

State of Wisconsin
2010
Prairie Island
Environmental Radioactivity Survey

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State Of Wisconsin DHS

2010

Prairie Island Environmental Radioactivity Survey

Introduction

Wisconsin Public Health Statutes 254.41 mandates the Department of Health Services 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 for the calendar year January - December 2010 and provides a description and results of this environmental monitoring program.

WI DHS Prairie Island Environmental Monitoring Sampling Program

The WI 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 (TLD), surface water, fish, soil, milk, well water and vegetation that are collected from selected locations at planned sampling intervals.

Table 1 is a listing of sampling sites and includes a description, direction and distance from the monitored power plant. Table 2 provides a listing of types of samples collected, sites where samples are collected, the number of samples collected, number of samples that 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

There were no program modifications for 2010.

Laboratory Services and Quality Assurance

The 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 to regularly calibrate the counters and daily performance checks are made between calibrations. In addition, quality control charts are maintained on the counters.

WSLH participates in the Environmental Resource Associates' Proficiency Testing program and has performed satisfactorily over the report period. Proficiency testing results are available from the Wisconsin State Laboratory of Hygiene.

Detection Limits

Detection limits, required by WI DHS, will be expressed as a lower limit of detection (LLD). The required WI 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, and
- t for environmental samples is 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 will be 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 are "a posteriori" calculations 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 WI DHS LLD indicating that the required WI 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:

<u>Example</u>	<u>Nuclide</u>	<u>Activity reported</u>
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.

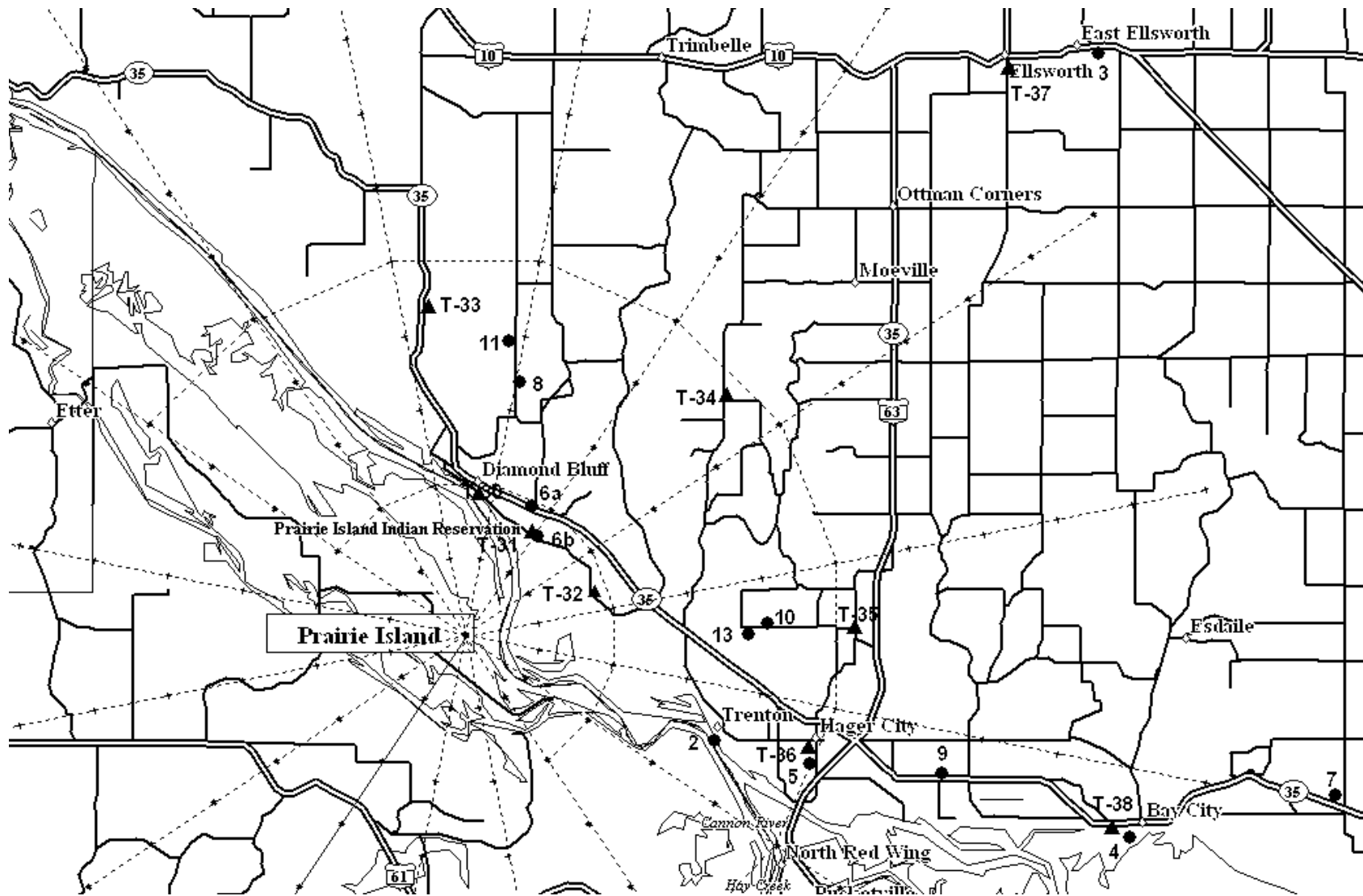


Figure 1. Location of WI DHS environmental monitoring sites for the Prairie Island monitoring program

Table 1. WI 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-3	10.9 NE	Ellsworth (discontinued 07/01/96)
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-7	11.9 E	Junction of Hwy 35 & Cty D (discontinued 07/01/96)
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
PRI-11	4.0 NNE	D. Dosdall farm (discontinued in March, 1995)
PRI-12	11.1 NNW	S. Rohl farm (discontinued in October, 1999)
PRI-13	3.8 E	Christiansen farm
PRI-14	13.8 N	A. Huppert farm (discontinued in February 2004)
PRI-15	13.9 N	R. Peterson farm
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 VV 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 2010.

