Prairie Island
Environmental Radioactivity Survey

2017

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 2017. 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 2017 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 2017, 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 2017, 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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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 2017. 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 2017:

- Milk collection near Prairie Island consisted of three dairy farms. The Welch (PRI-10) and Christiansen (PRI-13) dairy farms were within 5 miles of Prairie Island. A single gallon of milk was collected every other month from each farm (6 from Welch and 6 from Christiansen per year). The Peterson dairy farm (PRI-15) was located 10 miles North of Prairie Island, with milk samples being collected every month.

- In 2014 the Christiansen dairy discontinued milking operations. As a result, a milk sample was collected every month from the Welch and Peterson farm. Attempts were made to find a suitable replacement for the Christiansen dairy farm within 5 miles of Prairie Island, but there has been a steady decline in the number of dairies in the driftless area near Prairie Island.

- Milk sample collection was suspended in the last quarter of 2015 due to staffing and analysis issues at the Wisconsin State Laboratory of Hygiene. Milk sample collection was restarted in January of 2016 and shipped to ATI for analysis.

- 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.

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 (MAPER) for environmental matrix analysis. Proficiency testing results are available from the Wisconsin State Laboratory of Hygiene.

In late 2014, the State Laboratory of Hygiene experienced some staffing issues that impacted their capacity. Starting in 2015, monthly surface water and milk samples were sent to ATI Environmental Inc. for analysis.

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-10	2.6 NE	Welch farm (restarted January 2017 discontinued November of 2017)
PRI-13	3.8 E	Christiansen farm (Discontinued 2014)
PRI-15	13.9 N	R. Peterson farm
PRI-16	11.4 NW	Dairy Farm 356-177 Ellsworth (Started Sept 2017) - Control
PRI-17	7.5 NW	Dairy Farm 356-690 Ellsworth (Started September 2017)
PRI-18	7.3 NW	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 2017.

Sample Type	Collection and Frequency	Site Locations	Number of Samples Collected	Number of Sample Deviations	Required Analyses
Air particulate	C/BW	1a, 6a, 9	76	1	GA, GB, GI[w]
Air iodine	C/BW	1a, 6a, 9	73	4	GI
Precipitation	C/BW	1a, 9	12	0	GB[x], H[x]
TLD	C/Q	T30 – T39	40	0	direct exposure
Surface water	G/SA	1b, 2, 4a	6	0	GA, GB, GI, Sr, H
Fish	G/SA	upstream, downstream	7	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	8	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
Air Iodine	2/1/17	PRI-1	Software crash at state lab, data unavailable
Air Iodine	1/18/17	PRI-6	Software crash at state lab, data unavailable
Air Iodine & Particulate	2/15/17	PRI-9	Software crash at state lab, data unavailable
Air Particulate	4/27/17	PRI-6	Low air follow volume
Air Particulate	11/23/17	PRI-1 & PRI-9	Data sheet unavailable – not returned from the state lab prior data compilation
Milk	Jan – Aug 2017	PRI-10	Dairy farmer retired
Milk	Jan – Aug 2017	PRI-13	Dairy farmer retired
Milk	Jan – Aug 2017	PRI-15	Dairy farmer retired
Fish	Sept 2017	Downstream	Insufficient sample combined 3 samples, Carp, Fresh Water Drum, White Bass
Fish	11/9/17	Pump House	Insufficient sample combined 2 samples, Chinook Salmon, Burbot

