

**Prairie Island
Environmental Radioactivity Survey
2018**



**WISCONSIN DEPARTMENT
of HEALTH SERVICES**

**Division of Public Health
Bureau of Environmental and Occupational Health
Radiation Protection Section**

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Executive Summary

Wisconsin Stat. § 254.41 mandates the Wisconsin Department of Health Services (DHS) to conduct environmental radiation monitoring around the nuclear power facilities that affect Wisconsin. This environmental monitoring report is for the Prairie Island Nuclear Generating Plant, located near Red Wing, Minnesota, for the calendar year January–December 2018. It provides a description and results of this environmental monitoring program.

The DHS environmental monitoring program consists of the collection, analysis, and interpretation of various types of sampled data from the air, water, and terrestrial exposure pathways. The 2018 radioactivity-sampling program included samples of air, precipitation, ambient gamma radiation, surface water, fish, milk, well water, soil, and vegetation that were collected from selected locations at planned sampling intervals.

Program Summary

For 2018, all sample results from the Prairie Island environmental monitoring area were less than state and federal standards or guidelines.

The DHS environmental monitoring programs provide an ongoing baseline of radioactivity measurements to assess any Wisconsin health concerns from the operation of nuclear power generating facilities in or near Wisconsin or other radiological incidents that may occur within Wisconsin or worldwide. These monitoring programs show the following:

- Environmental radioactivity levels have been trending downward in the time period since the 1950s–1960s atmospheric nuclear testing and such radiological incidents as the Chernobyl nuclear reactor incident.
- There were no incidents during 2018, such as the 2011 Japan Fukushima Daiichi incident, that required additional environmental monitoring.
- There is no radioactive problem in types of food consumed in Wisconsin and no health problem related to radioactivity for Wisconsin citizens.

DHS' ongoing environmental monitoring programs provide assurances to the citizens of Wisconsin that we will continue to evaluate the Prairie Island nuclear power facility and other monitoring areas, for radioactivity levels.

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Prairie Island Environmental Radioactivity Survey, 2018

Introduction

Wisconsin Stat. § 254.41 mandates the Wisconsin Department of Health Services (DHS) to conduct environmental radiation monitoring around the nuclear power facilities that impact Wisconsin. This environmental monitoring report is for the Prairie Island Nuclear Generating Plant, located near Red Wing, Minnesota, for the calendar year January–December 2018. It provides a description and results of this environmental monitoring program.

Wisconsin DHS Prairie Island Environmental Monitoring Sampling Program

The DHS environmental monitoring program consists of the collection of various types of samples from the air, water, and terrestrial exposure pathways. The sampling program included samples of air, precipitation, ambient gamma radiation as measured by Thermoluminescent dosimeters (TLD), surface water, fish, soil, milk, well water, and vegetation are collected from selected locations at planned sampling intervals.

Table 1 is a listing of sampling sites and includes a site description and the direction and distance of each site from the monitored power plant. Table 2 provides a listing of types of samples collected, sites where samples are collected, number of samples collected, number of samples were missed or had a non-routine sample analysis, and a listing of the required analyses. Table 3 provides an explanation of missing samples or non-routine sample analyses. Figure 1 is a map showing the location of each environmental sampling site.

Program Modifications

The following program modifications were implemented for 2018:

- In October of 2016 both Welch (PRI-10) and Peterson (PRI-15) dairy farms discontinued milking operations. No suitable replacement for Welch and Christiansen dairy farms could be found within 5 miles of Prairie Island, resulting in the search being expanded to 10 miles. Three dairy farms were identified (PRI-16, PRI-17, PRI-18) with milk collection scheduled to start September of 2017.
- In August of 2018 the Hines dairy farm (PRI-16) discontinued milking operations. It was replaced by the Young dairy farm 356-283 and utilized the same sample ID number PRI-16.

Laboratory Services and Quality Assurance

Analysis of the samples is performed under contract with the Wisconsin State Laboratory of Hygiene (WSLH). WSLH maintains a quality assurance program. Analytical procedures provide for routine replicate analyses to verify methods and instrument operation. Traceable sources are used daily to regularly calibrate instrumentation and conduct performance checks. Instrumentation quality control charts are maintained and available upon written request.

WSLH participates in the Environmental Resource Associates' Proficiency Testing program and has performed satisfactorily over the report period. In addition, WSLH participates in the Multi Analytical Performance Evaluation Program (MAPEP) for environmental matrix analysis. Proficiency testing results are available from the Wisconsin State Laboratory of Hygiene.

ATI Environmental Inc. Midwest Laboratory participates in the National Environmental Laboratory Accreditation Conference Standards (2003) for a variety of radiological analyses during the reporting period.

Detection Limits

Detection limits, required by Wisconsin DHS, are expressed as a lower limit of detection (LLD). The required DHS LLD as indicated in Table 4 under the heading "LLD" is an "a priori" estimate of the

capability for detecting an activity concentration by a given measurement system, procedure, and type of sample. Counting statistics of the appropriate instrument background are used to compute the LLD for each specific analysis. Using 4.66 times the standard deviation (s_b) of the instrument background, the LLD for each specific analysis is defined at the 95% Confidence Level.

The LLD for each radioisotope listed in Table 4 has been calculated from the following equation:

$$LLD = \frac{4.66 s_b}{E * V * 2.22 * Y * S * \exp(-dt)}$$

Where:

- LLD is the "a priori" lower limit of detection as defined above, as picocuries per unit mass or volume.
- s_b is the standard deviation of the background counting rate or of the counting rate of blank sample as appropriate, as counts per minute.
- E is the counting efficiency, as counts per disintegration.
- V is the sample size in units of mass or volume.
- 2.22 is the number of disintegrations per minute per picocurie.
- Y is the fractional radiochemical yield, when applicable.
- S is the self-absorption correction factor.
- d is the radioactive decay constant for the particular radionuclide.
- t is for environmental samples, the elapsed time between sample collection, or end of the sample collection period, and time of counting.

Typical values for E, V, Y and dt have been used to calculate the LLD.

Reporting of Sample Analysis Results

Results for specific analyses are reported as either a "less than" (<) value or an actual activity value. The reporting of results in Table 4 under the heading "Range" and in Tables 5-14 is an "a posteriori" calculation based on the actual analysis performed using the actual sample values for E, V, Y and dt. Typically the reported "less than" (<) results are lower than the required Wisconsin DHS LLD indicating that the required DHS LLD has been met.

An actual activity value will be accompanied by an uncertainty term for that analysis. The uncertainty term is a plus or minus counting uncertainty term at the 2 sigma (95%) confidence interval and is printed as (+- or ±). Examples and explanations of data reporting are:

Example	Nuclide	Activity reported
1	¹³⁷ Cs	< 10 pCi/liter
2	¹³⁷ Cs	15 ± 3 pCi/liter

In example 1 we can be 95% confident that the sample activity, if any, is less than the LLD of 10 pCi/liter. In example 2 we can be 95% confident that the actual sample activity is greater than the LLD for that analysis and is between 12 and 18 pCi/liter.

Table 1. Wisconsin DHS Prairie Island environmental monitoring sampling sites.

Sample site	Distance and direction (miles)	Location description
PRI-1a	11.6 NW	Prescott; air site
PRI-1b	11.6 NW	Prescott; harbor area
PRI-2	3.6 ESE	Trenton
PRI-4a	8.7 ESE	Bay City park
PRI-4b	8.7 ESE	Bay City, Hwy 35
PRI-5	4.8 ESE	Hager City
PRI-6a	1.9 NNE	Diamond Bluff; Pierce County highway shed
PRI-6b	1.8 NNE	Diamond Bluff cemetery
PRI-8	3.4 N	Station 2 – farm
PRI-9	6.6 ESE	Bay City substation on Hwy 35
PRI-16	11.4 NE	Dairy Farm 356-177 Ellsworth (Started Sept 2017) – discontinued Aug 2018
PRI-16	18.4 NNE	Dairy Farm 356-283 Ellsworth (Started Aug 2018) - Control
PRI-17	7.5 NE	Dairy Farm 356-690 Ellsworth (Started September 2017)
PRI-18	7.3 NE	Dairy Farm 356-323 Ellsworth (Started Oct 2017)
PRI-T30	1.9 N	Diamond Bluff
PRI-T31	1.7 NNE	Diamond Bluff
PRI-T32	1.8 ENE	290th Avenue
PRI-T33	4.4 N	Hwy 35, Thomas Killian residence
PRI-T34	4.7 NE	Cty K and 840th Street
PRI-T35	5.2 E	Cty W and 790th Street
PRI-T36	4.8 ESE	Hager City
PRI-T37	10.3 NE	Ellsworth
PRI-T38	8.9 ESE	Bay City, Hwy 35
PRI-T39	11.6 NW	Prescott

Table 2. Sample collection summary and required analyses for 2018.