Sample Type	Collection and Frequency	Site locations	Number of Samples Collected	Number of Sample Deviations	Required Analyses
air particulate	C/BW	1a, 6a, 9	81	0	GA, GB, GI
air iodine	C/BW	1a, 6a, 9	81	0	GI
precipitation	C/BW	1a, 9	12	0	GB, H
TLD	C/Q	T30 – T39	39	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	10, 13, 15	24	0	GI, I, 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

Table 3. WI DHS missing sample report or non-routine analyses for 2010.

Sample type	Date	Site	Explanation
TLD	2 nd quarter	T33	The TLD was lost in the field.
TLD	3 rd quarter	T33	For the 3rd quarter, the TLD and cage were found on the ground.

Results And Discussion

Air Particulate

A summary of reported activities by WI DHS for air particulate samples is included in Table 4. Results from the individual sample analyses are listed in Tables 5-6.

From the individual activities or quarterly averages for gross beta activities it may be noted that there are no significant differences between sites at different distances from the Prairie Island facility. With no significant difference with distance from the Prairie Island site, an increase in gross beta activity attributable to the Prairie Island plant operation is not evident.

The gamma isotopic analysis of the quarterly air particulate filter composites detected only small amounts of the radioisotopes listed in Table 4. Beryllium-7 (⁷Be), detected in all composites, is a naturally occurring radioisotope that is constantly produced through nuclear reactions between cosmic rays and nuclei in the atmosphere and is detected in air composites from other areas of the state.

Influence by the Prairie Island nuclear generating facility on air quality is not evident from air particulate analysis.

Air Iodine

A summary of reported activities by WI DHS for air iodine samples is included in Table 4. Results from the individual sample analyses are listed in Table 5.

Air iodine measurements were all below the LLD of 0.07 pCi/m³ for all sites.

Direct Radiation - Thermoluminescent Dosimeters (TLD's)

A summary of reported activities by WI DHS for direct radiation is included in Table 4. Results from the individual sample analyses are listed in Table 7.

Direct radiation (TLD) data for 2010 from the WI DHS network was comparable for all sites. Significant differences in exposure were not noticed at different distances from the Prairie Island nuclear facility. The average quarterly exposure from the ten sites located within Wisconsin was 14.7 ± 2.7 milliroentgens. The average quarterly exposure for 2010 is at background levels and is comparable to other areas within Wisconsin.

Precipitation

A summary of reported activities by WI DHS for precipitation is included in Table 4. Results from the individual sample analyses are listed in Table 8.

The gross beta activity in precipitation was within the normal range of activity when compared to previous year's data.

Surface Water

A summary of reported activities by WI DHS for surface water samples is included in Table 4. Results from the individual sample analyses are listed in Table 9.

The surface water samples showed no unusual activities and are at background levels comparable to previous years. From the gamma isotopic analysis all radioisotopes were below their respective LLD. All reported activities for gross beta, gross alpha and tritium (^3H) are at background levels. The surface water samples uniformly show activities well below state or federal standards.

Fish

A summary of reported activities by WI DHS for fish samples is included in Table 4. Results from the individual sample analyses are listed in Table 10.

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.

Well Water

A summary of reported activities by WI DHS for well water samples is included in Table 4. Results from the individual sample analyses are listed in Table 11.

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 activity levels are all below state and federal standards.

Milk

A summary of reported activities by WI DHS for milk samples is included in Table 4. Results from the individual sample analyses are listed in Table 12.

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.

Vegetation

A summary of reported activities by WI DHS for vegetation samples is included in Table 4. Results from the individual sample analyses are listed in Tables 13.

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) listed in Table 4. All other radioisotopes were below their respective LLD.

Soil

A summary of reported activities by WI DHS for soil samples is included in Table 4. Results from the individual sample analyses are listed in Table 14.

Analysis of the soil samples showed no unusual activities. The gamma isotopic analysis detected only small amounts of the radionuclides listed in Table 4. Potassium-40 (^{40}K) is a naturally occurring radioisotope. The reported activities for cesium-137 (^{137}Cs) were also detected in previous years and are largely attributable to fallout from previous atmospheric nuclear weapons testing. Naturally occurring radioisotopes such as radium-226 (^{226}Ra), bismuth-214 (^{214}Bi), lead-214 (^{214}Pb), actinium-228 (^{228}Ac), bismuth-212 (^{212}Bi) and lead-212 (^{212}Pb) from the naturally occurring uranium-238 (^{238}U) and thorium-232 (^{232}Th) decay series are commonly detected but have not been quantified or reported.

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 facilities are less than the limits as stated in these Federal regulations.

The WI DHS limit for permissible levels of radiation exposure from external sources in unrestricted areas is defined in the Wis. Adm. Code section HFS 157.23. Doses resulting from gaseous and liquid effluent releases from the Prairie Island nuclear generating facilities are less than the limits as stated in Wis. Adm. Code section HFS 157.23.

References

State of Wisconsin, Wisconsin Administrative Code, HFS 157.23

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.

Table 4. Sample activity summary for the Prairie Island environmental monitoring program for 2010.