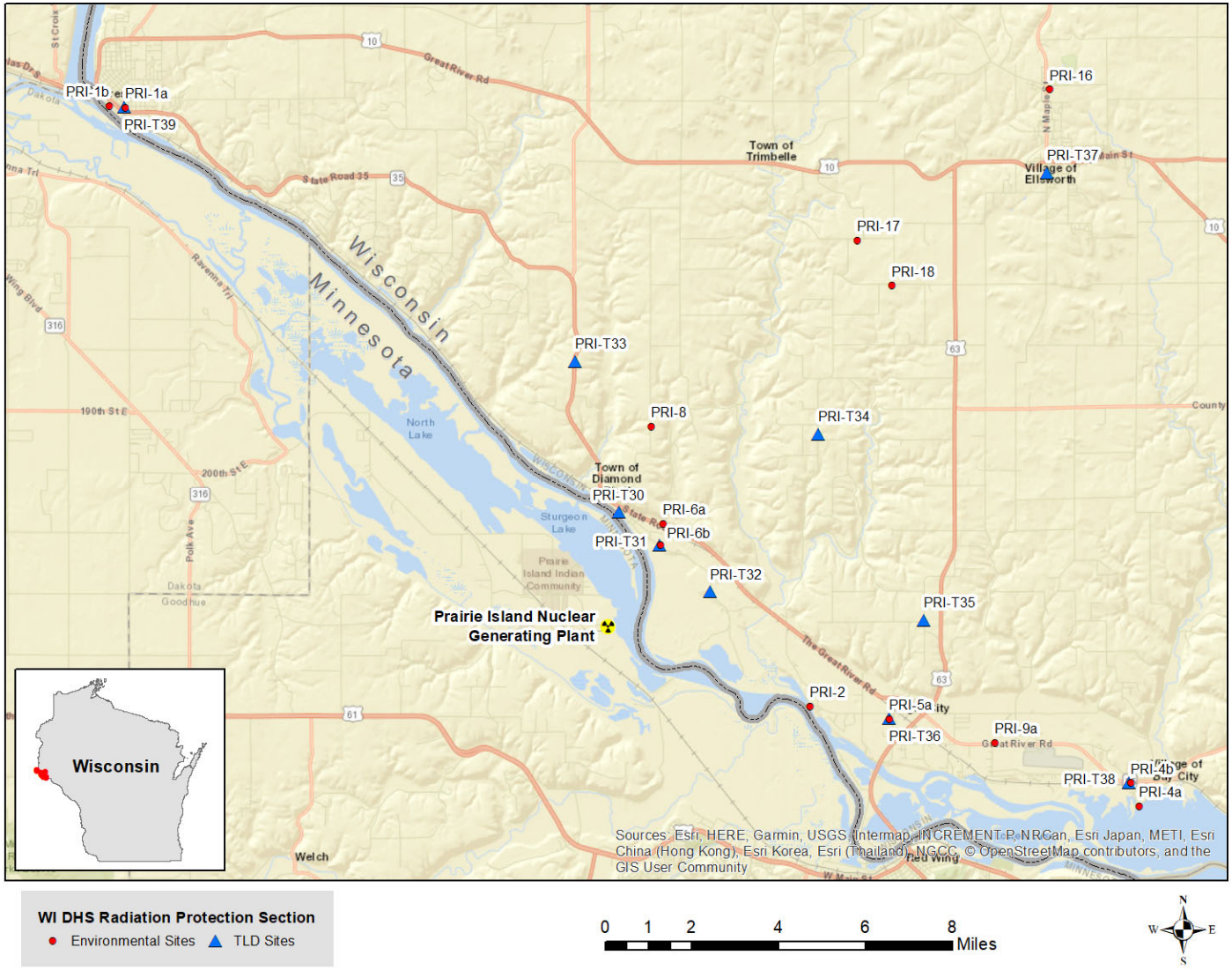

Figure 1. Location of Wisconsin DHS environmental monitoring sites for the Prairie Island monitoring program

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 (^{7}Be), 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 but one air 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 2017 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 16.2 ± 3.7 milliroentgens. The average quarterly exposure for 2017 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. Tables 9 provide results from the individual sample analyses.

Gamma isotopic analysis for all radioisotopes were below their respective LLD. All reported activities for gross beta; gross alpha and tritium (^{3}H) were at 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 provide 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 (^{3}H) 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. Tables 12 provide results from the individual sample analyses.

Milk collection was suspended in October of 2016 due to the closing of the dairies used for sampling. Unfortunately, no dairy could be found within 5 miles to replace the dairies that closed. Three dairies were found between 5 and 11 miles away and sampling began in September of 2017.

Analysis of the milk samples showed no unusual activities. Naturally occurring potassium-40 (^{40}K) was detected in all samples. 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. Tables 13 provide 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 (^{7}Be) and potassium-40 (^{40}K). All other radioisotopes were below their respective LLD except for Gross Beta, which were at background levels. 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. Radioactive 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 4 Sample activity summary for the Wisconsin DHS Prairie Island environmental monitoring program.

Sample type (units)	LLD	Number of samples [a]	Analysis	Range
Air particulate	0.005	76 / 76	gross beta	0.007 - 0.736
(pCi/m^3)			gamma isotopic	
	0.020	12 / 12	Be-7	0.046 - 0.103
	0.002	12 / 0	Mn-54	< 0.0004
	0.002	12 / 0	Co-58	< 0.0004
	0.005	12 / 0	Fe-59	< 0.0009
	0.002	12 / 0	Co-60	< 0.0004
	0.005	12 / 0	Zn-65	< 0.0010
	0.002	12 / 0	Nb-95	< 0.0004
	0.005	12 / 0	Zr-95	< 0.0006
	0.002	12 / 0	Ru-103	< 0.0004
	0.015	12 / 0	Ru-106	< 0.0036
	0.020	12 / 0	I-131	< 0.0018
	0.002	12 / 0	Cs-134	< 0.0004
	0.002	12 / 0	Cs-137	< 0.0004
	0.030	12 / 0	Ba-140	< 0.0031
	0.020	12 / 0	La-140	< 0.0012
	0.002	12 / 0	Ce-141	< 0.0006
	0.005	12 / 0	Ce-144	< 0.0019
Air iodine	0.07	73 / 1	I-131	< 0.1
(pCi/m^3)				
Surface water	3.0	6 / 1	gross alpha (sol)	< 2.4 - 3.12
(pCi/liter)	3.0	6 / 3	gross beta (sol)	< 3.7 - 4.3
	3.0	6 / 0	gross alpha (insol)	< 0.6 - 1.45
	3.0	6 / 0	gross beta (insol)	< 1.1 - 1.67
	300	6 / 0	H-3	< 214
	2.0	6 / 0	Sr-89	< 0.39
	1.0	6 / 0	Sr-90	< 0.3 - 0.4
			gamma isotopic	
	15	6 / 0	Mn-54	< 9.8
	15	6 / 0	Co-58	< 9
	30	6 / 0	Fe-59	< 19
	15	6 / 0	Co-60	< 10.2
	30	6 / 0	Zn-65	< 21.5
	15	6 / 0	Nb-95	< 7.6
	30	6 / 0	Zr-95	< 16.4
	15	6 / 0	I-131	< 14.5
	15	6 / 0	Cs-134	< 9
	15	6 / 0	Cs-137	< 11.2
	60	6 / 0	Ba-140	< 30.7
	15	6 / 0	La-140	< 10.8