Sample Type	Collection and Frequency	Site Locations	Number of Samples Collected	Number of Sample Deviations	Required Analyses
Air particulate	C/BW	1a, 6a, 9	78	2	GA, GB, GI ^w
Air iodine	C/BW	1a, 6a, 9	78	1	GI
Precipitation	C/BW	1a, 9	12	1	GB ^x , H ^x
TLD	C/Q	T30 – T39	38	2	direct exposure
Surface water	G/SA	1b, 2, 4a	6	0	GA, GB, GI, Sr, H
Fish	G/SA	upstream, downstream	4	0	GI
Vegetation	G/SA	1a, 4b, 5, 6a, 8, 9	12	0	GA, GB, GI
Soil	G/SA	1a, 4b, 5, 6a, 8, 9	12	0	GA, GB, GI
Well water	G/SA	4a, 5, 6b	6	0	GA, GB, H
Milk	G/M	16, 17, 18	24	0	GI, I ^y , Sr

Collection type: C/ = continuous; G/ = grab

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

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

^w = A quarterly composite for each site

^x = One monthly composite from 2 sites

^y = The procedure is performed six (6) times per year for each sample site

^z = The procedure is performed for each site on a quarterly composite (3 month composite)

Table 3. Wisconsin DHS missing sample report or non-routine analyses.

Sample type	Date	Site	Explanation
gross beta	8/1/18	PRI-6	Low air volume
gross beta	12/04/18	PRI-6	Low air volume
gross beta	6/20/18	PRI-9	Data unavailable
gross beta	08/13/18	PRI-9	Low air volume
Air Iodine	06/20/18	PRI-9	Not reported by lab
TLD	2 nd Quarter	PRI-T35	Lost in the field
TLD	3 rd Quarter	PRI-T31	Lost in the field
Precipitation	04/09/18	composite	Beta not reported by lab
Precipitation	05/09/18	PRI-1 & PRI-9	Analyzed past 180 days holding time.
Precipitation	06/06/18	PRI-1 & PRI-9	Analyzed past 180 days holding time.
Precipitation	07/02/18	PRI-1 & PRI-9	Analyzed past 180 days holding time.
Precipitation	08/13/18	PRI-1 & PRI-9	Analyzed past 180 days holding time.
Milk	02/05/18	PRI-16	Carrier recovery less than 40% - false positive
Milk	08/21/18	PRI-18	Carrier recovery less than 40% - false positive
Fish	09/24/18	upstream and downstream	Insufficient sample size, combined 3 samples, Carp, Fresh Water Drum – upstream, Fresh Water Drum – downstream

Results and Discussion for the Wisconsin DHS Prairie Island Environmental Monitoring program

Air Particulate

Table 4 provides a summary of reported activities by Wisconsin DHS for air particulate samples. Tables 5–6 provide results from the individual sample analyses.

Table 5 shows gross beta activities; it may be noted that there were no significant differences due to distance away from the Prairie Island facility. Although the gross beta activity was above the LLD, it was similar to previous years; and the elevated activity could not be attributed to the Prairie Island plant operation.

Table 6 provides gamma isotopic analysis of the quarterly air particulate filter composites. Only a small amount of the radioactive Beryllium-7 (^7Be), was detected in all composites. Beryllium-7 is a naturally occurring radioisotope that is constantly produced through nuclear reactions between cosmic rays and nuclei in the atmosphere. It was detected in air composites from other areas of the state on a routine basis. Influence by the Prairie Island nuclear generating facility on air quality is not evident from air particulate analysis.

Air Iodine

Table 4 provides a summary of reported activities by Wisconsin DHS for air iodine samples. Table 5 provide results from the individual sample analyses

All iodine measurements were below the LLD of 0.07 pCi/m^3 . Influence by the Prairie Island nuclear generating facility on air quality is not evident from air iodine analysis.

Ambient Gamma Radiation—Thermoluminescent Dosimeters (TLD)

Table 4 provides a summary of reported activities by Wisconsin DHS for ambient gamma radiation. Table 7 provides results from the individual sample analyses

Direct radiation (TLD) data for 2018 from the Wisconsin DHS network was comparable for all sites. Samples taken at varying distances from the Prairie Island nuclear facility did not result in significant differences in exposure. The average quarterly exposure from the ten sites located within Wisconsin was 15.4 ± 2.23 milliroentgens. The average quarterly exposure for 2018 is at background levels and is comparable to other areas within Wisconsin. Influence by the Prairie Island nuclear facility is not evident from air ambient gamma radiation analysis.

Precipitation

Table 4 provides a summary of reported activities by Wisconsin DHS for precipitation. Table 8 provides results from the individual sample analyses.

The results for gross beta activity in precipitation fell within the normal range of activity when compared to previous years' data. Influence by the Prairie Island nuclear facility is not evident from precipitation analysis.

Surface Water

Table 4 provides a summary of reported activities by Wisconsin DHS for surface water samples. Table 9 provides results from the individual sample analyses.

Gamma isotopic analysis for radioisotopes were near or below their respective LLD. Reported activities for gross beta; gross alpha and tritium (^3H) were at or near background levels and were comparable to data from previous years. The surface water samples uniformly showed activities well below state or federal standards. Influence by the Prairie Island nuclear facility is not evident from surface water sample analysis.

Fish

Table 4 provides a summary of reported activities by Wisconsin DHS for fish samples. Table 11 provides results from the individual sample analyses.

The fish samples showed no unusual activities. Naturally occurring potassium-40 (^{40}K) was detected in all samples. All other radioisotopes were below their respective LLD. Influence by the Prairie Island nuclear facility is not evident from fish sample analysis.

Well Water

Table 4 provides a summary of reported activities by Wisconsin DHS for well water samples. Table 10 provides results from the individual sample analyses.

The well water samples showed no unusual gross alpha and gross beta activities and all activities for tritium (^3H) were less than its LLD. The measured activities were all below state and federal standards. Influence by the Prairie Island nuclear facility is not evident from well water sample analysis.

Milk

Table 4 provides a summary of reported activities by Wisconsin DHS for milk samples. Table 12 provides results from the individual sample analyses.

Three milk samples contained iodine that exceeded the LLD, two of which had issues with the laboratory analysis. Naturally occurring potassium-40 (^{40}K) was detected in all samples at activity levels similar to previous years. The detected activities for strontium-90 (^{90}Sr) are attributable to residual fallout from previous atmospheric nuclear weapons testing and were also detected in previous years at similar activity levels. Influence by the Prairie Island nuclear facility is not evident from milk sample analysis.

Vegetation

Table 4 provides a summary of reported activities by Wisconsin DHS for vegetation samples. Table 13 provides results from the individual sample analyses.

Analysis of the vegetation samples showed no unusual activities. The gamma isotopic analysis detected only small amounts of the naturally occurring radioisotopes beryllium-7 (^7Be) and potassium-40 (^{40}K). All other radioisotopes were below their respective LLD except for Gross Beta, which were at background levels similar to previous years. Influence by the Prairie Island nuclear facility is not evident from vegetation sample analysis.

Soil

Table 4 provides a summary of reported activities by Wisconsin DHS for soil samples. Table 14 provides results from the individual sample analyses.

Analysis of the soil samples showed no unusual activities. The gamma isotopic analysis detected only small amounts of radioactive Potassium-40 (^{40}K), which is a naturally occurring radioisotope. Cesium-137 (^{137}Cs) was also detected in current and previous years samples. The cesium-137 radioisotopes are attributable to fallout from previous atmospheric nuclear tests. Naturally occurring radioisotopes from the uranium-238 (^{238}U) and thorium-232 (^{232}Th) decay series are commonly detected but have not been quantified or reported. Gross Beta was at background and consistent with previous years. Influence by the Prairie Island facility is not evident from soil sample analysis.

Dose to an Average Individual

Federal regulations 10 CFR 20, 10 CFR 50 Appendix I and 40 CFR 190 restrict the annual exposure of the population from all parts of the nuclear fuel cycle, including nuclear power plants. Doses resulting from gaseous and liquid effluent releases from the Prairie Island nuclear generating facility are less than the limits as stated in these Federal regulations.