Sample type (units)	LLD	Number of samples ^a	Analysis	Range
air particulate (pCi/m ³)	0.005	81 / 81	gross beta	0.010 - 0.040
			gamma isotopic	
	0.020	12 / 12	Be-7	0.055 - 0.134
	0.002	12 / 0	Mn-54	< 0.0006
	0.002	12 / 0	Co-58	< 0.0006
	0.005	12 / 0	Fe-59	< 0.0014
	0.002	12 / 0	Co-60	< 0.0008
	0.005	12 / 0	Zn-65	< 0.0013
	0.002	12 / 0	Nb-95	< 0.0008
	0.005	12 / 0	Zr-95	< 0.0012
	0.002	12 / 0	Ru-103	< 0.0006
	0.015	12 / 0	Ru-106	< 0.0043
	0.020	12 / 0	I-131	< 0.0020
	0.002	12 / 0	Cs-134	< 0.0006
	0.002	12 / 0	Cs-137	< 0.0006
	0.030	12 / 0	Ba-140	< 0.0050
	0.020	12 / 0	La-140	< 0.0018
	0.002	12 / 0	Ce-141	< 0.0010
0.005	12 / 0	Ce-144	< 0.0032	
air iodine (pCi/m ³)	0.07	81 / 0	I-131	< 0.033
surface water (pCi/liter)	3.0	6 / 5	gross beta (sol)	< 1.9 – 5.3
	3.0	6 / 1	gross beta (insol)	< 2.5 – 1.8
	3.0	6 / 5	gross alpha (sol)	< 1.5 – 7.8
	3.0	6 / 1	gross alpha (insol)	< 1.9 – 1.3
	300	6 / 0	H-3	< 210
	2.0	6 / 0	Sr-89	< 1.3
	1.0	6 / 0	Sr-90	< 0.4
			gamma isotopic	
	15	6 / 0	Mn-54	< 10
	15	6 / 0	Co-58	< 10
	30	6 / 0	Fe-59	< 16
	15	6 / 0	Co-60	< 12
	30	6 / 0	Zn-65	< 24
	15	6 / 0	Nb-95	< 10
	30	6 / 0	Zr-95	< 19
	15	6 / 0	I-131	< 14
	15	6 / 0	Cs-134	< 11
	15	6 / 0	Cs-137	< 11
	60	6 / 0	Ba-140	< 43
	15	6 / 0	La-140	< 15

Table 4. Sample activity summary for the Prairie Island environmental monitoring program for 2010.

Sample type (units)	LLD	Number of samples ^a	Analysis	Range
fish (pCi/kg wet)	800	4 / 4	gamma isotopic K-40	2510 – 3360
	50	4 / 0	Mn-54	< 12
	60	4 / 0	Co-58	< 12
	130	4 / 0	Fe-59	< 29
	60	4 / 0	Co-60	< 15
	130	4 / 0	Zn-65	< 29
	50	4 / 0	Nb-95	< 13
	100	4 / 0	Zr-95	< 22
	50	4 / 0	Cs-134	< 14
	60	4 / 0	Cs-137	< 15
	precipitation (nCi/m ²)	1.5 ^b	12 / 7	gross beta
300 ^b		12 / 0	H-3	< 43
well water (pCi/liter)	3.0	6 / 2	gross beta	< 0.9 – 1.1
	3.0	6 / 0	gross alpha	< 2.8
	300	6 / 0	H-3	< 210
vegetation (pCi/kg wet)	5000	12 / 0	gross alpha	< 5100
	4000	12 / 12	gross beta	3900 - 10300
	600	12 / 12	gamma isotopic Be-7	760 – 4500
	2000	12 / 12	K-40	3200 - 6600
	90	12 / 0	Mn-54	< 37
	100	12 / 0	Co-58	< 35
	200	12 / 0	Fe-59	< 68
	100	12 / 0	Co-60	< 40
	250	12 / 0	Zn-65	< 80
	100	12 / 0	Nb-95	< 42
	200	12 / 0	Zr-95	< 61
	80	12 / 0	I-131	< 42
	80	12 / 0	Cs-134	< 40
	90	12 / 0	Cs-137	< 40
	350	12 / 0	Ba-140	< 122
100	12 / 0	La-140	< 44	

Table 4. Sample activity summary for the Prairie Island environmental monitoring program for 2010.

Sample type (units)	LLD	Number of samples ^a	Analysis	Range
soil (pCi/kg dry)	6000	12 / 12	gross beta	13200 - 25700
	15000	12 / 7	gross alpha	< 11000 - 29800
			gamma isotopic	
	800	12 / 12	K-40	10800 - 15300
	60	12 / 0	Mn-54	< 27
	90	12 / 0	Co-58	< 25
	600	12 / 0	Fe-59	< 51
	90	12 / 0	Co-60	< 33
	300	12 / 0	Zn-65	< 65
	100	12 / 0	Nb-95	< 28
	250	12 / 0	Zr-95	< 48
	80	12 / 0	Cs-134	< 27
	80	12 / 12	Cs-137	100 - 260
	milk (pCi/liter)	1.0	24 / 18	Sr-90
1.5		14 / 0	I-131	< 0.6
			gamma isotopic	
500		24 / 24	K-40	1180 - 1650
15		24 / 0	Mn-54	< 14
15		24 / 0	Co-58	< 12
40		24 / 0	Fe-59	< 22
15		24 / 0	Co-60	< 15
40		24 / 0	Zn-65	< 29
15		24 / 0	Nb-95	< 12
40		24 / 0	Zr-95	< 23
15		24 / 0	I-131	< 15
15		24 / 0	Cs-134	< 14
15		24 / 0	Cs-137	< 13
60		24 / 0	Ba-140	< 48
15		24 / 0	La-140	< 15
direct exposure (mR/Std Qtr)	1.0 ^c	39 / 39	direct exposure	9.3 – 22.0

a - Number of analyses / number of analyses detected above the WI DHS LLD.
b - MDC activities expressed in units of pCi/liter.
c – 1.0 mR/ TLD