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			gamma isotopic	
(pCi/kg wet)	50	7 / 0	Cesium 134	< 9
	60	7 / 0	Cesium 137	< 14
	60	7 / 0	Cobalt 58	< 10
	60	7 / 0	Cobalt 60	< 13
	130	7 / 0	Iron 59	< 23
	50	7 / 0	Manganese 54	< 11
	50	7 / 0	Niobium 95	< 13
	800	7 / 7	Potassium 40	2560 - 2930
	130	7 / 0	Zinc 65	< 21
	100	7 / 0	Zirconium 95	< 19
Precipitation	1.5	12 / 0	gross beta	< 0.05 - 0.57
(nCi/m^2)	300	12 / 0	H-3	< 37 – 29
Well water	3.0	6 / 0	gross alpha	< 2.7
(pCi/liter)	3.0	6 / 0	gross beta	< 1.8 – 1.7
	300	6 / 0	H-3	< 214
Vegetation	5000	12 / 0	Gross Alpha	< 6420
(pCi/kg wet)	4000	12 / 10	Gross Beta	3020 - 20400
			gamma isotopic	
	350	12 / 0	Barium 140	< 149
	600	12 / 12	Beryllium 7	860 - 7740
	80	12 / 0	Cesium 134	< 24
	90	12 / 0	Cesium 137	< 29
	100	12 / 0	Cobalt 58	< 27
	100	12 / 0	Cobalt 60	< 30
	80	12 / 1	Iodine 131	< 82
	200	12 / 0	Iron 59	< 63
	100	12 / 0	Lanthanum 140	< 43
	90	12 / 0	Manganese 54	< 26
	100	12 / 0	Niobium 95	< 31
	2000	12 / 12	Potassium 40	3240 - 6470
	250	12 / 0	Zinc 65	< 65
	200	12 / 0	Zirconium 95	< 47

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	13000	12 / 0	gross alpha	< 4270 - 11500
(pCi/kg dry)	6000	12 / 12	gross beta	9960 - 18600
			gamma isotopic	
	80	12 / 0	Cs-134	< 22
	80	12 / 10	Cs-137	68 - 427
	90	12 / 0	Co-58	< 42
	90	12 / 0	Co-60	< 28
	600	12 / 0	Fe-59	< 149
	60	12 / 0	Mn-54	< 25
	100	12 / 0	Nb-95	< 100
	800	12 / 12	K-40	9930 - 15900
	300	12 / 0	Zn-65	< 65
	250	12 / 0	Zr-95	< 81
Milk	1.5	4 / 0	I-131	< 0.3
(pCi/liter)	1.0	8 / 0	Sr-90	< 0.5 – 0.8
	500	8 / 0	K-40	1392 - 1486
	15	8 / 0	Mn-54	< 3.8
	15	8 / 0	Co-58	< 3.7
	40	8 / 0	Fe-59	< 7.9
	15	8 / 0	Co-60	< 3.9
	40	8 / 0	Zn-65	< 7.7
	15	8 / 0	Nb-95	< 3.9
	40	8 / 0	Zr-95	< 6.0
	15	8 / 0	I-131	< 4.5
	15	8 / 0	Cs-134	< 3.7
	15	8 / 0	Cs-137	< 4.7
	60	8 / 0	Ba-140	< 14.2
	15	8 / 0	La-140	< 3.0
ambient radiation (TLD)	1.0 [c]	40 / 40	direct exposure	10.2 – 29.1
(mR/Std Qtr)				

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 5. 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/m^3

PRI-1 (3100 series); Prescott

Collection date	Volume m^3	Air particulate	Air iodine
1st Qtr			
01/05/17	878	0.035 ± 0.001	< 0.017
01/18/17	944	0.022 ± 0.001	< 0.015
02/01/17	950	0.022 ± 0.001	*a
02/15/17	937	0.020 ± 0.001	< 0.009
03/01/17	1073	0.020 ± 0.001	< 0.009
03/30/17	855	0.016 ± 0.001	< 0.014
03/30/17	1286	0.015 ± 0.001	< 0.013
mean +- s.d.		0.022 ± 0.006	< 0.014
2nd Qtr			
04/19/17	512	0.010 ± 0.002	< 0.014
04/27/17	762	0.016 ± 0.001	< 0.011
05/09/17	934	0.012 ± 0.001	< 0.007
05/24/17	847	0.014 ± 0.001	< 0.018
06/07/17	876	0.016 ± 0.001	< 0.015
06/22/17	894	0.014 ± 0.001	< 0.007
mean +- s.d.		0.014 ± 0.002	< 0.013
3rd Qtr			
07/07/17	702	0.017 ± 0.001	< 0.026
07/19/17	691	0.015 ± 0.001	< 0.028
07/31/17	886	0.018 ± 0.001	< 0.015
08/15/17	891	0.017 ± 0.001	< 0.029
08/30/17	756	0.023 ± 0.001	< 0.027
09/12/17	810	0.029 ± 0.001	< 0.027
09/26/17	864	0.021 ± 0.001	< 0.040
mean +- s.d.		0.018 ± 0.005	< 0.027
4th Qtr			
10/10/17	1014	0.018 ± 0.001	< 0.023
10/26/17	1002	0.017 ± 0.001	< 0.017
11/10/17	859	0.034 ± 0.002	< 0.030
11/23/17	*b	0.339 ± 0.002	< 0.030
12/08/17	878	0.023 ± 0.001	< 0.013
12/21/17	927	0.031 ± 0.001	< 0.017
mean +- s.d.		0.027 ± 0.129	< 0.020

