5](#) (Monticello) and [Table 6](#) (Prairie Island).

Data Analysis

The radiological component of the SDWA limits gross alpha particles to 15 pCi/L (including combined Radium 226 and Radium 228 at 5 pCi/L), and beta/photon emitters to doses equivalent to 4 mrem per year. For tritium the limit is 20,000 pCi/L, for Strontium 90 the limit is 8 pCi/L, and for Strontium 89 the limit is 20 pCi/L.

Gross alpha values for 2022 were below 3.3 pCi/L at both locations. Tritium values were below 350 pCi/L at both locations. Strontium-89 and Strontium-90 were both less than 2 pCi/L at both locations.

Milk Monitoring

Milk samples are collected monthly from a farm located near each power plant. Radiation contamination that may have been deposited in the fields and consumed by cows would be concentrated and forwarded to the milk. Since there are no standards for milk, except for emergency situations, sample analysis is compared to historical data and reviewed for trends.

Milk sampling locations are shown in [Image 1](#) (Monticello) and [Image 2](#) (Prairie Island). Milk sample results for select radionuclides of interest are shown in [Table 7](#) (Monticello) and [Table 8](#) (Prairie Island).

Data Analysis

There are no specific standards for milk samples, except for emergency situations, so samples are compared to historical data. Strontium-89 and Strontium-90 have

consistently been below the detection limit, and the results for Potassium-40, a naturally occurring radionuclide, remain consistent.

Ambient Gamma Radiation Monitoring

Ambient gamma radiation levels are measured around the power plants by using optically stimulated luminescence dosimeters (OSLDs). MDH has placed OSLDs beyond the plant's boundaries to estimate the dose a member of the public would receive if they were to be at that location continuously throughout the monitoring period. OSLDs are changed and analyzed quarterly. In 2006, MDH transferred the analysis of the dosimeters from an internal evaluation to Mirion Technologies (formerly Global Dosimetry), a processor approved by the National Voluntary Laboratory Accreditation Program. These results are compared to historical data and MDH regulatory limits.

OSLD locations are shown in [Image 3](#) (Monticello) and [Image 4](#) (Prairie Island).

Ambient Gamma radiation level results are shown in [Table 9](#) (Monticello) and [Table 10](#) (Prairie Island).

Data Analysis

Control badges are kept in St. Paul for the monitoring period, and the control badge readings are subtracted out by the processor to compensate for background radiation and radiation picked up during transit to and from the processor. Most of the badge results were below minimum threshold in which an actual reading can be measured with statistical accuracy. The results that were above that threshold were below the MDH regulatory dose limit for members of the public of 100 mrem in a year.

Well Water and Community Water Monitoring

Well water is periodically reviewed since radioactivity may seep through the soil and enter the water table. The collection point was selected to be a private farm located close to the Prairie Island nuclear power plant. Community water samples are collected at Prairie Island as part of the EPA RADNET system. These samples are sent into EPA RADNET for analysis and not part of this report. MDH does collect samples at the same time to represent the community water supply at Prairie Island for analysis by the MDH laboratory, which are included in this report. These samples are collected quarterly and are compared to historical data and the EPA Safe Drinking Water Act standards, but are not compliance samples for the community water system with the SDWA.

The well water and community water sample locations are shown in [Image 2](#). Community water samples are collected from the Dakota Station at Prairie Island. Well water sample results for gross alpha, gross beta, and select radionuclides of interest are shown in [Table 11](#). Community water sample results are shown in [Table 12](#).

Data Analysis

Well water and community water data are analyzed similar to surface water. The radiological component of the SDWA limits gross alpha particles to 15 pCi/L (including

combined Radium 226 and Radium 228 at 5 pCi/L), and beta/photon emitters to doses equivalent to 4 mrem per year. For tritium the limit is 20,000 pCi/L.

Gross alpha values for 2022 were below 12 pCi/L, and Tritium values were below 350 pCi/L.

Precipitation Monitoring

As part of the EPA RADNET program, MDH also collects precipitation samples at the air sampling location in St. Paul. These samples are collected when enough precipitation is in the collection bucket to fill an analysis container. Samples are split, one going to EPA RADNET and one to MDH's Public Health Lab. Data collected is compared to the EPA Safe Drinking Water Act standards for reference and historical data.

Precipitation sample results for gross alpha, gross beta, and select radionuclides of interest are shown in [Table 13](#).