Table 5. WI 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; Prescott				PRI-6; Diamond Bluff			
collection date	volume m ³	air particulate	air iodine	collection date	volume m ³	air particulate	air iodine
01/08/10	783	0.032 +- 0.002	< 0.020	01/08/10	830	0.033 +- 0.002	< 0.015
01/20/10	818	0.037 +- 0.002	< 0.019	01/20/10	855	0.040 +- 0.002	< 0.010
02/04/10	1047	0.021 +- 0.002	< 0.006	02/04/10	1099	0.022 +- 0.002	< 0.006
02/18/10	956	0.021 +- 0.002	< 0.026	02/18/10	1007	0.022 +- 0.002	< 0.022
03/03/10	889	0.029 +- 0.002	< 0.016	03/03/10	945	0.027 +- 0.002	< 0.015
03/18/10	985	0.021 +- 0.002	< 0.008	03/18/10	1039	0.021 +- 0.002	< 0.008
04/01/10	903	0.018 +- 0.002	< 0.009	04/01/10	954	0.016 +- 0.002	< 0.015
1st Qtr				1st Qtr			
mean +- s.d.		0.026 +- 0.007	< 0.015	mean +- s.d.		0.026 +- 0.008	< 0.013
04/14/10	839	0.018 +- 0.002	< 0.017	04/14/10	890	0.017 +- 0.002	< 0.009
05/01/10	1094	0.017 +- 0.001	< 0.011	05/01/10	1156	0.017 +- 0.001	< 0.008
05/15/10	883	0.010 +- 0.001	< 0.012	05/15/10	937	0.012 +- 0.001	< 0.010
05/28/10	781	0.017 +- 0.002	< 0.013	05/28/10	821	0.017 +- 0.002	< 0.012
06/11/10	846	0.012 +- 0.002	< 0.017	06/11/10	850	0.012 +- 0.002	< 0.015
06/26/10	893	0.010 +- 0.001	< 0.010	06/26/10	997	0.010 +- 0.001	< 0.013
2nd Qtr				2nd Qtr			
mean +- s.d.		0.014 +- 0.004	< 0.013	mean +- s.d.		0.014 +- 0.003	< 0.011
07/10/10	789	0.016 +- 0.002	< 0.020	07/10/10	851	0.016 +- 0.002	< 0.012
07/22/10	690	0.019 +- 0.002	< 0.022	07/22/10	755	0.018 +- 0.002	< 0.016
08/05/10	786	0.018 +- 0.002	< 0.007	08/05/10	860	0.019 +- 0.002	< 0.009
08/22/10	960	0.023 +- 0.002	< 0.014	08/22/10	1041	0.025 +- 0.002	< 0.008
09/01/10	589	0.021 +- 0.002	< 0.033	09/01/10	623	0.023 +- 0.002	< 0.012
09/18/10	1005	0.014 +- 0.001	< 0.009	09/18/10	1070	0.014 +- 0.001	< 0.014
09/29/10	661	0.017 +- 0.002	< 0.024	09/29/10	698	0.016 +- 0.002	< 0.020
3rd Qtr				3rd Qtr			
mean +- s.d.		0.018 +- 0.003	< 0.018	mean +- s.d.		0.019 +- 0.004	< 0.013
10/09/10	588	0.022 +- 0.002	< 0.014	10/09/10	631	0.019 +- 0.002	< 0.017
10/24/10	877	0.026 +- 0.002	< 0.006	10/24/10	959	0.026 +- 0.002	< 0.007
11/04/10	703	0.013 +- 0.002	< 0.013	11/04/10	739	0.014 +- 0.002	< 0.015
11/16/10	756	0.028 +- 0.002	< 0.018	11/16/10	789	0.027 +- 0.002	< 0.018
12/01/10	985	0.019 +- 0.002	< 0.012	12/01/10	1024	0.021 +- 0.002	< 0.013
12/15/10	945	0.033 +- 0.002	< 0.014	12/15/10	991	0.030 +- 0.002	< 0.019
12/29/10	936	0.022 +- 0.002	< 0.010	12/29/10	980	0.022 +- 0.002	< 0.016
4th Qtr				4th Qtr			
mean +- s.d.		0.023 +- 0.006	< 0.012	mean +- s.d.		0.023 +- 0.005	< 0.015

Table 5. WI 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; Bay City substation			
collection date	volume m ³	air particulate	air iodine
01/08/10	1037	0.031 +- 0.002	< 0.011
01/20/10	1101	0.035 +- 0.002	< 0.014
02/04/10	1396	0.022 +- 0.001	< 0.007
02/18/10	1281	0.022 +- 0.001	< 0.017
03/03/10	1194	0.029 +- 0.002	< 0.011
03/18/10	1335	0.022 +- 0.001	< 0.006
04/01/10	1234	0.017 +- 0.001	< 0.009
1st Qtr			
mean +- s.d.		0.025 +- 0.006	< 0.011
04/14/10	1129	0.017 +- 0.001	< 0.009
05/01/10	1484	0.017 +- 0.001	< 0.008
05/15/10	1193	0.011 +- 0.001	< 0.009
05/28/10	1066	0.015 +- 0.001	< 0.006
06/11/10	1154	0.012 +- 0.001	< 0.011
06/26/10	1232	0.011 +- 0.001	< 0.013
2nd Qtr			
mean +- s.d.		0.014 +- 0.003	< 0.009
07/10/10	1140	0.015 +- 0.001	< 0.014
07/22/10	989	0.020 +- 0.002	< 0.015
08/05/10	1120	0.020 +- 0.002	< 0.013
08/22/10	1387	0.025 +- 0.001	< 0.011
09/01/10	844	0.023 +- 0.002	< 0.019
09/18/10	1441	0.013 +- 0.001	< 0.009
09/29/10	947	0.017 +- 0.002	< 0.009
3rd Qtr			
mean +- s.d.		0.019 +- 0.004	< 0.013
10/09/10	845	0.019 +- 0.002	< 0.013
10/24/10	1273	0.025 +- 0.002	< 0.007
11/04/10	973	0.016 +- 0.002	< 0.011
11/16/10	1038	0.026 +- 0.002	< 0.011
12/01/10	1338	0.021 +- 0.001	< 0.009
12/15/10	1275	0.030 +- 0.002	< 0.012
12/29/10	1265	0.021 +- 0.001	< 0.012
4th Qtr			
mean +- s.d.		0.023 +- 0.005	< 0.011