The Wisconsin DHS limit for permissible levels of radiation exposure from external sources in unrestricted areas is defined in the Wis. Admin. Code § DHS 157.23. Doses resulting from gaseous and liquid effluent releases from the Prairie Island nuclear generating facility are less than the limits stated in Wis. Admin. Code § DHS 157.23.

References

State of Wisconsin, Wis. Admin. Code § DHS 157.23

U.S. Environmental Protection Agency (EPA), Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion, Federal Guidance Report No. 11, EPA-520/1-88-020, (Office of Radiation Programs Washington, DC), September 1988.

U.S. Environmental Protection Agency, Environmental Radiation Requirements for Normal Operations of Activities in the Uranium Fuel Cycle, EPA 520/4-76-016, 40 CFR Part 190, November 1976.

U.S. Nuclear Regulatory Commission, Title 10, Part 20.

U.S. Nuclear Regulatory Commission, Title 10, Part 50, Appendix I.

Sample Activity Summary

Table 5 Sample activity summary for the Wisconsin DHS Prairie Island environmental monitoring program.

Sample type (units)	LLD	Number of samples ^a	Analysis	Range
Air particulate (pCi/m ³)	0.005	78 / 78	gross beta	0.010 - 0.635
			gamma isotopic	
	0.030	12 / 0	Barium 140	0.0033
	0.020	12 / 12	Beryllium 7	0.048 - 0.108
	0.002	12 / 0	Cerium 141	< 0.0008
	0.005	12 / 0	Cerium 144	< 0.0026
	0.002	12 / 0	Cesium 134	< 0.0004
	0.002	12 / 0	Cesium 137	< 0.0005
	0.002	12 / 0	Cobalt 58	< 0.0004
	0.002	12 / 0	Cobalt 60	< 0.0005
	0.020	12 / 0	Iodine 131	< 0.0017
	0.005	12 / 0	Iron 59	< 0.0009
	0.020	12 / 0	Lanthanum 140	< 0.0014
	0.002	12 / 0	Manganese 54	< 0.0004
	0.002	12 / 0	Niobium 95	< 0.0005
	0.002	12 / 0	Ruthenium 103	< 0.0005
	0.015	12 / 0	Ruthenium 106	< 0.0041
	0.005	12 / 0	Zinc 65	< 0.0008
	0.005	12 / 0	Zirconium 95	< 0.0008
Air iodine (pCi/m ³)	0.07	77 / 0	I-131	< 0.0656
Surface Water (pCi/liter)	3.0	6 / 0	Gross Alpha Sus Sol	< 0.901
	3.0	6 / 0	Gross Beta Sus Sol	< 1.07 - 1.47
	3.0	6 / 0	Gross Alpha	< 1.37 - 1.79
	3.0	6 / 1	Gross Beta	< 0.949 - 3.95
	300	6 / 0	Tritium	< 231
	2.0	6 / 0	Strontium 89	< 0.259
	1.0	6 / 0	Strontium 90	< 0.233 - 0.546
			gamma isotopic	
	60	6 / 0	Barium 140	< 43.6
	15	6 / 0	Cesium 134	< 9.32
	15	6 / 0	Cesium 137	< 9.89
	15	6 / 0	Cobalt 58	< 9.48
	15	6 / 0	Cobalt 60	< 12.3
	15	6 / 0	Iodine 131	< 12.9
	30	6 / 0	Iron 59	< 18.2
	15	6 / 0	Lanthanum 140	< 14.5
	15	6 / 0	Manganese 54	< 9.74
	15	6 / 0	Niobium 95	< 9.83
	30	6 / 0	Zinc 65	< 17.1
	30	6 / 0	Zirconium 95	< 17

Table 4 (continued). Sample activity summary for the Wisconsin DHS Prairie Island environmental monitoring program.

Sample type (units)	LLD	Number of samples ^a	Analysis	Range
Fish (pCi/kg wet)			gamma isotopic	
	50	4 / 0	Cesium 134	< 8
	60	4 / 0	Cesium 137	< 6
	60	4 / 0	Cobalt 58	< 8
	60	4 / 0	Cobalt 60	< 7
	130	4 / 0	Iron 59	< 22
	50	4 / 0	Manganese 54	< 8
	50	4 / 0	Niobium 95	< 20
	800	4 / 4	Potassium 40	2310 - 2480
	130	4 / 0	Zinc 65	< 18
100	4 / 0	Zirconium 95	< 13	
Precipitation (nCi/m ²)	1.5	11 / 0	gross beta	< 0.39 – 0.77
	300	12 / 0	H-3	< 42
Well water (pCi/liter)	3.0	6 / 0	gross alpha	< 1.96 - 1.71
	3.0	6 / 0	gross beta	< 1.1 - 1.61
	300	6 / 0	H-3	< 231
Vegetation (pCi/kg wet)	5000	12 / 0	Gross Alpha	< 1570 - 2090
	4000	12 / 12	Gross Beta	4040 - 7980
			gamma isotopic	
	350	12 / 0	Barium 140	< 129
	600	12 / 12	Beryllium 7	829 - 9040
	80	12 / 0	Cesium 134	< 22.1
	90	12 / 0	Cesium 137	< 28.8
	100	12 / 0	Cobalt 58	< 20.4
	100	12 / 0	Cobalt 60	< 25.9
	80	12 / 0	Iodine 131	< 55.3
	200	12 / 0	Iron 59	< 53.1
	100	12 / 0	Lanthanum 140	< 39.4
	90	12 / 0	Manganese 54	< 22.3
	100	12 / 0	Niobium 95	< 23
	2000	12 / 12	Potassium 40	3340 - 6030
250	12 / 0	Zinc 65	< 47.7	
200	12 / 0	Zirconium 95	< 41.6	

Table 4 (continued). Sample activity summary for the Wisconsin DHS Prairie Island environmental monitoring program.

Sample type (units)	LLD	Number of samples ^a	Analysis	Range
Soil (pCi/kg dry)	15000	12 / 0	Gross Alpha	< 5810 - 13600
	6000	12 / 12	Gross Beta	119 - 21100
			gamma isotopic	
	80	12 / 0	Cesium 134	< 29.0
	80	12 / 6	Cesium 137	< 43.9 - 350
	90	12 / 0	Cobalt 58	< 35.2
	90	12 / 0	Cobalt 60	< 27.3
	600	12 / 0	Iron 59	< 157
	60	12 / 0	Manganese 54	< 25.9
	100	12 / 0	Niobium 95	< 98.2
	800	12 / 12	Potassium 40	11000 - 15300
	300	12 / 0	Zinc 65	< 60.2
	250	12 / 0	Zirconium 95	< 87.6
	Milk (pCi/liter)	0.5	12 / 3	Iodine 131
1.5		24 / 0	Strontium 90	< 0.6 - 3.34
			gamma isotopic	
350		24 / 0	Barium 140	< 44.1
80		24 / 0	Cesium 134	< 12.3
90		24 / 0	Cesium 137	< 12.6
600		24 / 0	Cobalt 58	< 12.2
100		24 / 0	Cobalt 60	< 14
80		24 / 0	Iodine 131	< 23.7
200		24 / 0	Iron 59	< 22.6
100		24 / 0	Lanthanum 140	< 14.9
90		24 / 0	Manganese 54	< 11.9
100		24 / 0	Niobium 95	< 11.5
2000		24 / 0	Potassium 40	1130 - 1510
250		24 / 0	Zinc 65	< 27.4
200		24 / 0	Zirconium 95	< 23.6
Ambient radiation (TLD) (mR/Std Qtr)	1.0 ^c	38 / 38	direct exposure	11.1 - 21.2

a - Number of analyses / number of analyses detected above the Wisconsin DHS LLD.

b - LLD (minimum detectable concentration) activities expressed in units of pCi/liter.

c - 1.0 mR / TLD



Table 6. Wisconsin DHS air particulate gross beta and air iodine (I-131) analysis results from the Prairie Island environmental monitoring program.