Data Analysis

Precipitation data is analyzed similar to surface water. The radiological component of the SDWA limits gross alpha particles to 15 pCi/L (including combined Radium 226 and Radium 228 at 5 pCi/L), and beta/photon emitters to doses equivalent to 4 mrem per year. For tritium the limit is 20,000 pCi/L, for Strontium 90 the limit is 8 pCi/L, and for Strontium 89 the limit is 20 pCi/L.

Gross alpha values for 2022 were below 6.4 pCi/L. Tritium values were below 659 pCi/L. Strontium-89 and Strontium-90 were both less than 2 pCi/L.

Program Modifications

There were no significant program modifications in 2022.

Sampling Sites/OSLD Locations

Image 1: Monticello Environmental Sampling Sites

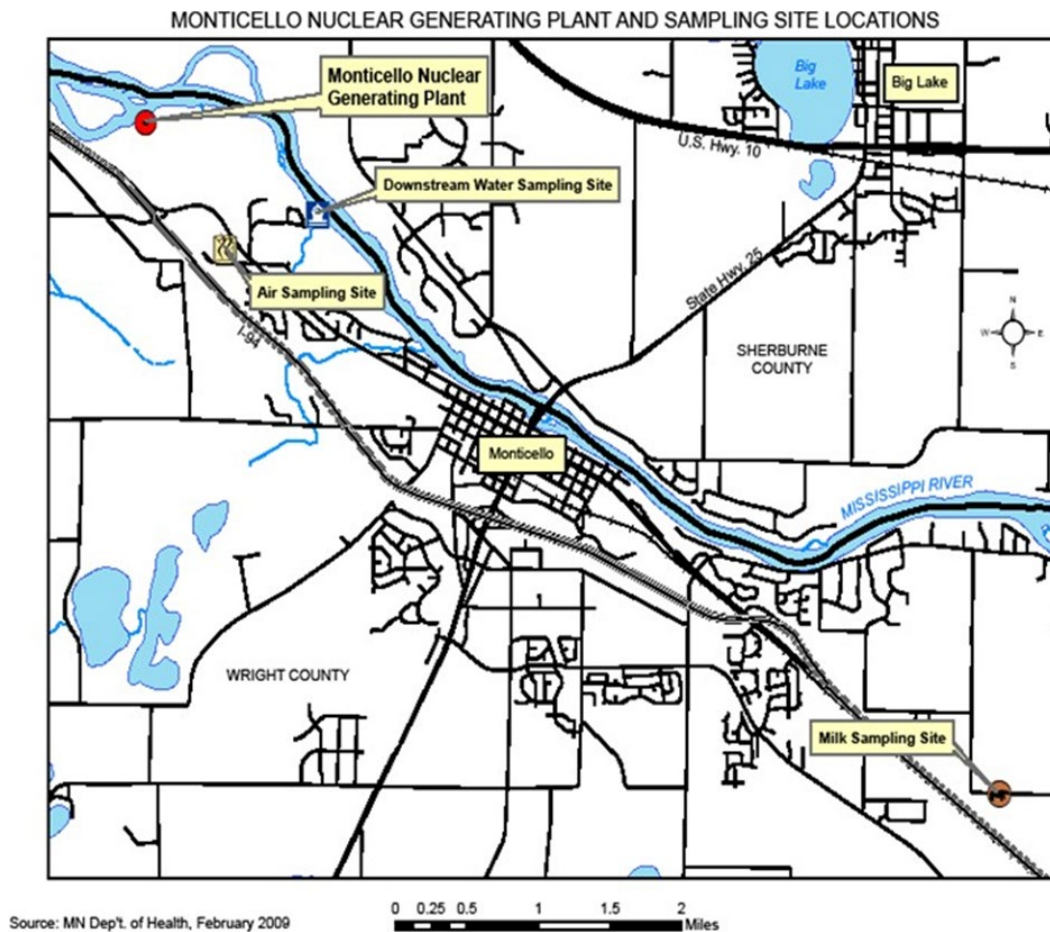
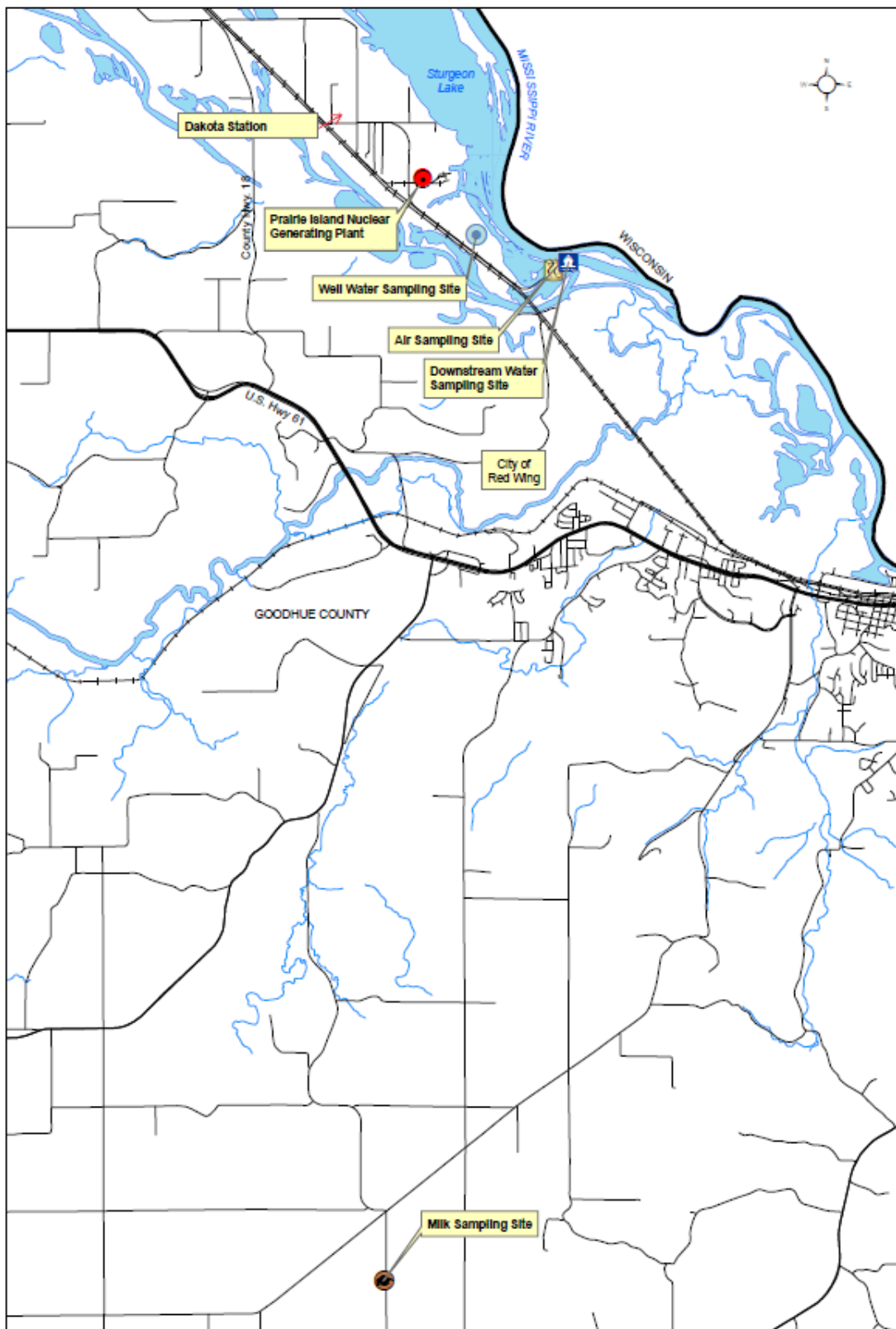