Table 6. WI 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/m ³				
Site: PRI-1	1st quarter	2nd quarter	3 rd quarter	4th quarter
Be-7	0.104 +- 0.006	0.128 +- 0.009	0.082 +- 0.009	0.055 +- 0.008
Mn-54	< 0.0006	< 0.0002	< 0.0004	< 0.0004
Co-58	< 0.0004	< 0.0003	< 0.0005	< 0.0003
Fe-59	< 0.0012	< 0.0006	< 0.0012	< 0.0008
Co-60	< 0.0008	< 0.0003	< 0.0006	< 0.0005
Zn-65	< 0.0010	< 0.0005	< 0.0010	< 0.0009
Nb-95	< 0.0008	< 0.0004	< 0.0005	< 0.0005
Zr-95	< 0.0012	< 0.0005	< 0.0009	< 0.0006
Ru-103	< 0.0006	< 0.0003	< 0.0006	< 0.0003
Ru-106	< 0.0040	< 0.0025	< 0.0040	< 0.0035
I-131	< 0.0019	< 0.0016	< 0.0018	< 0.0010
Cs-134	< 0.0006	< 0.0004	< 0.0005	< 0.0004
Cs-137	< 0.0004	< 0.0003	< 0.0005	< 0.0004
Ba-140	< 0.0050	< 0.0032	< 0.0038	< 0.0026
La-140	< 0.0018	< 0.0012	< 0.0013	< 0.0012
Ce-141	< 0.0007	< 0.0004	< 0.0010	< 0.0004
Ce-144	< 0.0024	< 0.0011	< 0.0030	< 0.0013
Site: PRI-6				
Be-7	0.095 +- 0.006	0.134 +- 0.009	0.072 +- 0.009	0.067 +- 0.008
Mn-54	< 0.0005	< 0.0003	< 0.0003	< 0.0005
Co-58	< 0.0006	< 0.0003	< 0.0003	< 0.0004
Fe-59	< 0.0014	< 0.0008	< 0.0008	< 0.0009
Co-60	< 0.0006	< 0.0004	< 0.0003	< 0.0005
Zn-65	< 0.0013	< 0.0006	< 0.0008	< 0.0010
Nb-95	< 0.0006	< 0.0004	< 0.0005	< 0.0006
Zr-95	< 0.0007	< 0.0007	< 0.0004	< 0.0010
Ru-103	< 0.0005	< 0.0004	< 0.0004	< 0.0005
Ru-106	< 0.0043	< 0.0031	< 0.0038	< 0.0043
I-131	< 0.0019	< 0.0019	< 0.0011	< 0.0016
Cs-134	< 0.0004	< 0.0004	< 0.0005	< 0.0006
Cs-137	< 0.0004	< 0.0004	< 0.0004	< 0.0006
Ba-140	< 0.0041	< 0.0033	< 0.0033	< 0.0034
La-140	< 0.0016	< 0.0010	< 0.0017	< 0.0010
Ce-141	< 0.0010	< 0.0008	< 0.0004	< 0.0009
Ce-144	< 0.0026	< 0.0023	< 0.0014	< 0.0032
Site: PRI-9				
Be-7	0.101 +- 0.006	0.123 +- 0.008	0.081 +- 0.008	0.057 +- 0.007
Mn-54	< 0.0005	< 0.0003	< 0.0004	< 0.0002
Co-58	< 0.0005	< 0.0003	< 0.0003	< 0.0002
Fe-59	< 0.0011	< 0.0006	< 0.0010	< 0.0005
Co-60	< 0.0004	< 0.0003	< 0.0004	< 0.0004
Zn-65	< 0.0010	< 0.0005	< 0.0009	< 0.0005
Nb-95	< 0.0006	< 0.0004	< 0.0005	< 0.0003
Zr-95	< 0.0009	< 0.0005	< 0.0006	< 0.0004
Ru-103	< 0.0004	< 0.0003	< 0.0005	< 0.0002
Ru-106	< 0.0041	< 0.0022	< 0.0033	< 0.0029
I-131	< 0.0018	< 0.0020	< 0.0015	< 0.0007
Cs-134	< 0.0004	< 0.0003	< 0.0004	< 0.0004
Cs-137	< 0.0004	< 0.0003	< 0.0005	< 0.0003
Ba-140	< 0.0031	< 0.0030	< 0.0026	< 0.0018
La-140	< 0.0011	< 0.0008	< 0.0010	< 0.0013
Ce-141	< 0.0007	< 0.0007	< 0.0008	< 0.0003
Ce-144	< 0.0020	< 0.0018	< 0.0026	< 0.0011

Radioisotopes other than those reported were not detected.

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

Date Placed:	01/13/10	04/13/10	07/14/10	10/12/10
Date Removed:	04/13/10	07/14/10	10/12/10	01/11/11
Days in the Field:	90	92	90	91
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	12.1 +- 0.8	12.8 +- 0.7	16.4 +- 0.9	13.9 +- 0.5
T31	12.6 +- 1.2	11.7 +- 1.2	16.0 +- 1.2	14.3 +- 0.8
T32	12.6 +- 0.9	12.9 +- 1.4	17.5 +- 0.9	14.8 +- 1.1
Quarterly average +- s.d.	12.4 +- 0.3	12.5 +- 0.7	16.6 +- 0.8	14.3 +- 0.5
TLD sites that are located 2– 5 miles from the Prairie island facility				
* a T33	15.4 +- 0.6	ND	22.0 +- 0.8	13.6 +- 0.6
T34	14.7 +- 1.0	15.9 +- 0.7	19.4 +- 0.7	17.7 +- 0.7
T35	12.9 +- 0.6	13.8 +- 1.1	19.0 +- 0.6	17.9 +- 1.3
T36	12.3 +- 0.7	14.8 +- 0.9	16.6 +- 0.7	18.6 +- 0.8
Quarterly average +- s.d.	13.8 +- 1.5	14.8 +- 1.1	19.3 +- 2.2	17.0 +- 2.3
TLD sites that are located greater than 5 miles from the Prairie island facility				
T37	12.8 +- 1.1	13.3 +- 0.6	17.3 +- 1.4	16.8 +- 0.7
T38	11.9 +- 0.5	9.3 +- 0.7	15.2 +- 0.6	11.5 +- 0.8
T39	11.6 +- 0.9	10.8 +- 0.7	15.2 +- 1.0	13.8 +- 0.7
Quarterly average +- s.d.	12.1 +- 0.6	11.1 +- 2.0	15.9 +- 1.2	14.0 +- 2.7
ND – The TLD was lost in the field.				
*a - For the 3rd quarter, the TLD and cage were found on the ground.				