Measurements in units of pCi/m³

PRI-1 (3100 series); Prescott

1st Qtr			
Collection date	Volume m ³	Air particulate	Air iodine
01/03/18	926.9	0.0306 ± 0.0013	< 0.0113
01/17/18	971	0.0271 ± 0.0012	< 0.0120
01/30/18	886.7	0.0344 ± 0.0014	< 0.0201
02/13/18	990.3	0.0267 ± 0.0012	< 0.0080
02/27/18	959.2	0.0229 ± 0.0012	< 0.0143
03/13/18	953.3	0.0200 ± 0.0011	< 0.0184
03/27/18	937.2	0.0193 ± 0.0011	< 0.0080
mean +- s.d.		0.0154 ± 0.0207	< 0.0140

2nd Qtr			
Collection date	Volume m ³	Air particulate	Air iodine
04/10/18	955	0.0192 ± 0.0011	< 0.0171
04/27/18	1124.4	0.0190 ± 0.0010	< 0.0130
05/11/18	877	0.0107 ± 0.0011	< 0.0109
05/22/18	660.5	0.015 ± 0.0013	< 0.0186
06/05/18	782.1	0.0201 ± 0.0013	< 0.0233
06/20/18	858.8	0.0145 ± 0.0011	< 0.0119
mean +- s.d.		0.0146 ± 0.0116	< 0.0158

3rd Qtr			
Collection date	Volume m ³	Air particulate	Air iodine
07/04/18	742.4	0.0182 ± 0.0013	< 0.0121
07/19/18	566	0.0239 ± 0.0017	< 0.0196
08/01/18	737.7	0.0262 ± 0.0014	< 0.0079
08/13/18	683.4	0.0141 ± 0.0012	< 0.0188
08/28/18	741.4	0.0178 ± 0.0013	< 0.0294
09/11/18	742.4	0.0182 ± 0.0013	< 0.0262
09/26/18	566	0.0239 ± 0.0017	< 0.0296
mean +- s.d.		0.0203 ± 0.0044	< 0.0190

4th Qtr			
Collection date	Volume m ³	Air particulate	Air iodine
10/10/18	712.8	0.0112 ± 0.0011	< 0.0017
10/23/18	684.2	0.0165 ± 0.0013	< 0.0085
11/07/18	772.7	0.0173 ± 0.0012	< 0.0252
11/20/18	691.8	0.022 ± 0.0014	< 0.0098
12/04/18	743.9	0.0279 ± 0.0015	< 0.0216
12/18/18	736.7	0.0459 ± 0.0018	< 0.0152
mean +- s.d.		0.0140 ± 0.0113	< 0.0137

PRI-6 (3200 series); Diamond Bluff

1st Qtr			
Collection date	Volume m ³	Air particulate	Air iodine
01/03/18	918.1	0.031 ± 0.0014	< 0.0154
01/17/18	962.2	0.026 ± 0.0012	< 0.0090
01/30/18	875.4	0.0314 ± 0.0014	< 0.0229
02/13/18	984.9	0.0253 ± 0.0012	< 0.0174
02/27/18	949	0.0262 ± 0.0012	< 0.0127
03/13/18	947.7	0.0204 ± 0.0011	< 0.0097
03/27/18	934	0.0187 ± 0.0011	< 0.0069
mean +- s.d.		0.0153 ± 0.0207	< 0.0145

2nd Qtr			
Collection date	Volume m ³	Air particulate	Air iodine
04/10/18	952.7	0.0197 ± 0.0011	< 0.0143
04/28/18	1126.6	0.0187 ± 0.0010	< 0.0155
05/11/18	884.6	0.0168 ± 0.0011	< 0.0175
05/22/18	863	0.0141 ± 0.0012	< 0.0307
06/05/18	816.3	0.0196 ± 0.0012	< 0.0212
06/20/18	899	0.0170 ± 0.0011	< 0.0180
mean +- s.d.		0.0177 ± 0.0022	< 0.0195

3rd Qtr			
Collection date	Volume m ³	Air particulate	Air iodine
07/04/18	792.3	0.0169 ± 0.0012	< 0.011
07/19/18	849.9	0.0167 ± 0.0011	< 0.0189
08/01/18	46.2	0.0194 ± 0.0060	< 0.0656
08/13/18	583.8	0.0252 ± 0.0017	< 0.0205
08/28/18	821.3	0.0269 ± 0.0014	< 0.0114
09/11/18	761.4	0.0134 ± 0.0012	< 0.0195
09/26/18	622.7	0.0222 ± 0.0016	< 0.0186
mean +- s.d.		0.0201 ± 0.0049	< 0.0245

4th Qtr			
Collection date	Volume m ³	Air particulate	Air iodine
10/10/18	796.3	0.0100 ± 0.0011	< 0.0132
10/23/18	771.1	0.0143 ± 0.0012	< 0.0177
11/07/18	868.4	0.0168 ± 0.0012	< 0.0065
11/20/18	1281.3	0.0142 ± 0.0008	< 0.0122
12/04/18	360.5	0.0635 ± 0.0015	< 0.0544
12/18/18	831	0.0443 ± 0.0017	< 0.0115
mean +- s.d.		0.0272 ± 0.0217	< 0.0193

*a = Data unavailable

Table 5 (continued). Wisconsin DHS air particulate gross beta and air iodine (I-131) analysis results from the Prairie Island environmental monitoring program.



Measurements in units of pCi/m³

PRI-9 (3400 series); Bay City substation

1st Qtr			
Collection date	Volume m ³	Air particulate	Air iodine
01/03/18	1113	0.0318 ± 0.0013	< 0.0106
01/17/18	1169	0.0260 ± 0.0012	< 0.0112
01/30/18	1065	0.0328 ± 0.0014	< 0.0199
02/13/18	1189	0.0256 ± 0.0012	< 0.0161
02/27/18	1161	0.0260 ± 0.0012	< 0.0107
03/13/18	1154	0.0212 ± 0.0011	< 0.0135
03/27/18	1147	0.0191 ± 0.0011	< 0.0054
mean +- s.d.		0.0261 ± 0.0050	< 0.0125

2nd Qtr			
Collection date	Volume m ³	Air particulate	Air iodine
04/10/18	1163	0.0179 ± 0.0009	< 0.0094
04/27/18	1391	0.0163 ± 0.0010	< 0.0093
05/11/18	1109	0.0137 ± 0.0011	< 0.0160
05/22/18	862	0.0175 ± 0.0011	< 0.0109
06/05/18	1076	0.0148 ± 0.0010	< 0.0156
06/20/18	1071	0.0177 ± 0.0011	*a
mean +- s.d.		0.0166 ± 0.0020	<0.0122

3rd Qtr			
Collection date	Volume m ³	Air particulate	Air iodine
07/04/18	1071	0.0159 ± 0.0010	< 0.0075
07/19/18	1164	0.0156 ± 0.0011	< 0.0137
08/01/18	1025	0.0229 ± 0.0018	< 0.0077
08/13/18	54	0.0301 ± 0.0017	< 0.0623
08/28/18	693	0.0158 ± 0.0014	< 0.0291
09/11/18	643	0.0192 ± 0.0014	< 0.0166
09/26/18	701	0.0118 ± 0.0013	< 0.0179
mean +- s.d.		0.0196 ± 0.0053	< 0.0221

4th Qtr			
Collection date	Volume m ³	Air particulate	Air iodine
10/10/18	659	0.0118 ± 0.0013	< 0.0141
10/23/18	642	0.0151 ± 0.0014	< 0.0164
11/07/18	727	0.0177 ± 0.0014	< 0.0086
11/20/18	659	0.0226 ± 0.0016	< 0.0175
12/04/18	709	0.0282 ± 0.0016	< 0.0245
12/18/18	704	0.0468 ± 0.0020	< 0.0159
mean +- s.d.		0.0237 ± 0.0127	< 0.0162

*a = Data unavailable

Table 7. Wisconsin DHS gamma isotopic analysis results from the quarterly composites of air particulate filters collected from the Prairie Island environmental monitoring program.