Image 2: Prairie Island Environmental Sampling Sites



Source: MN Dept. of Health, June, 2021



Image 3: Monticello OSLD Locations

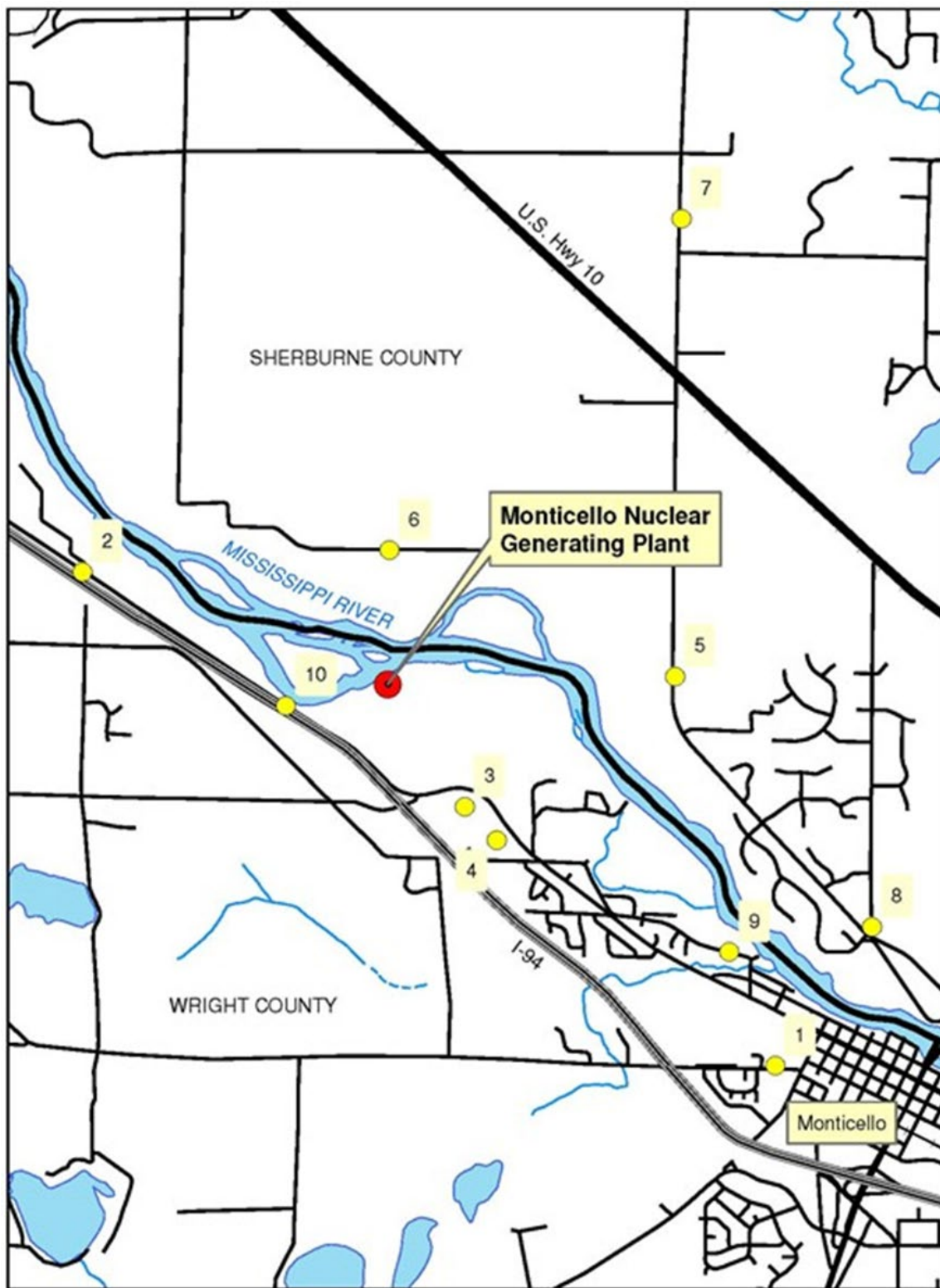
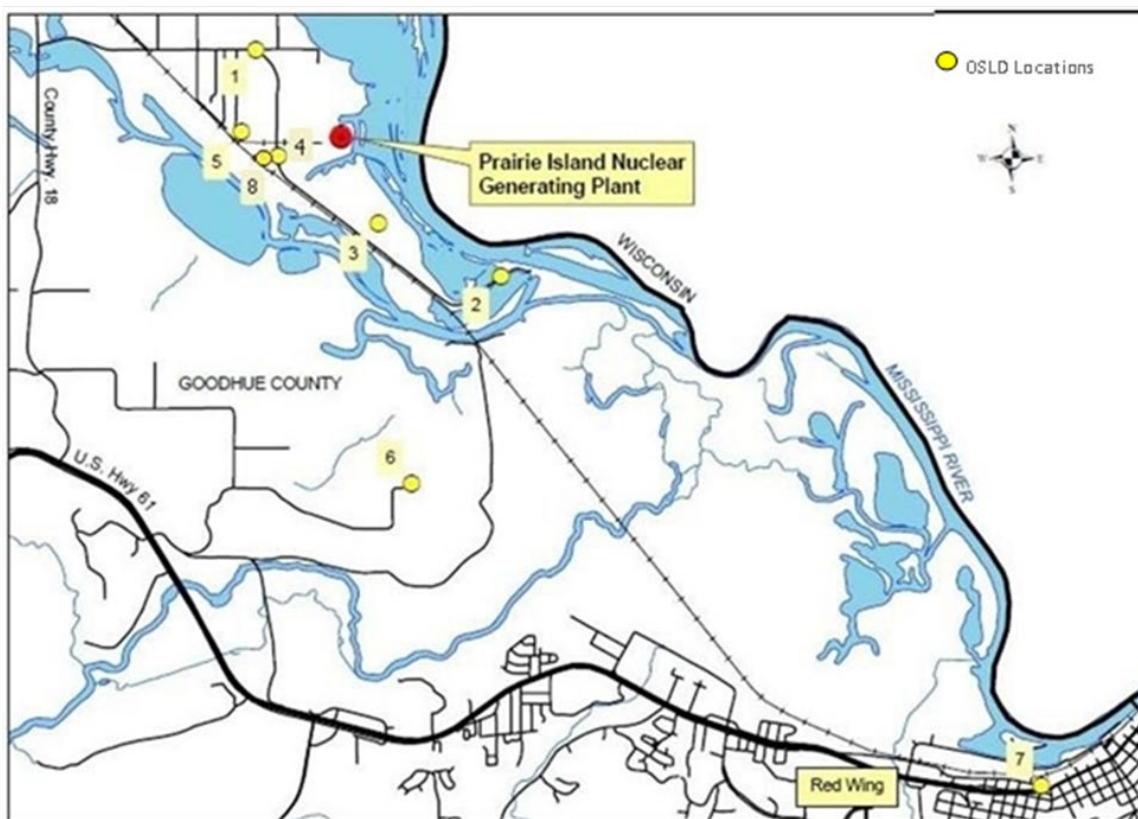