Table 8. WI 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
01/20/10	0.06	0.011 +- 0.002	< 0.28
02/18/10	0.52	0.06 +- 0.02	< 2.4
03/18/10	0.45	0.077 +- 0.015	< 2.1
04/14/10	0.41	0.07 +- 0.02	< 2.2
05/28/10	3.14	< 0.20	< 17
06/26/10	6.60	< 0.40	< 30
07/22/10	3.53	< 0.22	< 16
08/22/10	6.45	< 0.24	< 30
09/29/10	9.41	0.40 +- 0.25	< 43
10/24/10	0.30	0.033 +- 0.011	< 1.34
11/16/10	2.35	< 0.15	< 11
12/29/10	2.66	0.27 +- 0.07	< 12

Table 9. WI 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-4	PRI-1	PRI-2	PRI-4
Collection date:	06/08/10	06/08/10	06/08/10	09/08/10	09/08/10	09/08/10
gross alpha-sol	< 1.5	7.8 +- 2.5	3.2 +- 1.7	4.8 +- 2.7	2.6 +- 1.7	4.5 +- 2.2
gross beta-sol	< 1.9	5.3 +- 1.0	2.8 +- 1.6	3.3 +- 1.3	3.8 +- 0.8	3.1 +- 1.0
gross alpha-insol	< 1.1	< 1.2	1.3 +- 0.8	< 1.4	< 1.5	< 1.9
gross beta-insol	< 2.4	< 2.5	< 2.2	< 1.4	< 1.4	1.8 +- 1.1
H-3 *	< 210	< 210	< 210	< 180	< 180	< 180
Sr-89 *	< 0.7	< 0.8	< 0.7	< 1.0	< 0.8	< 1.3
Sr-90 *	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.4
gamma isotopic						
Mn-54	< 9	< 9	< 9	< 8	< 10	< 8
Co-58	< 7	< 9	< 10	< 6	< 9	< 7
Fe-59	< 13	< 14	< 16	< 11	< 16	< 15
Co-60	< 10	< 12	< 12	< 9	< 10	< 7
Zn-65	< 17	< 18	< 12	< 16	< 24	< 17
Nb-95	< 10	< 9	< 10	< 8	< 10	< 8
Zr-95	< 14	< 16	< 15	< 12	< 19	< 12
I-131	< 10	< 8	< 10	< 8	< 14	< 10
Cs-134	< 11	< 10	< 11	< 7	< 11	< 8
Cs-137	< 11	< 8	< 11	< 9	< 11	< 7
Ba-140	< 43	< 35	< 36	< 29	< 37	< 24
La-140	< 12	< 13	< 15	< 13	< 14	< 13

Radioisotopes other than those reported were not detected.

Table 10. WI DHS analysis results for fish samples collected for the Prairie Island environmental monitoring program.

Measurements in units of pCi/kilogram (wet)				
Collection date:	05/24/10	05/26/10	11/01/10	11/03/10
Location:	downstream	upstream	downstream	upstream
Type:	white bass	white bass	walleye	walleye
gamma isotopic				
K-40	3100 +- 300	2500 +- 300	3400 +- 600	3300 +- 600
Mn-54	< 11	< 9	< 10	< 12
Co-58	< 12	< 9	< 8	< 10
Fe-59	< 28	< 29	< 25	< 29
Co-60	< 11	< 12	< 14	< 15
Zn-65	< 29	< 26	< 27	< 28
Nb-95	< 13	< 11	< 13	< 13
Zr-95	< 22	< 16	< 18	< 22
Cs-134	< 12	< 9	< 11	< 14
Cs-137	< 15	< 9	< 12	< 11
Radioisotopes other than those reported were not detected				

Table 11. WI 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:	06/08/10	06/08/10	06/08/10	09/08/10	09/08/10	09/08/10
gross alpha	< 1.9	< 1.6	< 2.1	< 2.8	< 2.0	< 2.3
gross beta	< 0.7	0.8 +- 0.4	< 1.5	< 1.0	1.1 +- 0.5	< 0.9
H-3	< 210	< 210	< 210	< 180	< 180	< 180

Table 12. WI DHS analysis results for milk samples collected for the Prairie Island environmental monitoring program.