Measurements in units of pCi/m³

Site: PRI-1	1st quarter	2nd quarter	3 rd quarter	4th quarter
Barium 140	< 0.003	< 0.0024	< 0.0029	< 0.0026
Beryllium 7	0.0696 ± 0.0066	0.108 ± 0.0073	0.0897 ± 0.0082	0.0486 ± 0.0039
Cerium 141	< 0.0008	< 0.0003	< 0.0005	< 0.0003
Cerium 144	< 0.0026	< 0.0008	< 0.0017	< 0.0008
Cesium 134	< 0.0004	< 0.0002	< 0.0004	< 0.0001
Cesium 137	< 0.0005	< 0.0001	< 0.0002	< 0.0001
Cobalt 58	< 0.0004	< 0.0001	< 0.0003	< 0.0002
Cobalt 60	< 0.0005	< 0.0002	< 0.0003	< 0.0001
Iodine 131	< 0.0014	< 0.0016	< 0.0016	< 0.0017
Iron 59	< 0.0009	< 0.0004	< 0.0007	< 0.0005
Lanthanum 140	< 0.0009	< 0.0010	< 0.0014	< 0.0009
Manganese 54	< 0.0003	< 0.0001	< 0.0004	< 0.0001
Niobium 95	< 0.0005	< 0.0003	< 0.0005	< 0.0003
Ruthenium 103	< 0.0005	< 0.0002	< 0.0004	< 0.0002
Ruthenium 106	< 0.0041	< 0.0015	< 0.0028	< 0.0014
Zinc 65	< 0.0007	< 0.0003	< 0.0006	< 0.0003
Zirconium 95	< 0.0007	< 0.0004	< 0.0008	< 0.0003

Site: PRI-6

Barium 140	< 0.0017	< 0.0024	< 0.0028	< 0.0025
Beryllium 7	0.0599 ± 0.0058	0.0946 ± 0.007	0.0877 ± 0.0078	0.0483 ± 0.0038
Cerium 141	< 0.0004	< 0.0003	< 0.0005	< 0.0003
Cerium 144	< 0.0012	< 0.001	< 0.0017	< 0.0008
Cesium 134	< 0.0003	< 0.0002	< 0.0004	< 0.0001
Cesium 137	< 0.0002	< 0.0001	< 0.0003	< 0.0001
Cobalt 58	< 0.0002	< 0.0002	< 0.0004	< 0.0002
Cobalt 60	< 0.0003	< 0.0002	< 0.0005	< 0.0001
Iodine 131	< 0.0007	< 0.0015	< 0.0017	< 0.0017
Iron 59	< 0.0004	< 0.0003	< 0.0008	< 0.0004
Lanthanum 140	< 0.0004	< 0.0010	< 0.0013	< 0.0007
Manganese 54	< 0.0002	< 0.0002	< 0.0004	< 0.0001
Niobium 95	< 0.0003	< 0.0003	< 0.0004	< 0.0002
Ruthenium 103	< 0.0002	< 0.0002	< 0.0003	< 0.0002
Ruthenium 106	< 0.0026	< 0.0017	< 0.0032	< 0.0012
Zinc 65	< 0.0006	< 0.0003	< 0.0008	< 0.0003
Zirconium 95	< 0.0006	< 0.0004	< 0.0007	< 0.0003

Site: PRI-9

Barium 140	< 0.0028	< 0.002	< 0.0033	< 0.0022
Beryllium 7	0.0713 ± 0.0063	0.0851 ± 0.006	0.079 ± 0.0072	0.0569 ± 0.0039
Cerium 141	< 0.0007	< 0.0002	< 0.0004	< 0.0003
Cerium 144	< 0.0021	< 0.0007	< 0.0013	< 0.0007
Cesium 134	< 0.0004	< 0.0001	< 0.0003	< 0.0002
Cesium 137	< 0.0004	< 0.0001	< 0.0003	< 0.0002
Cobalt 58	< 0.0003	< 0.0001	< 0.0003	< 0.0002
Cobalt 60	< 0.0004	< 0.0001	< 0.0003	< 0.0002
Iodine 131	< 0.0012	< 0.0014	< 0.0014	< 0.0017
Iron 59	< 0.0007	< 0.0004	< 0.0005	< 0.0004
Lanthanum 140	< 0.0009	< 0.0008	< 0.0010	< 0.0010
Manganese 54	< 0.0002	< 0.0001	< 0.0003	< 0.0001
Niobium 95	< 0.0004	< 0.0002	< 0.0004	< 0.0002
Ruthenium 103	< 0.0004	< 0.0001	< 0.0004	< 0.0002
Ruthenium 106	< 0.0029	< 0.0011	< 0.0026	< 0.0012
Zinc 65	< 0.0005	< 0.0002	< 0.0005	< 0.0003
Zirconium 95	< 0.0006	< 0.0003	< 0.0006	< 0.0003

Radioisotopes other than those reported were not detected

Table 8. Wisconsin DHS TLD network for the Prairie Island environmental monitoring program.



	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Date Placed:	01/11/18	04/11/18	07/17/18	10/10/18
Date Removed:	04/11/18	07/17/18	10/10/18	01/15/19
Days in the Field:	89	97	85	97
Location:	Individual quarterly date is reported as: mR / Standard Quarter + 2 sigma counting error.			

TLD sites that are located 0 – 2 miles from the Prairie island facility.

T30	14.7 ± 0.9	13.8 ± 0.6	15.8 ± 0.6	15.6 ± 0.7
T31	11.2 ± 0.7	11.1 ± 0.6	ND	12.4 ± 1
T32	14.3 ± 0.9	14 ± 1.1	16.5 ± 1	15.9 ± 1.7
Quarterly average +- s.d.	13.4 ± 1.9	13 ± 1.7	16.2 ± 0.5	14.7 ± 2

TLD sites that are located 2– 5 miles from the Prairie island facility

T33	14.9 ± 0.7	15 ± 0.6	16.1 ± 0.7	16.7 ± 0.9
T34	18.3 ± 0.7	16.8 ± 0.6	21.2 ± 0.6	18 ± 0.8
T35	15.7 ± 0.7	ND	17.4 ± 0.8	14.2 ± 0.7
T36	17.8 ± 0.8	13.3 ± 0.7	19.8 ± 1	15.1 ± 0.8
Quarterly average +- s.d.	16.7 ± 0.1	15.0 ± 1.6	18.6 ± 2.4	16 ± 1.7

TLD sites that are located greater than 5 miles from the Prairie island facility

T37	14.1 ± 1.2	13.8 ± 0.6	14.5 ± 1	15.5 ± 0.8
T38	16.6 ± 0.7	12.7 ± 0.9	17.1 ± 0.7	14.5 ± 1
T39	13 ± 0.7	14.3 ± 0.6	13.8 ± 0.7	15.4 ± 0.8
Quarterly average +- s.d.	14.6 ± 1.8	13.6 ± 0.9	15.1 ± 1.8	15.2 ± 0.6

ND – The TLD was lost in the field.

Table 9. Wisconsin DHS analysis results for precipitation samples collected for the Prairie Island environmental monitoring program.



Measurements in units of nCi/m2

monthly composite sample

Collection	inches	Gross beta	Tritium
01/03/18	0.76	0.23 ± 0.02	< 4.19
02/13/18	1.66	0.31 ± 0.03	< 9.11
03/13/18	0.62	0.18 ± 0.01	< 3.39
04/09/18	1.85	*a *a	< 11.00
05/09/18	4.40	< 0.28 *b	< 26.04 *b
06/06/18	6.53	< 0.37 *b	< 38.48 *b
07/02/18	3.10	< 0.16 *b	< 18.19 *b
08/05/18	7.12	< 0.39 *b	< 41.60 *b
09/11/18	3.22	0.22 ± 0.10	< 18.89
10/01/18	5.03	< 0.28	< 29.51
11/07/18	0.82	0.05 ± 0.03	< 4.79
12/04/18	1.71	0.77 ± 0.10	< 9.95

*a = not reported by lab

*b = analyzed past 180 days holding time

Table 10. Wisconsin DHS analysis results for surface water samples collected for the Prairie Island environmental monitoring program.