Image 4: Prairie Island OSLD Locations



Tables

Table 1: Sample Summary for 2022

Sample Type	Collection and Frequency	Number of Samples Collected	Analyses Performed
Air	C, W & BW	104	GA, GB, GI, Sr, I
Surface Water	G, Q	8	GA, GB, GI, Sr, H
Well Water	G, Q	4	GA, GB, GI, Sr, H
Community Water	G, Q	4	GA, GB, GI, Sr, H
Milk	G, M	24	GI, Sr, I
OSLD	C, Q	72	Direct exposure
Precipitation	C	15	GA, GB, GI, Sr, H

Collection type: C = continuous; G = grab

Frequency: W = weekly; M = monthly; Q = quarterly; A = annually; BW = bi-weekly

Analyses performed: GA = gross alpha; GB = gross beta; GI = gamma isotopic; Sr = strontium; I = iodine; H = tritium

Table 2: 2022 Air Sampling Results for Monticello Nuclear Generating Plant

Results and Detection Limits in pCi/m³

Date Collected	Gross Alpha	Gross Beta	Be-7	K-40
01/13/22	0.00376	0.0407	<300	<6.0
01/25/22	0.00321	0.0258	<300	<6.0
02/08/22	0.00184	0.0283	<300	<6.0
02/23/22	0.00251	0.0249	<300	<6.0
03/08/22	0.00284	0.0300	<300	<6.0
03/21/22	0.00623	0.0206	<300	<6.0
04/05/22	0.00578	0.0183	<300	<6.0
04/19/22	<0.00075	0.00884	<300	<6.0
05/05/22	0.00213	0.0124	<300	<6.0
05/17/22	0.00890	0.0193	<300	<6.0
05/31/22	<0.00068	<0.0106	<300	<6.0
06/14/22	0.00136	0.0168	<300	<6.0
06/28/22	0.00140	0.0142	<300	<6.0
07/12/22	0.00251	0.0179	<300	<6.0
07/26/22	0.00179	0.0197	<300	<6.0
08/09/22	0.00125	0.0134	<300	<6.0
08/25/22	0.00161	0.0194	<300	<6.0
09/06/22	0.00394	0.0656	<300	<6.0
09/20/22	0.00484	0.0346	<300	<6.0

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Date Collected	Gross Alpha	Gross Beta	Be-7	K-40
10/04/22	0.00134	0.0187	<300	<6.0
10/18/22	0.00168	0.0194	<300	<6.0
11/01/22	0.00264	0.0305	<300	<6.0
11/15/22	0.00266	0.0191	<300	<6.0
11/28/22	0.00625	0.0367	<300	<6.0
12/13/22	0.00234	0.0316	<300	<6.0
12/28/22	0.00207	0.0203	<300	<6.0