PRI-6 (3200 series); Diamond Bluff

Collection date	Volume m^3	Air particulate	Air iodine
1st Qtr			
01/05/17	890	0.033 ± 0.001	< 0.015
01/18/17	950	0.022 ± 0.001	*a
02/01/17	949	0.021 ± 0.001	< 0.008
02/15/17	935	0.019 ± 0.001	< 0.008
03/01/17	1072	0.021 ± 0.001	< 0.019
03/17/17	854	0.017 ± 0.001	< 0.013
03/30/17	960	0.015 ± 0.001	< 0.017
mean +- s.d.		0.021 ± 0.006	< 0.014
2nd Qtr			
04/14/17	843	0.012 ± 0.001	< 0.009
04/27/17	17	0.736 ± 0.058	< 0.100
05/09/17	1695	0.007 ± 0.001	< 0.010
05/24/17	863	0.015 ± 0.001	< 0.018
06/07/17	885	0.016 ± 0.001	< 0.014
06/22/17	899	0.014 ± 0.001	< 0.013
mean +- s.d.		0.150 ± 0.295	< 0.014
3rd Qtr			
07/07/17	703	0.015 ± 0.001	< 0.030
07/19/17	689	0.016 ± 0.001	< 0.023
07/31/17	883	0.018 ± 0.001	< 0.017
08/15/17	886	0.017 ± 0.001	< 0.025
08/30/17	764	0.020 ± 0.001	< 0.027
09/12/17	801	0.028 ± 0.001	< 0.026
09/26/17	859	0.019 ± 0.001	< 0.037
mean +- s.d.		0.018 ± 0.004	< 0.026
4th Qtr			
10/10/17	1004	0.018 ± 0.001	< 0.026
10/26/17	990	0.016 ± 0.001	< 0.016
11/10/17	844	0.032 ± 0.001	< 0.033
11/23/17	992	0.024 ± 0.001	< 0.001
12/08/17	862	0.023 ± 0.001	< 0.010
12/21/17	918	0.031 ± 0.001	< *b
mean +- s.d.		0.024 ± 0.007	< 0.016

*a = Software crash at State Lab of Hygiene caused data to be lost (Laboratory Accident).

*b = 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/m^3

PRI-9 (3400 series); Bay City substation

Collection date	Volume m3	Air particulate	Air iodine
1st Qtr			
01/05/17	1084	0.032 ± 0.001	< 0.013
01/18/17	1164	0.021 ± 0.001	< 0.012
02/01/17	1163	0.021 ± 0.001	< 0.008
02/15/17	*a	*a *a	*a
03/01/17	1325	0.016 ± 0.001	< 0.007
03/17/17	1057	0.016 ± 0.001	< 0.016
03/30/17	1185	0.014 ± 0.001	< 0.006
mean +- s.d.		0.020 ± 0.007	< 0.010
2nd Qtr			
04/14/17	1047	0.010 ± 0.001	< 0.005
04/27/17	951	0.015 ± 0.001	< 0.010
05/09/17	1182	0.011 ± 0.001	< 0.012
05/24/17	1084	0.014 ± 0.001	< 0.015
06/07/17	1145	0.016 ± 0.001	< 0.012
06/22/17	1166	0.014 ± 0.001	< 0.004
mean +- s.d.		0.0134 ± 0.002	< 0.010
3rd Qtr			
07/07/17	910	0.015 ± 0.001	< 0.004
07/19/17	916	0.015 ± 0.001	< 0.018
07/31/17	1167	0.017 ± 0.001	< 0.017
08/15/17	1162	0.017 ± 0.001	< 0.011
09/12/17	1003	0.021 ± 0.001	< 0.021
09/12/17	1059	0.028 ± 0.001	< 0.018
09/26/17	1114	0.019 ± 0.001	< 0.020
mean +- s.d.		0.019 ± 0.005	< 0.016
4th Qtr			
10/10/17	1279	0.017 ± 0.001	< 0.020
10/26/17	1228	0.015 ± 0.001	< 0.012
11/10/17	1052	0.031 ± 0.001	< 0.021
11/23/17	*b	0.312 ± 0.001	< 0.008
12/21/17	1113	0.032 ± 0.001	< 0.012
mean +- s.d.		0.081 ± 0.129	< 0.015

*a = Software crash at State Lab of Hygiene caused data to be lost (Laboratory Accident).

*b = Data unavailable

Table 6. Wisconsin DHS gamma isotopic analysis results from the quarterly composites of air particulate filte collected from the Prairie Island environmental monitoring program.