Measurements in units of pCi/liter

Site:	PRI-1	PRI-2	PRI-4a	PRI-1	PRI-2	PRI-4a
Collection date:	05/09/18	05/10/18	05/10/18	09/14/18	09/12/18	09/12/18
Gross Alpha Sus Sol	< 0.611	< 0.823	< 0.619	< 0.901	< 0.778 *a	< 0.615 *a
Gross Beta Sus Sol	0.932 ± 0.577	< 1.07	< 1.04	< 1.01	1 ± 0.648 *a	1.47 ± 0.66 *a
Gross Alpha	< 0.718	< 0.522	< 0.628	< 1.37	1.79 ± 1.14 *a	< 1.12 *a
Gross Beta	1.31 ± 0.639	1.76 ± 0.644	1.62 ± 0.809	2.64 ± 1.25	3.95 ± 1.09 *a	< 0.949 *a
Iodine 131	< 7.64	< 11.2	< 12.9	< 8.62	< 12.4 *a	< 9.24 *a
Tritium	< 231	< 231	< 231	< 231	< 229 *a	< 229 *a
Strontium 89	< 0.217	< 0.243	< 0.209	< 0.185	< 0.227 *a	< 0.259 *a
Strontium 90	0.244 ± 0.080	0.395 ± 0.094	0.546 ± 0.090	< 0.155	< 0.173 *a	< 0.233 *a
gamma isotopic						
Barium 140	< 25.8	< 38.2	< 43.6	< 28.7	< 35.8 *a	< 25.5 *a
Cesium 134	< 6.26	< 7.99	< 8.51	< 6.12	< 9.32 *a	< 5.43 *a
Cesium 137	< 5.58	< 6.62	< 9.89	< 5.49	< 8.06 *a	< 6.38 *a
Cobalt 58	< 5.34	< 9.48	< 9.4	< 6.16	< 7.68 *a	< 6.36 *a
Cobalt 60	< 4.94	< 9.06	< 12.3	< 7.13	< 9.01 *a	< 4.86 *a
Iodine 131	< 7.64	< 11.2	< 12.9	< 8.62	< 12.4 *a	< 9.24 *a
Iron 59	< 12	< 13.8	< 18.2	< 11.7	< 14.8 *a	< 13.3 *a
Lanthanum 140	< 9	< 14.5	< 10.1	< 9.49	< 12.6 *a	< 8.79 *a
Manganese 54	< 5.9	< 6.61	< 9.74	< 6.4	< 6.58 *a	< 5.45 *a
Niobium 95	< 5.85	< 9.83	< 5.96	< 7.37	< 8.73 *a	< 6.56 *a
Zinc 65	< 8.23	< 17.1	< 16.7	< 16.4	< 15.8 *a	< 14.1 *a
Zirconium 95	< 10.8	< 12.6	< 14.9	< 11.4	< 17 *a	< 12.8 *a

Radioisotopes other than those reported were not detected.

*a – Analyzed past the 180 days holding time

Table 11. Wisconsin DHS analysis results for well water samples collected for the Prairie Island environmental monitoring program.



Measurements in units of pCi/liter

	PRI-4a	PRI-5	PRI-6b	PRI-4a	PRI-5	PRI-6b
Collection date:	05/11/18	05/11/18	05/11/18	09/12/18	10/10/18	09/11/18
Gross Alpha	1.03 ± 0.612	< 1.96	0.996 ± 0.646	1.71 ± 0.706	< 1.13	< 1.69
Gross Beta	1.26 ± 0.59	< 1.1	< 0.837	< 1.02	1.61 ± 0.706	< 1.52
Tritium	< 231	< 231	< 231	< 231	< 231	< 224



Table 12. Wisconsin DHS analysis results for fish samples collected for the Prairie Island environmental monitoring program.

Measurements in units of pCi/kilogram (wet)

Collection date:	05/17/18	05/18/18	09/24/18	09/25/18
Location:	Downstream (P-13)	Upstream (P-19)	(P-13 & P-19)	Upstream (P-19)
Type:	Carp, White Bass	Carp, Fresh water drum, White Bass	Carp, Fresh water drum	Carp
gamma isotopic				
Cesium 134	< 4.42 *b	< 3.77 *b	< 7.69 *b	< 6.43
Cesium 137	< 4.48 *b	< 4.09 *b	< 6.25 *b	< 5.6
Cobalt 58	< 7.5 *b	< 7.35 *b	< 6.80 *b	< 6.91
Cobalt 60	< 5.17 *b	< 4.75 *b	< 7.11 *b	< 7.42
Iron 59	< 21.1 *b	< 19.6 *b	< 19.9 *b	< 22.3
Manganese 54	< 5.38 *b	< 5.31 *b	< 7.67 *b	< 6.16
Niobium 95	< 12.5 *b	< 13.5 *b	< 19.9 *b	< 8.19
Potassium 40	2330 ± 386 *b	2390 ± 400 *b	2480 ± 432 *b	2310 ± 404
Zinc 65	< 12.2 *b	< 12.7 *b	< 17.6 *b	< 16.2
Zirconium 95	< 13.1 *b	< 11.8 *b	< 13.2 *b	< 12.3

Radioisotopes other than those reported were not detected

*a = Sample was too small for analysis

*b = Sample was combined due to insufficient sample size



Table 13. Wisconsin DHS analysis results for milk samples collected for the Prairie Island environmental monitoring program.

Measurements in units of pCi/liter

Location	PRI-16	PRI-16	PRI-16	PRI-16	PRI-16	PRI-16
Collection date:	01/09/18	02/05/18	03/12/18	04/09/18	05/14/18	06/11/18
Iodine 131 *c		1.18 ± 0.316 *b	< 0.292	< 0.183		
Strontium 90	< 0.322	0.199 ± 0.0721	0.649 ± 0.208	< 0.317	0.418 ± 0.219	< 0.625
gamma isotopic						
Barium 140	< 27.4	< 20.6	< 34.5	< 26.5	< 30.8	< 33.7
Cesium 134	< 6.61	< 5.61	< 9.39	< 7.79	< 5.72	< 6.51
Cesium 137	< 6.38	< 4.83	< 10.2	< 6.7	< 7	< 5.68
Cobalt 58	< 6.05	< 3.88	< 8.39	< 6.42	< 7.14	< 6.86
Cobalt 60	< 8.19	< 5.52	< 7.94	< 7.52	< 7.87	< 8.49
Iodine 131	< 7.97	< 6.98	< 11.1	< 7.98	< 8.24	< 10.9
Iron 59	< 14.6	< 9.35	< 18.6	< 14.6	< 16	< 14.7
Lanthanum 140	< 9.26	< 4.98	< 13.9	< 7.89	< 9.75	< 10.7
Manganese 54	< 7.34	< 5.17	< 8.92	< 7.63	< 7.5	< 7.1
Niobium 95	< 7.54	< 5.44	< 8.66	< 6.13	< 8.5	< 9.44
Potassium 40	1390 ± 268	1380 ± 245	1230 ± 253	1480 ± 284	1380 ± 268	1430 ± 275
Zinc 65	< 14.6	< 11	< 19.8	< 18	< 16	< 15.2
Zirconium 95	< 12.8	< 7.86	< 15.3	< 11.7	< 12.4	< 12.6

Location	PRI-16	PRI-16	PRI-16	PRI-16	PRI-16	PRI-16
Collection date:	07/10/18	08/21/18	09/12/18	10/08/18	11/12/18	12/11/18
Iodine 131 *c	< 0.324	< 0.48			< 0.308	
Strontium 90	< 0.428	0.584 ± 0.198	0.784 ± 0.244	0.795 ± 0.224	0.567 ± 0.237	3.34 ± 0.317
gamma isotopic						
Barium 140	< 37.3	< 20	< 41.1	< 35.9	< 37.3	< 24.1
Cesium 134	< 9.33	< 4.14	< 10.6	< 9.05	< 11.1	< 6.1
Cesium 137	< 9.67	< 4.92	< 12.1	< 9.46	< 10.8	< 7.57
Cobalt 58	< 9.8	< 3.85	< 9.98	< 7.85	< 9.3	< 6.95
Cobalt 60	< 11.7	< 5.14	< 14	< 10.3	< 10.2	< 7.86
Iodine 131	< 11.2	< 7.24	< 10.6	< 10.4	< 11.1	< 6.15
Iron 59	< 16.9	< 7.73	< 22.6	< 18.4	< 21.3	< 12.1
Lanthanum 140	< 14.3	< 5.58	< 13.6	< 13.5	< 13	< 7.81
Manganese 54	< 11	< 3.92	< 9.24	< 9.26	< 9.82	< 7.16
Niobium 95	< 9.42	< 4.33	< 11	< 10.3	< 9.33	< 7.42
Potassium 40	1330 ± 275	1510 ± 250	1460 ± 312	1130 ± 237	1400 ± 271	1210 ± 242
Zinc 65	< 21.3	< 8.63	< 27.4	< 18.8	< 20	< 17.9
Zirconium 95	< 17.8	< 7.18	< 16.7	< 13.6	< 16.2	< 8.94

Radioisotopes other than those reported were not detected.

*a = Lower Limit of Detection not met

*b = Did not meet matrix recovery

*c - The analysis is performed bi-monthly

Table 12 (continued). Wisconsin DHS analysis results for milk samples collected for the Prairie Island environmental monitoring program.