Measurements in units of pCi/liter

Location	PRI-13	PRI-10	PRI-13	PRI-10	PRI-13	PRI-10
Collection date:	01/12/10	02/09/10	03/09/10	04/15/10	05/11/10	06/16/10
I-131		< 0.2	< 0.4	< 0.2	< 0.2	
Sr-90	1.2 +- 0.6	< 0.6	0.8 +- 0.4	0.6 +- 0.4	1.0 +- 0.4	0.6 +- 0.3
gamma isotopic						
K-40	1300 +- 130	1460 +- 90	1330 +- 130	1300 +- 130	1200 +- 90	1200 +- 300
Mn-54	< 6	< 6	< 6	< 7	< 6	< 10
Co-58	< 6	< 6	< 7	< 9	< 6	< 6
Fe-59	< 12	< 14	< 12	< 17	< 13	< 20
Co-60	< 7	< 7	< 7	< 7	< 7	< 10
Zn-65	< 15	< 15	< 15	< 19	< 12	< 20
Nb-95	< 6	< 6	< 7	< 9	< 6	< 7
Zr-95	< 12	< 10	< 12	< 11	< 10	< 19
I-131	< 6	< 6	< 7	< 11	< 6	< 11
Cs-134	< 6	< 5	< 6	< 6	< 7	< 8
Cs-137	< 6	< 6	< 5	< 7	< 7	< 8
Ba-140	< 23	< 22	< 22	< 30	< 24	< 31
La-140	< 5	< 6	< 8	< 8	< 1	< 11
Location	PRI-13	PRI-10	PRI-13	PRI-10	PRI-13	PRI-10
Collection date:	07/13/10	08/10/10	09/07/10	10/12/10	11/09/10	12/07/10
I-131	< 0.4	< 0.3				< 0.6
Sr-90	1.2 +- 0.4	< 0.6	< 0.6	0.6 +- 0.4	0.6 +- 0.3	1.0 +- 0.5
gamma isotopic						
K-40	1300 +- 300	1200 +- 300	1300 +- 300	1500 +- 300	1300 +- 300	1400 +- 300
Mn-54	< 9	< 8	< 10	< 8	< 10	< 9
Co-58	< 10	< 10	< 9	< 9	< 8	< 11
Fe-59	< 21	< 21	< 16	< 17	< 21	< 16
Co-60	< 12	< 10	< 9	< 12	< 13	< 15
Zn-65	< 22	< 23	< 16	< 26	< 21	< 20
Nb-95	< 9	< 8	< 10	< 8	< 9	< 9
Zr-95	< 21	< 11	< 15	< 9	< 17	< 16
I-131	< 10	< 9	< 10	< 11	< 10	< 9
Cs-134	< 12	< 7	< 9	< 9	< 10	< 9
Cs-137	< 10	< 11	< 9	< 8	< 11	< 8
Ba-140	< 31	< 38	< 35	< 26	< 34	< 38
La-140	< 15	< 12	< 14	< 8	< 12	< 10

Radioisotopes other than those reported were not detected.

Table 12. WI DHS analysis results for milk samples collected for the Prairie Island environmental monitoring program.

Measurements in units of pCi/liter

Location: PRI-15

Collection date:	01/12/10	02/09/10	03/09/10	04/14/10	05/11/10	06/16/10
I-131		< 0.2	< 0.4	< 0.2	< 0.2	
Sr-90	< 0.7	< 0.7	1.1 +- 0.4	0.9 +- 0.3	1.3 +- 0.4	0.9 +- 0.4
gamma isotopic						
K-40	1210 +- 130	1650 +- 100	1470 +- 150	1180 +- 130	1380 +- 140	1200 +- 300
Mn-54	< 7	< 8	< 7	< 9	< 8	< 9
Co-58	< 6	< 7	< 8	< 7	< 7	< 10
Fe-59	< 14	< 15	< 14	< 16	< 14	< 18
Co-60	< 9	< 9	< 7	< 10	< 8	< 10
Zn-65	< 19	< 18	< 16	< 17	< 19	< 19
Nb-95	< 10	< 9	< 9	< 9	< 6	< 8
Zr-95	< 13	< 12	< 12	< 14	< 11	< 10
I-131	< 8	< 9	< 8	< 12	< 8	< 12
Cs-134	< 8	< 7	< 7	< 7	< 7	< 7
Cs-137	< 8	< 8	< 7	< 7	< 8	< 7
Ba-140	< 29	< 27	< 27	< 35	< 29	< 41
La-140	< 10	< 10	< 8	< 11	< 7	< 12
Collection date:	07/13/10	08/10/10	09/07/10	10/12/10	11/09/10	12/07/10
I-131	< 0.4	< 0.3				< 0.6
Sr-90	1.5 +- 0.4	< 0.6	0.8 +- 0.4	1.1 +- 0.4	0.8 +- 0.3	1.2 +- 0.5
gamma isotopic						
K-40	1300 +- 300	1400 +- 300	1300 +- 300	1400 +- 300	1400 +- 300	1500 +- 300
Mn-54	< 11	< 14	< 12	< 9	< 10	< 7
Co-58	< 11	< 11	< 12	< 8	< 9	< 8
Fe-59	< 20	< 22	< 20	< 15	< 19	< 18
Co-60	< 15	< 15	< 15	< 11	< 10	< 10
Zn-65	< 29	< 22	< 25	< 23	< 19	< 21
Nb-95	< 10	< 12	< 11	< 8	< 9	< 8
Zr-95	< 20	< 23	< 19	< 15	< 16	< 13
I-131	< 14	< 12	< 15	< 9	< 13	< 9
Cs-134	< 11	< 14	< 13	< 9	< 10	< 10
Cs-137	< 12	< 12	< 13	< 7	< 10	< 10
Ba-140	< 44	< 48	< 42	< 32	< 40	< 27
La-140	< 11	< 12	< 14	< 14	< 13	< 13

Radioisotopes other than those reported were not detected.

Table 13. WI DHS analysis results for vegetation samples collected for the Prairie Island environmental monitoring program.