Measurements in units of pCi/m^3

Site: PRI-1	1st quarter	2nd quarter	3rd quarter	4th quarter
Be-7	0.0642 +- 0.0054	0.103 +- 0.0078	0.0469 +- 0.0042	0.047 ± 0.0042
Mn-54	< 0.0003	< 0.0004	< 0.0002	< 0.0002
Co-58	< 0.0003	< 0.0004	< 0.0002	< 0.0002
Fe-59	< 0.0007	< 0.0009	< 0.0005	< 0.0005
Co-60	< 0.0004	< 0.0004	< 0.0002	< 0.0002
Zn-65	< 0.0006	< 0.0009	< 0.0004	< 0.0004
Nb-95	< 0.0004	< 0.0004	< 0.0004	< 0.0004
Zr-95	< 0.0006	< 0.0006	< 0.0004	< 0.0004
Ru-103	< 0.0004	< 0.0003	< 0.0002	< 0.0002
Ru-106	< 0.0029	< 0.0036	< 0.0018	< 0.0018
I-131	< 0.0008	< 0.0009	< 0.0017	< 0.0017
Cs-134	< 0.0003	< 0.0003	< 0.0002	< 0.0002
Cs-137	< 0.0004	< 0.0004	< 0.0002	< 0.0002
Ba-140	< 0.0018	< 0.0024	< 0.0028	< 0.0028
La-140	< 0.0005	< 0.0012	< 0.0009	< 0.0009
Ce-141	< 0.0006	< 0.0005	< 0.0004	< 0.0004
Ce-144	< 0.0019	< 0.0015	< 0.0009	< 0.0009
Site: PRI-6				
Be-7	0.0584 +- 0.0050	0.0905 +- 0.0072	0.0464 +- 0.0048	0.046 ± 0.0048
Mn-54	< 0.0003	< 0.0004	< 0.0002	< 0.0002
Co-58	< 0.0003	< 0.0003	< 0.0002	< 0.0002
Fe-59	< 0.0006	< 0.0009	< 0.0007	< 0.0007
Co-60	< 0.0004	< 0.0004	< 0.0003	< 0.0003
Zn-65	< 0.0006	< 0.0010	< 0.0006	< 0.0006
Nb-95	< 0.0003	< 0.0004	< 0.0004	< 0.0004
Zr-95	< 0.0006	< 0.0006	< 0.0005	< 0.0005
Ru-103	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Ru-106	< 0.0027	< 0.0033	< 0.0022	< 0.0022
I-131	< 0.0007	< 0.0010	< 0.0018	< 0.0018
Cs-134	< 0.0003	< 0.0004	< 0.0003	< 0.0003
Cs-137	< 0.0004	< 0.0004	< 0.0002	< 0.0002
Ba-140	< 0.0016	< 0.0023	< 0.0031	< 0.0031
La-140	< 0.0004	< 0.0012	< 0.0012	< 0.0012
Ce-141	< 0.0005	< 0.0005	< 0.0004	< 0.0004
Ce-144	< 0.0019	< 0.0015	< 0.0011	< 0.0011
Site: PRI-9				
Be-7	0.0978 +- 0.0077	0.0667 +- 0.0048	0.0558 +- 0.0041	0.056 ± 0.0041
Mn-54	< 0.0003	< 0.0003	< 0.0002	< 0.0002
Co-58	< 0.0003	< 0.0002	< 0.0002	< 0.0002
Fe-59	< 0.0006	< 0.0005	< 0.0005	< 0.0005
Co-60	< 0.0003	< 0.0003	< 0.0002	< 0.0002
Zn-65	< 0.0007	< 0.0005	< 0.0004	< 0.0004
Nb-95	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Zr-95	< 0.0005	< 0.0004	< 0.0004	< 0.0004
Ru-103	< 0.0003	< 0.0002	< 0.0003	< 0.0003
Ru-106	< 0.0028	< 0.0023	< 0.0018	< 0.0018
I-131	< 0.0008	< 0.0011	< 0.0018	< 0.0018
Cs-134	< 0.0004	< 0.0003	< 0.0002	< 0.0002
Cs-137	< 0.0003	< 0.0002	< 0.0003	< 0.0003
Ba-140	< 0.0017	< 0.0018	< 0.0027	< 0.0027
La-140	< 0.0008	< 0.0010	< 0.0010	< 0.0010
Ce-141	< 0.0005	< 0.0004	< 0.0005	< 0.0005
Ce-144	< 0.0015	< 0.0011	< 0.0013	< 0.0013

Table 7. Wisconsin DHS TLD network for the Prairie Island environmental monitoring program.

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Date Placed:	01/18-19/17	04/19-20/17	07/11-12/17	10/11/17
Date Removed:	04/19-20/17	07/11-12/17	10/11-12/17	01/10/18
Days in the Field:	91	84	91	92
	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	14.0 +- 1.1	13.0 +- 0.7	18.0 +- 0.9	16.6 +- 0.6
T31	10.2 +- 1.3	11.6 +- 0.8	14.9 +- 1.2	13.4 +- 0.8
T32	16.5 +- 1.3	13.2 +- 1.3	23.6 +- 1.4	16.1 +- 1.3
Quarterly average +- s.d.	13.6 +- 3.2	12.6 +- 0.9	18.8 +- 4.4	15.4 +- 0.4
TLD sites that are located 2– 5 miles from the Prairie island facility				
T33	14.4 +- 1.0	15.5 +- 0.8	21.1 +- 1.0	18.0 +- 0.6
T34	19.1 +- 1.5	17.8 +- 1.1	29.1 +- 1.5	19.2 +- 0.6
T35	14.9 +- 1.0	17.3 +- 1.4	17.3 +- 0.9	17.9 +- 1.0
T36	15.5 +- 1.2	14.4 +- 0.9	19.2 +- 1.1	15.3 +- 0.8
Quarterly average +- s.d.	16.0 +- 2.1	16.3 +- 1.6	21.7 +- 5.2	17.6 +- 0.2
TLD sites that are located greater than 5 miles from the Prairie island facility				
T37	14.1 +- 1.4	15.9 +- 0.8	15.5 +- 1.5	16.5 +- 0.6
T38	11.6 +- 0.9	13.6 +- 1.2	17.7 +- 1.0	15.2 +- 0.9
T39	12.2 +- 0.9	16.5 +- 1.0	14.4 +- 1.0	16.8 +- 0.7
Quarterly average +- s.d.	12.6 +- 1.3	15.3 +- 1.5	15.9 +- 1.7	16.2 +- 0.2

ND – The TLD was lost in the field.