Measurements in units of pCi/liter

Location	PRI-17	PRI-18	PRI-17	PRI-18	PRI-17	PRI-18
Collection date:	01/09/18	02/05/18	03/12/18	04/09/18	05/14/18	06/11/18
I-131 *c		0.643 ± 0.245	< 0.321	< 0.23		
Sr-90	0.314 ± 0.158	0.494 ± 0.0867	< 0.254	< 0.329	< 0.367	< 0.393
gamma isotopic						
Barium 140	< 43.9	< 18.5	< 33.2	< 40.3	< 44.1	< 36.3
Cesium 134	< 12.3	< 5.93	< 9.24	< 9.34	< 9.68	< 7.1
Cesium 137	< 10.7	< 5.87	< 8.86	< 11	< 12.6	< 8.7
Cobalt 58	< 11.4	< 4.63	< 10.4	< 9.7	< 8.79	< 6.76
Cobalt 60	< 13.4	< 6.98	< 11.4	< 12.1	< 12.6	< 8.05
Iodine 131	< 12.3	< 7.15	< 10	< 12.6	< 13.7	< 13.7
Iron 59	< 15.9	< 10.4	< 17.2	< 20.3	< 17.7	< 15.1
Lanthanum 140	< 14.2	< 6.28	< 14.9	< 12.8	< 13.2	< 12.2
Manganese 54	< 11.9	< 5.84	< 9.15	< 10	< 9.54	< 7.14
Niobium 95	< 11.5	< 5.4	< 8.39	< 10.3	< 11	< 7.38
Potassium 40	1260 ± 275	1380 ± 245	1270 ± 261	1160 ± 267	1370 ± 270	1430 ± 254
Zinc 65	< 23.1	< 11.3	< 21.9	< 31.2	< 20.5	< 13.3
Zirconium 95	< 19.3	< 8.11	< 12.2	< 19.8	< 15.5	< 11.6

Location	PRI-17	PRI-18	PRI-17	PRI-18	PRI-17	PRI-18
Collection date:	07/10/18	08/21/18	09/12/18	10/08/18	11/12/18	12/11/18
I-131 *c	< 0.29	< 0.773 *b			< 0.341	
Sr-90	< 0.349	0.583 ± 0.197	0.505 ± 0.25	1.4 ± 0.233	0.637 ± 0.259	1.03 ± 0.284
gamma isotopic						
Barium 140	< 24.8	< 10.6	< 40.9	< 41	< 38.9	< 31.4
Cesium 134	< 7.06	< 2.25	< 10.6	< 9.87	< 11	< 9.47
Cesium 137	< 6.85	< 2.25	< 10.4	< 11	< 10.7	< 10.9
Cobalt 58	< 6.06	< 2.42	< 12.2	< 10.5	< 9.64	< 8.49
Cobalt 60	< 8.47	< 2.59	< 13.2	< 13.3	< 11.1	< 10.4
Iodine 131	< 7.6	< 3.69	< 11.5	< 12.3	< 11.2	< 10.8
Iron 59	< 14.6	< 5.25	< 18	< 23.7	< 17.3	< 19.1
Lanthanum 140	< 6.15	< 3.67	< 10.4	< 11.2	< 14.8	< 14.7
Manganese 54	< 8.04	< 2.62	< 11	< 9.65	< 10.7	< 8.24
Niobium 95	< 7.13	< 2.71	< 10.4	< 10.6	< 9.95	< 10.5
Potassium 40	1350 ± 263	1350 ± 222	1270 ± 281	1390 ± 300	1300 ± 285	1310 ± 280
Zinc 65	< 15.9	< 5.65	< 21	< 28.3	< 25.1	< 22.1
Zirconium 95	< 10.5	< 4.5	< 18.5	< 23.6	< 14.8	< 19.6

Radioisotopes other than those reported were not detected.

*a = Lower Limit of Detection not met

*b = Did not meet matrix recovery

*c - The analysis is performed bi-monthly



Table 14. Wisconsin DHS analysis results for vegetation samples collected for the Prairie Island environmental monitoring program.

Measurements in units of pCi/kilogram (wet)						
Sample Location	PRI-1a	PRI-4b	PRI-5	PRI-6a	PRI-8	PRI-9
Collection Start	05/09/18	05/11/18	05/10/18	05/10/18	05/10/18	05/10/18
Gross Alpha	< 1110	< 723	< 785	659 ± 469	< 1570	< 501
Gross Beta	7980 ± 420	4090 ± 234	5960 ± 310	5910 ± 320	5160 ± 582	4950 ± 229
gamma isotopic						
Barium 140	< 109	< 86.8	< 57.4	< 129	< 85.4	< 101
Beryllium 7	1010 ± 161	829 ± 116	1070 ± 130	1490 ± 180	9040 ± 650	2320 ± 254
Cesium 134	< 21.3	< 16.3	< 11.4	< 22.1	< 14	< 19.7
Cesium 137	< 15.6	< 21.7	< 12	< 28.8	< 15.9	< 17.8
Cobalt 58	< 20.1	< 17	< 10.8	< 19.7	< 18	< 20.3
Cobalt 60	< 24.5	< 22	< 11.2	< 25.9	< 16.1	< 20.2
Iodine 131	< 37.5	< 31.9	< 18.8	< 55.3	< 36.7	< 42.4
Iron 59	< 48.4	< 38.5	< 29.1	< 50.5	< 36.2	< 53.1
Lanthanum 140	< 28.9	< 29.5	< 18.3	< 39.4	< 28.3	< 32.8
Manganese 54	< 18.6	< 16.2	< 11.9	< 22.3	< 18.3	< 21.8
Niobium 95	< 20.3	< 18.2	< 13.6	< 23	< 22.6	< 21.2
Potassium 40	5050 ± 933	4650 ± 811	5480 ± 939	5890 ± 1030	3830 ± 713	3950 ± 748
Zinc 65	< 40.7	< 41.1	< 27.4	< 47.7	< 35.7	< 35.4
Zirconium 95	< 40.4	< 27.5	< 17.1	< 41.6	< 29.9	< 35.6
Sample Location	PRI-1a	PRI-4b	PRI-5	PRI-6a	PRI-8	PRI-9
Collection Start	09/13/18	09/12/18	09/12/18	09/13/18	09/13/18	09/12/18
Gross Alpha	1550 ± 850	2090 ± 1140	866 ± 600	< 1190	< 1320	< 1420
Gross Beta	6840 ± 407	7960 ± 571	6360 ± 357	4760 ± 355	4040 ± 360	4920 ± 433
gamma isotopic						
Barium 140	< 79.5	< 78.3	< 69.3	< 69	< 53.4	< 69.1
Beryllium 7	2480 ± 241	4030 ± 325	3060 ± 262	3380 ± 292	3590 ± 283	4310 ± 377
Cesium 134	< 14.3	< 17.5	< 14.2	< 12.9	< 9.62	< 17.6
Cesium 137	< 14.8	< 14.1	< 16.3	< 14.2	< 10.2	< 18.2
Cobalt 58	< 15.6	< 13.4	< 13.5	< 14.2	< 13	< 20.4
Cobalt 60	< 13.6	< 20.2	< 17.6	< 19.1	< 11.5	< 17.6
Iodine 131	< 25.3	< 23.9	< 23.6	< 21.5	< 18.2	< 30.1
Iron 59	< 30	< 36.9	< 28.6	< 27.6	< 25.9	#N/A
Lanthanum 140	< 22.8	< 22.4	< 17.1	< 19.7	< 14.7	< 32.9
Manganese 54	< 14.4	< 16.3	< 14.3	< 12.3	< 10.6	< 19.9
Niobium 95	< 16.2	< 15.7	< 13.8	< 15.1	< 12.6	< 21.4
Potassium 40	4440 ± 801	6030 ± 1030	5620 ± 957	3340 ± 623	5100 ± 877	4850 ± 889
Zinc 65	< 31.2	< 37	< 33	< 36	< 21.3	< 44.4
Zirconium 95	< 30	< 29	< 23.4	< 25.9	< 20.9	< 36.2

Radioisotopes other than those reported were not detected.



Table 15. Wisconsin DHS analysis results for soil samples collected for the Prairie Island environmental monitoring program.