Table 3: 2022 Air Sampling Results for Prairie Island Nuclear Generating Plant

Results and Detection Limits in pCi/m³

Date Collected	Gross Alpha	Gross Beta	Be-7	K-40
01/13/22	0.00251	0.0306	<300	<6.0
01/25/22	0.00232	0.0193	<300	<6.0
02/08/22	0.00147	0.0184	<300	<6.0
02/23/22	0.00133	0.0161	<300	<6.0
03/08/22	0.00189	0.0216	<300	<6.0
03/21/22	0.00134	0.0255	<300	<6.0
04/05/22	0.00301	0.0121	<300	<6.0
04/19/22	0.00092	0.0902	<300	<6.0
05/05/22	0.00105	0.0862	<300	<6.0
05/17/22	0.00153	0.0286	<300	<6.0
05/31/22	0.00085	0.0874	<300	<6.0
06/14/22	0.00091	0.0119	<300	<6.0
06/28/22	0.00081	0.0109	<300	<6.0
07/12/22	0.00170	0.0135	<300	<6.0
07/26/22	0.00077	0.0115	<300	<6.0
08/09/22	0.00078	0.0964	<300	<6.0
08/25/22	0.00109	0.0140	<300	<6.0
09/06/22	0.00180	0.0345	<300	<6.0
09/20/22	0.00331	0.0244	<300	<6.0
10/04/22	0.00061	0.0126	<300	<6.0
10/18/22	<0.00049	0.0346	<300	<6.0
11/01/22	0.00232	0.0289	<300	<6.0
11/15/22	0.00252	0.0211	<300	<6.0
11/28/22	0.00803	0.0407	<300	<6.0
12/13/22	0.00237	0.0260	<300	<6.0

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Date Collected	Gross Alpha	Gross Beta	Be-7	K-40
12/28/22	0.00287	0.0268	<300	<6.0

Table 4: 2022 Air Sampling Results for St. Paul

Results and Detection Limits in pCi/m3

Date Collected	Gross Alpha	Gross Beta	Be-7	K-40
01/04/22	0.00733	0.0545	<300	<6.0
01/14/22	0.00283	0.0307	<300	<6.0
01/18/22	<0.00057	0.0991	<300	<6.0
01/25/22	0.00432	0.0358	<300	<6.0
02/01/22	<0.00194	0.0267	<300	<6.0
02/08/22	<0.00188	0.0308	<300	<6.0
02/15/22	<0.00202	0.0116	<300	<6.0
02/23/22	<0.00171	0.0223	<300	<6.0
03/01/22	0.00276	0.0355	<300	<6.0
03/08/22	<0.00195	0.0165	<300	<6.0
03/15/22	<0.00201	0.0112	<300	<6.0
03/21/22	0.00282	0.0404	<300	<6.0
03/30/22	<0.00149	0.00722	<300	<6.0
04/07/22	<0.00168	0.0298	<300	<6.0
04/12/22	0.00883	0.00157	<300	<6.0
04/19/22	<0.00197	0.00912	<300	<6.0
04/26/22	<0.00195	0.0898	<300	<6.0
05/03/22	<0.00190	0.0722	<300	<6.0
05/10/22	<0.00195	0.00757	<300	<6.0
05/17/22	0.00207	0.0304	<300	<6.0
05/24/22	<0.0188	0.0687	<300	<6.0
05/31/22	0.00541	0.0348	<300	<6.0
06/08/22	<0.00166	0.0124	<300	<6.0
06/15/22	<0.00196	0.0125	<300	<6.0
06/22/22	<0.00199	0.0108	<300	<6.0
06/28/22	<0.00228	0.0131	<300	<6.0
07/05/22	0.00792	0.0216	<300	<6.0
07/11/22	0.00312	0.0179	<300	<6.0
07/19/22	0.00199	0.0161	<300	<6.0
07/26/22	0.00201	0.0139	<300	<6.0
08/02/22	<0.01940	0.0102	<300	<6.0
08/10/22	<0.00170	0.0105	<300	<6.0