Table 8. 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
1/5/2017	1.34	0.10 ± 0.05	< 7.1
2/1/2017	1.1	< 0.05	< 5.8
3/1/2017	1.61	0.16 ± 0.06	< 8.5
4/14/2017	5	0.43 ± 0.15	28.58 ± 16.3
5/9/2017	6.28	0.40 ± 0.19	< 32.9
6/7/2017	4.09	0.57 ± 0.12	< 21.3
7/7/2017	6.11	0.54 ± 0.15	< 33.4
8/1/2017	6.73	0.44 ± 0.18	< 36.8
9/1/2017	5.28	0.18 ± 0.11	< 26.4
10/10/2017	1.24	0.04 ± 0.02	< 6.2
11/10/2017	0.35	0.11 ± 0.01	< 1.7
12/8/2017	0.18	0.09 ± 0.01	< 0.9

Table 9. 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-4
Collection date:	05/25/17	05/25/17	05/25/17	08/24/17	08/24/17	08/23/17
gross alpha-sol (DS)	< 1.7	< 2.4	2.0 +- 1.2	1.87 +- 0.8	3.12 +- 1.0	2.1 +- 0.9
gross beta-sol (DS)	< 3.7	3.4 +- 1.9	< 3.4	2.4 +- 1.0	3.6 +- 1.1	4.3 +- 1.1
gross alpha-insol (SS)	< 0.6	< 0.6	< 0.6	< 0.6	1.45 +- 0.7	1.01 +- 0.6
gross beta-insol (SS)	< 1.0	< 1.1	1.1 +- 0.7	1.56 +- 0.6	1.67 +- 0.7	< 1.0
H-3	< 206	< 206	< 206	< 214	< 213	< 213
Sr-89	< 0.36	< 0.39	< 0.35	< 0.2	< 0.3	< 0.3
Sr-90	< 0.28	< 0.30	< 0.28	0.4 +- 0.2	< 0.2	< 0.1
gamma isotopic						
Mn-54	< 4.9	< 9.0	< 9.8	< 3.1	< 3.0	< 3.6
Co-58	< 5.2	< 9.0	< 7.3	< 3.3	< 3.2	< 3.9
Fe-59	< 10.0	< 13.5	< 19.0	< 6.2	< 6.2	< 7.8
Co-60	< 5.4	< 10.2	< 8.3	< 3.0	< 3.0	< 3.8
Zn-65	< 14.6	< 21.5	< 18.3	< 6.4	< 6.4	< 7.8
Nb-95	< 5.5	< 7.6	< 7.0	< 3.5	< 3.6	< 4.5
Zr-95	< 9.8	< 16.4	< 14.7	< 5.4	< 5.6	< 7.1
I-131	< 6.8	< 9.7	< 8.6	< 10.1	< 10.9	< 14.5
Cs-134	< 6.1	< 9.0	< 8.1	< 3.2	< 3.1	< 3.7
Cs-137	< 5.2	< 11.2	< 6.3	< 3.1	< 3.0	< 4.1
Ba-140	< 18.8	< 30.7	< 28.5	< 21.7	< 23.1	< 28.6
La-140	< 7.5	< 8.3	< 10.8	< 6.4	< 6.7	< 8.0

Radioisotopes other than those reported were not detected.

*a - The analysis is performed on a quarterly composite. *b - did not meet lower limit of detection.

*c - analysis not performed.

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

Measurements in units of pCi/liter

	PRI-4	PRI-5	PRI-6	PRI-4	PRI-5	PRI-6
Collection date:	05/25/17	05/25/17	05/25/17	08/23/17	08/24/17	08/24/17
gross alpha	< 1.6	< 2.7	< 1.7	< 1.9	< 2.4	< 1.5
gross beta	< 1.7	< 1.8	< 1.6	< 1.1	1.7 +- 0.8	< 1.1
H-3	< 206	< 206	< 206	< 214	< 213	< 214

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

Measurements in units of pCi/kilogram (wet)

Collection date:	05/18/17	6/12/17	9/18/17	09/21/17
Location:	downstream	upstream	downstream	upstream
Type:	White Bass	White Bass	Combined Sample	White Bass
gamma isotopic				
Cesium 134	< 6	< 9	< 3	< 1
Cesium 137	< 6	< 14	< 3	< 1
Cobalt 58	< 7	< 10	< 5	< 2
Cobalt 60	< 8	< 13	< 3	< 1
Iron 59	< 18	< 23	< 21	< 7
Manganese 54	< 6	< 11	< 3	< 1
Niobium 95	< 9	< 11	< 13	< 4
Potassium 40	2770 ± 499	2560 ± 459	2930 ± 508	2640 ± 452
Zinc 65	< 17	< 21	< 8	< 3
Zirconium 95	< 13	< 19	< 10	< 3

Collection date:	10/10/17	11/7/17	11/9/17	11/11/17
Location:	upstream	Pump house	Pump house	Pump house
Type:	Fresh Water Drum	Chinook Salmon	Combined Sample	Burbot
gamma isotopic				
Cesium 134	*a	< 3	< 4	< 5
Cesium 137	*a	12 ± 3	21 ± 3	22 ± 4
Cobalt 58	*a	< 6	< 7	< 7
Cobalt 60	*a	< 4	< 5	< 5
Iron 59	*a	< 24	< 20	< 20
Manganese 54	*a	< 5	< 4	< 4
Niobium 95	*a	< 14	< 14	< 13
Potassium 40	*a	2830 ± 462	2830 ± 460	2190 ± 357
Zinc 65	*a	< 12	< 11	< 12
Zirconium 95	*a	< 11	< 14	< 14

Radioisotopes other than those reported were not detected
*a = Sample was too small for analysis

Table 12. 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:	January	February	March	April	May	June
I-131						
Sr-90						
gamma isotopic						
K-40						
Mn-54						
Co-58	No sample collected	No sample collected	No sample collected	No sample collected	No sample collected	No sample collected
Fe-59						
Co-60						
Zn-65						
Nb-95						
Zr-95						
I-131						
Cs-134						
Cs-137						
Ba-140						
La-140						