Measurements in units of pCi/kilogram (wet)

Site	PRI-1	PRI-4	PRI-5	PRI-6	PRI-8	PRI-9
Collection date:	06/08/10	06/08/10	06/08/10	06/08/10	06/08/10	06/08/10
gross alpha	< 3300	< 2200	< 2000	< 3300	< 2500	< 2700
gross beta	7800 +- 1100	4600 +- 700	4600 +- 700	6800 +- 1000	3900 +- 800	7400 +- 900
gamma isotopic						
Be-7	1080 +- 130	760 +- 80	1260 +- 120	860 +- 130	840 +- 100	1720 +- 120
K-40	3800 +- 400	3500 +- 400	3400 +- 300	3400 +- 400	3400 +- 300	3800 +- 400
Mn-54	< 29	< 23	< 15	< 22	< 17	< 24
Co-58	< 25	< 19	< 13	< 23	< 11	< 21
Fe-59	< 52	< 38	< 31	< 49	< 35	< 47
Co-60	< 37	< 31	< 16	< 36	< 16	< 25
Zn-65	< 63	< 52	< 28	< 39	< 37	< 41
Nb-95	< 27	< 20	< 12	< 24	< 17	< 20
Zr-95	< 47	< 30	< 25	< 49	< 21	< 30
I-131	< 35	< 19	< 14	< 24	< 16	< 26
Cs-134	< 30	< 19	< 14	< 28	< 16	< 21
Cs-137	< 33	< 21	< 15	< 30	< 10	< 22
Ba-140	< 108	< 70	< 60	< 73	< 52	< 80
La-140	< 28	< 28	< 12	< 23	< 24	< 20
Collection date:	09/08/10	09/08/10	09/08/10	09/08/10	09/08/10	09/08/10
gross alpha	< 3300	< 3800	< 4100	< 3400	< 3600	< 5100
gross beta	6600 +- 1000	8200 +- 1200	8600 +- 1300	10300 +- 1100	6800 +- 1100	6900 +- 1500
gamma isotopic						
Be-7	1500 +- 300	2700 +- 400	4500 +- 500	2400 +- 300	3400 +- 500	3300 +- 400
K-40	3200 +- 800	4900 +- 1000	5100 +- 1100	6600 +- 1200	5900 +- 1300	4300 +- 900
Mn-54	< 35	< 32	< 27	< 23	< 37	< 18
Co-58	< 26	< 35	< 26	< 21	< 30	< 26
Fe-59	< 59	< 68	< 61	< 53	< 68	< 41
Co-60	< 37	< 36	< 37	< 23	< 40	< 28
Zn-65	< 65	< 78	< 69	< 61	< 80	< 56
Nb-95	< 22	< 31	< 30	< 18	< 42	< 17
Zr-95	< 58	< 57	< 50	< 37	< 61	< 45
I-131	< 36	< 42	< 39	< 20	< 32	< 18
Cs-134	< 40	< 34	< 33	< 21	< 37	< 21
Cs-137	< 37	< 34	< 36	< 21	< 40	< 27
Ba-140	< 100	< 120	< 120	< 76	< 85	< 79
La-140	< 44	< 41	< 38	< 26	< 41	< 27

Radioisotopes other than those reported were not detected.

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

Measurements in units of pCi/kilogram (dry)						
Site	PRI-1	PRI-4	PRI-5	PRI-6	PRI-8	PRI-9
Collection date:	06/08/10	06/08/10	06/08/10	06/08/10	06/08/10	06/08/10
gross alpha	13000 +- 9000	< 11000	< 11000	15000 +- 9000	30000 +- 11000	< 10900
gross beta	21000 +- 4000	14000 +- 3000	18000 +- 3000	25000 +- 4000	22000 +- 4000	13000 +- 3000
gamma isotopic						
K-40	13500 +- 1300	12100 +- 1200	12000 +- 1200	12500 +- 1300	15300 +- 1500	12300 +- 1200
Mn-54	< 19	< 18	< 20	< 27	< 25	< 19
Co-58	< 17	< 16	< 22	< 25	< 23	< 19
Fe-59	< 49	< 31	< 48	< 47	< 51	< 43
Co-60	< 26	< 18	< 29	< 33	< 28	< 24
Zn-65	< 55	< 35	< 59	< 65	< 59	< 48
Nb-95	< 22	< 15	< 22	< 28	< 27	< 20
Zr-95	< 38	< 22	< 37	< 46	< 46	< 36
Cs-134	< 19	< 12	< 23	< 27	< 22	< 17
Cs-137	148 +- 14	175 +- 13	159 +- 15	260 +- 20	119 +- 14	194 +- 15
Collection date:	09/08/10	09/08/10	09/08/10	09/08/10	09/08/10	09/08/10
gross alpha	18000 +- 9000	< 11000	22000 +- 10000	26000 +- 10000	21000 +- 10000	< 11000
gross beta	25000 +- 4000	19000 +- 3000	17000 +- 3000	24000 +- 4000	26000 +- 4000	16000 +- 3000
gamma isotopic						
K-40	12900 +- 2500	12100 +- 1900	10800 +- 1800	12700 +- 2500	14800 +- 2400	10900 +- 1800
Mn-54	< 22	< 19	< 23	< 21	< 25	< 22
Co-58	< 18	< 18	< 25	< 18	< 23	< 17
Fe-59	< 39	< 44	< 35	< 39	< 47	< 43
Co-60	< 18	< 25	< 20	< 22	< 21	< 23
Zn-65	< 41	< 48	< 54	< 41	< 58	< 46
Nb-95	< 18	< 21	< 20	< 17	< 25	< 24
Zr-95	< 31	< 38	< 42	< 35	< 48	< 42
Cs-134	< 16	< 18	< 22	< 17	< 24	< 19
Cs-137	100 +- 20	150 +- 30	150 +- 30	260 +- 30	130 +- 40	180 +- 30
Naturally occurring radioisotopes such as radium-226 (²²⁶ Ra), bismuth-214 (²¹⁴ Bi), lead-214 (²¹⁴ Pb), actinium-228 (²²⁸ Ac), bismuth-212 (²¹² Bi), lead-212 (²¹² Pb) from the naturally occurring uranium-238 (²³⁸ U) and thorium-232 (²³² Th) decay series are commonly detected but have not been quantified or reported.						
Radioisotopes other than those reported were not detected.						