Sample Location	PRI-1a	PRI-4b	PRI-5	PRI-6a	PRI-8	PRI-9
Collection Start	05/09/18	05/11/18	05/10/18	05/10/18	05/10/18	05/11/18
Gross Alpha	< 4420	< 5420	5250 ± 2820	11500 ± 3190	13600 ± 3580	5530 ± 3160
Gross Beta	10800 ± 1160	16600 ± 0	13700 ± 1160	21100 ± 1290	16500 ± 1230	10900 ± 1100
gamma isotopic						
Cesium 134	< 13.2	< 7.6	< 18	< 22.7	< 15.9	< 17.6
Cesium 137	59.7 ± 12.7	174 ± 14.5	28.9 ± 10.8	121 ± 17.7	55.3 ± 13.4	350 ± 30.4
Cobalt 58	< 19.3	< 11.6	< 23.8	< 25.5	< 28.1	< 35.2
Cobalt 60	< 14.9	< 10.1	< 19.9	< 22.3	< 20	< 20.6
Iron 59	< 59.8	< 37.5	< 57.2	< 76.1	< 87	< 157
Manganese 54	< 15.9	< 10	< 23.7	< 23.6	< 25.8	< 22.5
Niobium 95	< 37.2	< 21.3	< 40.3	< 38.4	< 70.4	< 98.2
Potassium 40	11000 ± 1810	12300 ± 1980	12900 ± 2110	15300 ± 2490	15000 ± 2450	12300 ± 2010
Zinc 65	< 42	*a	< 43.3	< 47.1	< 60.2	< 54.2
Zirconium 95	< 42.8	< 22.8	< 49.3	< 52.7	< 58.9	< 87.6

Sample Location	PRI-1a	PRI-4b	PRI-5	PRI-6a	PRI-8	PRI-9
Collection Start	9/13/18	5/11/18	09/12/18	09/14/18	9/13/18	09/12/18
Gross Alpha	9460 ± 3390	3610 ± 3520	10400 ± 3290	< 5810	10600 ± 3600	6550 ± 3140
Gross Beta	16500 ± 1260	16600 ± 1300	15100 ± 1200	12200 ± 1160	119 ± 16.5	12600 ± 1350
gamma isotopic						
Cesium 134	< 13.5	7.6	< 21.6	< 15	< 29.0	< 18.1
Cesium 137	79.1 ± 12.4	174 ± 14.5	97.1 ± 16.7	27.8 ± 7.64	< 43.9	258 ± 30.4
Cobalt 58	< 26.9	11.6	< 21.1	< 25	< 29.0	< 24.9
Cobalt 60	< 13.9	10.1	< 27.3	< 16.3	< 19.4	< 24.8
Iron 59	< 79.2	37.5	< 52.9	< 80.4	< 94.8	< 60.4
Manganese 54	< 18.5	10.0	< 21.6	< 15.7	< 23.8	< 25.9
Niobium 95	< 58.9	21.3	< 26.8	< 53.7	< 75.1	< 29.2
Potassium 40	12900 ± 2080	12300 ± 1980	14700 ± 2410	12700 ± 2050	15000 ± 2430	11600 ± 1970
Zinc 65	< 38.4	23.1	< 56.7	< 40.6	< 45.3	< 51.2
Zirconium 95	< 58.7	22.8	< 44.4	< 49.9	< 59.6	< 44.9

*a - not reported by lab

Naturally occurring radioisotopes such as radium-226 (226Ra), bismuth-214 (214Bi), lead-214 (214Pb), actinium-228 (228Ac), bismuth-212 (212Bi), lead-212 (212Pb) from the naturally occurring uranium-238 (238U) and thorium-232 (232Th) decay series are commonly detected but have not been quantified or reported

Radioisotopes other than those reported were not detected.

Appendices

Appendix A – Radionuclide Concentration Levels needing review by State Radiological Coordinator (SRC)

Should radioactivity concentrations exceed SRC review levels for a given radionuclide, the SRC will be consulted for review and assessment.

Medium	Radionuclide	SRC Review Level ^a
Airborne Particulates or Gas (pCi/m ³)	Gross Beta	1
	I-131 (Charcoal)	0.1
	Cs-134	1
	Cs-137	1
Precipitation (pCi/l)	H-3	1,000
Water (pCi/l)	Gross Alpha	10
	Gross Beta	30
	H-3	10,000
	Mn-54	100
	Fe-59	40
	Co-58	100
	Co-60	30
	Zn-65	30
	Zr-Nb-95	40
	I-131	1
	Cs-134	10
	Cs-137	20
	Ba-La-140	100
	Sr-89	8
	Sr-90	8 ^d
Milk (pCi/l)	I-131	1
	Cs-134	20
	Cs-137	20
	Ba-La-140	100
	Sr-89	10
Grass (Vegetation), Cattle Feed, and Vegetables (pCi/kg wet)	Gross Beta	30,000
	I-131	100
	Cs-134	200
	Cs-137	200
	Sr-89	1,000
	Sr-90	1,000

Medium	Radionuclide	SRC Review Level ^a
Eggs (pCi/kg) wet	Gross Beta	30,000
	Cs-134	200
	Cs-137	200
	Sr-89	1,000
	Sr-90	1,000
Soil, Bottom Sediment (pCi/kg)	Gross Beta	5,000
	Cs-134	5,000
	Cs-137	5,000
	Sr-89	5,000
	Sr-90	5,000
Meat (pCi/kg)	Gross Beta (Flesh, Bones)	10,000
	Cs-134 (Flesh)	1,000
	Cs-137 (Flesh)	2,000
	Sr-89 (Bones)	2,000
	Sr-90 (Bones)	2,000
Fish (pCi/kg wet)	Gross Beta (Flesh, Bones)	10,000
	Mn-54	--
	Fe-59	--
	Co-58	--
	Co-60	--
	Cs-134 (Flesh)	1,000
	Cs-137 (Flesh)	2,000
	Sr-89 (Bones)	2,000
	Sr-90 (Bones)	2,000
	Zn-65 (Bones)	--
Thermoluminescent Dosimeter (mR/Std Qtr)	Direct Exposure	

- a. Radionuclides will be monitored by Wisconsin Dept. of Health Services, Radiation Protection Sections, Environmental Monitoring program and concentrations above the listed levels will be reported to the Wisconsin State Radiological Coordinator (SRC) for further review and assessment.
- b. For drinking water (well water) samples, this is a 40 CFR Part 141 value. If no drinking water pathway exists, a value of 30,000 pCi/l may be used. (NUREG-1301. Supplement No. 1, page 64, table 3.12-2)
- c. If no drinking water pathway exists, a value of 20 pCi/l may be used. (NUREG-1301. Supplement No. 1, page 64, table 3.12-2)
- d. Drinking Water values from Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-80-032, August 1980.

Appendix B – Sample Point Locations

The sample point locations.

Sample Point	Location Description	Latitude or Y	Longitude or X
PRI-1a	Prescott; air site	44.74481	-92.79400
PRI-1b	Prescott; harbor area	44.74521	-92.79915
PRI-1vs	Prescott; air site - vegetation and soil	44.74363	-92.79210
PRI-2	Trenton	44.60299	-92.56593
PRI-4a	Bay City Park	44.57934	-92.45615
PRI-4b	Bay City, Hwy 35	44.58487	-92.45910
PRI-4sw	Bay City, Hwy 35 soil and surface water	44.57916	-92.45664
PRI-5a	Hager City - Post Office	44.60002	-92.53955
PRI-5b	Hager City - vegetation and soil	44.60099	-92.53809
PRI-6a	Diamond Bluff; Pierce County highway shed	44.64623	-92.61479
PRI-6b	Diamond Bluff cemetery - well water	44.64128	-92.61552
PRI-6c	Diamond Bluff; Pierce County highway shed - vegetation and soil	44.64600	-92.61524
PRI-8	Station 2 – farm	44.66949	-92.61880
PRI-9a	Bay City substation	44.59433	-92.50426
PRI-9b	Bay City substation - vegetation and soil	44.59435	-92.50451
PRI-16 - Dis	Dairy Farm 356-177 Ellsworth (Started Sept 2017) – control Discontinued August 2018	44.74907	-92.48600
PRI-16	Dairy Farm 356-283 replaced Dairy Farm 356-177 starting August 2018	44.750660	-92.437912
PRI-17	Dairy Farm 356-690 Ellsworth (Started September 2017)	44.71331	-92.55019
PRI-18	Dairy Farm 356-323 Ellsworth (Started Oct 2017)	44.70270	-92.53849
PRI-T30	Diamond Bluff - Naughty Hog	44.64892	-92.62931
PRI-T31	Diamond Bluff cemetery	44.64116	-92.61579
PRI-T32	290th Avenue	44.63014	-92.59893
PRI-T33	Hwy 35, Thomas Killian residence	44.68485	-92.64411
PRI-T34	Cty K and 840th Street	44.66767	-92.56297
PRI-T35	Cty VV and 790th Street	44.62336	-92.52780
PRI-T36	Hager City	44.60021	-92.53953
PRI-T37	Ellsworth	44.72943	-92.48681
PRI-T38	Bay City, Hwy 35	44.58494	-92.45959
PRI-T39	Prescott; air site	44.74500	-92.79431