Location	PRI-16	PRI-16	PRI-16	PRI-16	PRI-16	PRI-16
Collection date:	July	August	09/11/17	10/9/17	11/13/17	12/11/17
I-131				< 0.3		< 0.2
Sr-90			0.6 +- 0.3	0.5 +- 0.3	0.6 +- 0.3	< 0.5
gamma isotopic						
K-40			1450 +- 123	1485 +- 119	1430 +- 113	1486 +- 123
Mn-54			< 2.9	< 3.8	< 2.4	< 1.8
Co-58	No sample collected	No sample collected	< 3.3	< 3.2	< 3.1	< 3.7
Fe-59			< 7.9	< 4.8	< 4.9	< 4.3
Co-60			< 2.4	< 1.9	< 2.0	< 3.9
Zn-65			< 6.8	< 7.7	< 7.2	< 7.5
Nb-95			< 2.8	< 3.9	< 2.3	< 3.9
Zr-95			< 3.9	< 4.6	< 5.1	< 4.9
I-131			< 3.6	< 4.5	< 3.2	< 4.1
Cs-134			< 3.7	< 3.0	< 3.5	< 3.6
Cs-137			< 2.8	< 2.5	< 3.7	< 4.7
Ba-140			< 14.2	< 13.4	< 13.6	< 11.6
La-140			< 1.8	< 2.5	< 2.8	< 2.6

Radioisotopes other than those reported were not detected.

*a = Lower Limit of Detection not met

*b = Did not meet matrix recovery

*c = not reported

*d = Farm has gone out of business, as a result the control will not be collected as well

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						
Collection date:						
I-131						
Sr-90						
gamma isotopic						
K-40						
Mn-54						
Co-58	No sample collected	No sample collected	No sample collected	No sample collected	No sample collected	No sample collected
Fe-59						
Co-60						
Zn-65						
Nb-95						
Zr-95						
I-131						
Cs-134						
Cs-137						
Ba-140						
La-140						

Location			**PRI-17**	**PRI-18**	**PRI-17**	**PRI-18**
Collection date:			09/11/17	10/9/17	11/13/17	12/11/17
I-131				< 0.2		< 0.2
Sr-90			0.8 +- 0.4	< 0.5	0.7 +- 0.3	0.6 +- 0.3
gamma isotopic						
K-40			1481 +- 115	1392 +- 102	1430 +- 113	1394 +- 110
Mn-54			< 1.8	< 3.1	< 2.4	< 3.5
Co-58	No sample collected	No sample collected	< 1.7	< 1.8	< 3.1	< 2.7
Fe-59			< 3.4	< 3.4	< 4.9	< 7.4
Co-60			< 2.5	< 2.0	< 2.0	< 3.3
Zn-65			< 4.0	< 4.6	< 7.2	< 4.4
Nb-95			< 1.8	< 3.1	< 2.3	< 3.5
Zr-95			< 2.9	< 6.0	< 5.1	< 5.8
I-131			< 2.0	< 3.1	< 3.2	< 3.5
Cs-134			< 1.9	< 3.0	< 3.5	< 3.5
Cs-137			< 2.1	< 3.6	< 3.7	< 3.1
Ba-140			< 5.8	< 13.2	< 13.6	< 11.4
La-140			< 1.4	< 2.7	< 2.8	< 3.0

Radioisotopes other than those reported were not detected.

*a = Lower Limit of Detection not met

*b = Did not meet matrix recovery

*c = not reported

*d = Farm has gone out of business, as a result the control will not be collected as well

Table 13. 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-6**	**PRI-8**	PRI-9
Collection Start	5/25/17	5/25/17	5/25/17	5/25/17	5/25/17	5/25/17
Analyte						
Gross Alpha	< 2190	< 6420	< 1900	< 3290	< 3340	< 3220
Gross Beta	9270 ± 789	14000 ± 1470	19500 ± 960	20400 ± 1400	7720 ± 1160	12100 ± 1250
Barium 140	< 73.8	< 96.9	< 78.9	< 89.8	< 128	< 119
Beryllium 7	1060 ± 128	1510 ± 219	860 ± 118	1230 ± 156	1120 ± 204	1510 ± 186
Cesium 134	< 14.4	< 24.4	< 15	< 16.9	< 23.3	< 18.4
Cesium 137	< 18.7	< 28.3	< 21.8	< 27	< 29.2	< 28
Cobalt 58	< 14.5	< 26.7	< 15.8	< 19.7	< 22.9	< 22
Cobalt 60	< 18.4	< 21.5	< 21.8	< 29.7	< 26.4	< 27.5
Iodine 131	< 27.3	< 39.7	< 28.1	< 39.5	< 39.9	< 46.4
Iron 59	< 34.2	< 51	< 37.4	< 45	< 62.6	< 52
Lanthanum 140	< 15.8	< 32	< 23.1	< 22.5	< 38.7	< 37
Manganese 54	< 14.4	< 26	< 18	< 20.4	< 26.1	< 22.6
Niobium 95	< 17.7	< 28	< 18.5	< 22.4	< 31.1	< 23.9
Potassium 40	3410 ± 615	4040 ± 817	5040 ± 877	6080 ± 1050	4680 ± 926	5230 ± 937
Zinc 65	< 30.9	< 65.1	< 41.1	< 45.5	< 63.6	< 56.3
Zirconium 95	< 27.9	< 42.3	< 27.2	< 32.4	< 47	< 42.6