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Date Collected	Gross Alpha	Gross Beta	Be-7	K-40
08/16/22	0.00217	0.0393	<300	<6.0
08/25/22	<0.00151	0.0216	<300	<6.0
09/01/22	<0.00190	0.0147	<300	<6.0
09/06/22	0.00306	0.0433	<300	<6.0
09/13/22	0.00454	0.00286	<300	<6.0
09/20/22	0.00568	0.0404	<300	<6.0
09/27/22	<0.00170	0.0191	<300	<6.0
10/05/22	0.00128	0.0246	<300	<6.0
10/11/22	0.00108	0.0310	<300	<6.0
10/18/22	0.00453	0.00426	<300	<6.0
10/25/22	0.00173	0.0449	<300	<6.0
11/02/22	0.00232	0.0277	<300	<6.0
11/08/22	0.00285	0.0218	<300	<6.0
11/15/22	0.00149	0.0106	<300	<6.0
11/22/22	0.00182	0.0222	<300	<6.0
11/28/22	0.00505	0.0386	<300	<6.0
12/06/22	0.00229	0.0190	<300	<6.0
12/13/22	0.00232	0.0368	<300	<6.0
12/20/22	0.00161	0.0132	<300	<6.0
12/27/22	0.00341	0.0252	<300	<6.0

Table 5: 2022 Surface Water Results for Monticello Nuclear Generating Plant

Results and Detection Limits in pCi/L

Date Collected	Gross Alpha	Gross Beta	Tritium	Sr-89 ¹	Sr-90 ¹	K-40
01/13/22	<3.0	<4.0	<350	<2.0	<2.0	<40
04/19/22	<3.0	<4.0	<350	<2.0	<2.0	<40
07/12/22	<3.0	<4.0	<350	<2.0	<2.0	<40
10/04/22	<3.0	<4.0	<350	<2.0	<2.0	86.7

¹Sr-89 and Sr-90 were below the required detection limit of 2 pCi/L (§ 141.25)

Table 6: 2022 Surface Water Results for Prairie Island Nuclear Generating Plant

Results and Detection Limits in pCi/L

Date Collected	Gross Alpha	Gross Beta	Tritium	Sr-89 ¹	Sr-90 ¹	K-40
01/13/22	<3.0	<4.0	<350	<2.0	<2.0	<40

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Date Collected	Gross Alpha	Gross Beta	Tritium	Sr-89 ¹	Sr-90 ¹	K-40
04/19/22	3.3	<4.0	<350	<2.0	<2.0	<40
07/12/22	<3.0	<4.0	<350	<2.0	<2.0	<40
10/04/22	<3.0	<4.0	<350	<2.0	<2.0	74.6

¹Sr-89 and Sr-90 were below the required detection limit of 2 pCi/L (§ 141.25)

Table 7: 2022 Milk Analysis Results for Monticello Nuclear Generating Plant

Results and Detection Limits in pCi/L

Date Collected	Sr-89 ¹	Sr-90 ¹	K-40
01/13/22	<2.0	<2.0	1450
02/08/22	<2.0	<2.0	1430
03/08/22	<2.0	<2.0	1460
04/05/22	<2.0	<2.0	1500
05/05/22	<2.0	<2.0	1250
06/14/22	<2.0	<2.0	1430
07/12/22	<2.0	<2.0	1550
08/09/22	<2.0	<2.0	1430
09/06/22	<2.0	<2.0	1420
10/04/22	<2.0	<2.0	1560
11/01/22	<2.0	<2.0	1530
12/28/22	<2.0	<2.0	1410

¹Sr-89 and Sr-90 were below the required detection limit of 2 pCi/L (§ 141.25)

Table 8: 2022 Milk Analysis Results for Prairie Island Nuclear Generating Plant

Results and Detection Limits in pCi/L

Date Collected	Sr-89 ¹	Sr-90 ¹	K-40
01/13/22	<2.0	<2.0	1530
02/08/22	<2.0	<2.0	1530
03/08/22	<2.0	<2.0	1530
04/05/22	<2.0	<2.0	1430
05/05/22	<2.0	<2.0	1440
06/14/22	<2.0	<2.0	1610
07/12/22	<2.0	<2.0	1530
08/09/22	<2.0	<2.0	1520
09/06/22	<2.0	<2.0	1470

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Date Collected	Sr-89 ¹	Sr-90 ¹	K-40
10/04/22	<2.0	<2.0	1480
11/01/22	<2.0	<2.0	1390
12/13/22	<2.0	<2.0	1410

¹Sr-89 and Sr-90 were below the required detection limit of 2 pCi/L (§ 141.25)