Sample Location	**PRI-1A**	**PRI-4B**	**PRI-5**	**PRI-6**	**PRI-8**	PRI-9
Collection Start	8/24/17	8/23/17	8/23/17	8/24/17	8/24/17	8/23/17
Analyte						
Gross Alpha	< 1870	< 1980	< 1390	< 1550	< 1690	< 2090
Gross Beta	4390 ± 444	3690 ± 408	4730 ± 435	6010 ± 529	4960 ± 515	3020 ± 569
Barium 140	< 135	< 146	< 81.4	< 113	< 105	< 149
Beryllium 7	5980 ± 378	3660 ± 296	4490 ± 282	7430 ± 444	5820 ± 361	7740 ± 517
Cesium 134	< 14.3	< 16.4	< 10	< 11.2	< 11.6	< 20.3
Cesium 137	< 15.9	< 18.3	< 9.76	< 12.2	< 13.2	< 18.7
Cobalt 58	< 15.9	< 18.1	< 10.7	< 12.5	< 13.2	< 19.9
Cobalt 60	< 15	< 18.2	< 9.95	< 11.8	< 12.4	< 19.7
Iodine 131	< 78.5	< 82.2	< 43.2	< 69.8	< 59	< 77.3
Iron 59	< 35.2	< 40.5	< 24.3	< 27.8	< 28.8	< 43.8
Lanthanum 140	< 38.2	< 38.8	< 20.7	< 30.4	< 27.4	< 43
Manganese 54	< 14.5	< 16.4	< 9.66	< 11.1	< 11.7	< 17.3
Niobium 95	< 18.9	< 22.3	< 12.1	< 15.3	< 15.7	< 23.1
Potassium 40	4710 ± 771	5300 ± 871	6470 ± 1120	5320 ± 859	4060 ± 662	3240 ± 611
Zinc 65	< 34.6	< 38.3	< 23.3	< 26.8	< 26.8	< 41.3
Zirconium 95	< 29	< 32.9	< 19	< 22.9	< 24	< 36.9

Radioisotopes other than those reported were not detected.

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

Sample Location	**PRI-1A**	**PRI-4B**	**PRI-5**	**PRI-6**	**PRI-8**	**PRI-9**
Collection Start	05/25/17	05/25/17	05/25/17	05/25/17	05/25/17	05/25/17
Analyte						
Gross Alpha	5600 ± 3070	< 4270	7150 ± 3130	8630 ± 3330	7960 ± 3250	10800 ± 3680
Gross Beta	9960 ± 1190	10800 ± 1210	13200 ± 1140	18600 ± 1290	18000 ± 1310	11600 ± 1280
Cesium 134	< 15.1	< 13.8	< 14.1	< 18.7	< 22.5	< 17.4
Cesium 137	427 ± 34	124 ± 15.2	68.2 ± 11.9	109 ± 17.2	102 ± 18.3	313 ± 29.6
Cobalt 58	< 16.5	< 14.2	< 16.7	< 24.1	< 26.1	< 21.8
Cobalt 60	< 18.6	< 18.3	< 17.9	< 25.9	< 28	< 22
Iron 59	< 37.4	< 35.3	< 43.7	< 57.5	< 75.6	< 54.8
Manganese 54	< 16	< 17	< 15.9	< 22.5	< 24.8	< 18.7
Niobium 95	< 20.4	< 18.7	< 23.5	< 29.6	< 37.8	< 27.8
Potassium 40	9930 ± 1630	10600 ± 1740	11200 ± 1830	15900 ± 2580	15500 ± 2550	12300 ± 2020
Zinc 65	< 34.9	< 36.8	< 36.1	< 56.8	< 65.1	< 49.3
Zirconium 95	< 31.7	< 26.8	< 33.2	< 47.6	< 58.6	< 41.1
Sample Location	PRI-1A	PRI-4B	PRI-5	PRI-6	PRI-8	PRI-9
Collection Start	08/24/17	08/23/17	08/23/17	08/24/17	08/24/17	08/23/17
Analyte						
Gross Alpha	5730 ± 3860	10800 ± 3750	6200 ± 3110	11500 ± 3840	11300 ± 3600	5900 ± 3660
Gross Beta	12500 ± 1310	13900 ± 1280	12100 ± 1260	17600 ± 1530	14500 ± 1350	12400 ± 1270
Cesium 134	< 15	< 17.2	< 18.3	< 18.3	< 16.7	< 13.5
Cesium 137	187 ± 17.7	115 ± 16.3	78.5 ± 13.4	96.5 ± 14.6	99.9 ± 12.9	273 ± 23.3
Cobalt 58	< 23.2	< 35.8	< 34.9	< 41.7	< 32.2	< 30.2
Cobalt 60	< 12.3	< 22	< 21.2	< 21.1	< 16.9	< 14.9
Iron 59	< 78.2	< 140	< 149	< 138	< 126	< 121
Manganese 54	< 17.3	< 22.7	< 22.2	< 23.2	< 21.6	< 18.1
Niobium 95	< 79.9	< 97.6	< 85.9	< 100	< 92.8	< 87.5
Potassium 40	9950 ± 1620	12000 ± 1960	11300 ± 1860	15100 ± 2450	14700 ± 2370	11500 ± 1880
Zinc 65	< 37.1	< 51.4	< 47	< 54.6	< 50.1	< 44.2
Zirconium 95	< 64.5	< 73.1	< 79.5	< 81.3	< 71.6	< 71.9

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
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 Doseimeter (mR/Std Qtr)	Direct Exposure	

a. Radionuclides will be monitored by Wisconsin DHS, 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-10	Welch farm (discontinued October 2015)	44.623106	-92.552814
PRI-13	Christiansen Dairy Farm (discontinued April 2014)	44.622813	-92.556890
PRI-15	R. Peterson farm (discontinued October 2015) - control	44.690302	-92.527982
PRI-16	Dairy Farm 356-177 Ellsworth (Started Sept 2017) - control	44.74907	-92.48600
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 - Naughy 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