Table 9: 2022 OSLD Results for Monticello Nuclear Generating Plant

Results in mrem

Location	Number on Image 3	1st Qtr ¹	2nd Qtr	3rd Qtr	4th Qtr	Average
Control						
City Office	1	*	*	*	*	*
CR75 Acacia	2	*	*	*	*	*
CR75 120 St Bridge	3	*	*	*	*	*
XCEL Training Center	4	*	*	*	12	3.00
East Pole 433	5	*	*	*	*	*
North Pole 485	6	*	*	*	*	*
Olson Farm	7	*	*	*	*	*
CR 50/CR11	8	*	*	*	*	*
CR 75 - Monticello	10	*	*	*	13	*
River Street	9	*	*	*	*	*

¹ 1stth quarter OSLDs were unable to be replaced on time due to supply issues with the vendor. The value in the table reflects the combined total reading for 4th quarter 2021 and 1st quarter 2022.

Table 10: 2022 OSLD Results for Prairie Island Nuclear Generating Plant

Results in mrem

Location	Number on Image 4	1st Qtr ¹	2nd Qtr	3rd Qtr	4th Qtr	Average
Control						
Sturgeon Lake Rd	1	*	*	*	*	*
Lock & Dam 3	2	*	*	*	*	*
Suter Farm	3	*	*	*	*	*
ISFSI Wakonade	4	*	13	*	*	3.25
Tower	5	*	13	*	*	3.25

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Location	Number on Image 4	1st Qtr ¹	2nd Qtr	3rd Qtr	4th Qtr	Average
Gustafson Farm	6	*	12	*	*	3.00
Red Wing	7	*	12	*	*	3.00
Training Center	8	*	*	*	*	*

*Dosimeter reading is a below minimum threshold in which an actual reading can be measured with statistical accuracy.

¹ 1st quarter OSLDs were unable to be replaced on time due to supply issues with the vendor. The value in the table reflects the combined total reading for 4th quarter 2021 and 1st quarter 2022.

Table 11: 2022 Well Water Analysis Results - City of Welch

Results and Detection Limits in pCi/L

Date Collected	Gross Alpha	Gross Beta	Tritium	K-40
01/13/22	<3.0	<4.0	<350	<40
04/05/22	<3.0	<4.0	<350	<40
07/12/22	<3.0	<4.0	<350	<40
10/04/22	<3.0	<4.0	<350	<40

Table 12: 2022 Community Water Analysis Results - City of Welch

Results and Detection Limits in pCi/L

Date Collected	Gross Alpha	Gross Beta	Tritium	K-40
01/13/22	<3.0	4.8	<350	<40
04/05/22	<3.0	4.4	<350	<40
07/12/22	3.1	4.9	<350	<40
10/04/22	12	<4.0	<350	<40

Table 13: 2022 Precipitation Water Results for St. Paul

Results and Detection Limits in pCi/L

Date Collected	Gross Alpha	Gross Beta	Tritium	Sr-89 ¹	Sr-90 ¹	K-40
03/08/22	<3.0	7.9	<350	<2.0	<2.0	<40.0
04/07/22	<3.0	< 4.0	<350	<2.0	<2.0	<40.0
04/20/22	6.4	20	<350	<2.0	<2.0	<40.0
04/27/22	<3.0	< 4.0	<350	<2.0	<2.0	<40.0
05/03/22	<3.0	< 4.0	<350	<2.0	<2.0	<40.0
05/17/22	<3.0	< 4.0	<350	<2.0	<2.0	<40.0
05/31/22	<3.0	< 4.0	<350	<2.0	<2.0	<40.0
07/05/22	<3.0	< 4.0	<350	<2.0	<2.0	<40.0

ENVIRONMENTAL MONITORING REPORT

Date Collected	Gross Alpha	Gross Beta	Tritium	Sr-89 ¹	Sr-90 ¹	K-40
08/10/22	<3.0	< 4.0	<350	<2.0	<2.0	61.9
08/16/22	<3.0	< 4.0	<350	<2.0	<2.0	68.2
08/25/22	<3.0	< 4.0	<350	<2.0	<2.0	<40.0
09/01/22	<3.0	< 4.0	<350	<2.0	<2.0	<40.0
11/17/22	<3.0	< 4.0	<350	<2.0	<2.0	<40.0
12/27/22	<3.0	< 4.0	659	<2.0	<2.0	<40.0
12/27/22	<3.0	4.3	<350	<2.0	<2.0	<40.0

¹Sr-89 and Sr-90 were below the required detection limit of 2 pCi/L (§ 141.25)