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10 CFR 72.44

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U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Subject: 2016 Radiological Environmental Operating Report

Big Rock Point Plant
Dockets 50-155 and 72-043
License No. DPR-6

Dear Sir or Madam:

Entergy Nuclear Operations, Inc. is submitting the enclosed Radiological Environmental Operating Report for the Big Rock Point Independent Spent Fuel Storage Installation (ISFSI). This report was prepared in accordance with the requirements of 10 CFR 50, Appendix I, Section IV.B, and Defueled Technical Specification 6.6.2. The period covered by the enclosed report is January 1, 2016, through December 31, 2016.

This letter contains no new commitments and no revision to existing commitments.

Sincerely,

A handwritten signature in black ink, appearing to read "JAH" followed by a stylized flourish.

JAH/bed

Enclosure: Big Rock Point 2016 Annual Radiological Environmental Operating Report
Attachment 1: Sample Collection Anomalies
Attachment 2: Environmental Sample Schedule and Sample Location Maps
Attachment 3: Radiological Environmental Monitoring Program Data for BRP ISFSI

CC Administrator, Region III, USNRC
BRP ISFSI Inspector, USNRC
NMSS Project Manager, USNRC

ENCLOSURE

Big Rock Point 2016 Annual Radiological Environmental Operating Report

I. Introduction

The 2016 Big Rock Point (BRP) Annual Radiological Environmental Operating Report provides a summary and data interpretation of the BRP Radiological Environmental Monitoring Program (REMP) as conducted during the 2016 reporting period. Reporting requirements are detailed in the BRP Defueled Technical Specification 6.6.2 and Offsite Dose Calculation Manual (ODCM).

The BRP ODCM contains the requirements for the REMP. The radiological environmental monitoring sampling requirements are greatly reduced from the plant's operating period and now only encompass Independent Spent Fuel Storage Installation (ISFSI) operations.

All samples were collected during the monitoring period with no anomalies.

Tables 1, 2, and 3, of this enclosure, provide a summary of 2016 BRP REMP sample requirements and results.

II. Discussion and Interpretation of Results

A. TLDs – Gamma Dose

The BRP Gamma Dose Assessment Program consists of eleven thermoluminescent dosimeter (TLD) locations: Four at the outside perimeter of the ISFSI (locations: BR-18, BR-19, BR-20, and BR-21), four at the ISFSI protected area fence line (locations: BR-22, BR-23, BR-24, and BR-25), and three control TLDs, approximately 13 miles out (locations: BR-5 Petoskey, BR-6 Boyne City, and BR-7 Ironton). These are the only TLDs required for ISFSI operation. The additional locations are no longer applicable because they no longer exist. Environmental gamma doses are measured quarterly by placement of one TLD badge per designated location. Detailed sample station identification and location information is provided in Attachment 2.

For 2016, the average quarterly gamma readings were:

23.1 millirem for protected area fence TLDs,
18.1 millirem for ISFSI outside perimeter TLDs, and
17.3 millirem for the control TLD locations.

The comparative evaluation of the protected area fence line quarterly TLD mean measured in 2016 is the same as that of 2015. The 2016 quarterly TLD mean of the ISFSI outside perimeter is slightly higher than that of 2015, but still within the statistical standard deviation.

A comparative evaluation was also completed of the 2016 offsite control TLD data to the ISFSI outside perimeter TLD data. There was excellent correlation between the off-site control TLDs and the ISFSI outside perimeter TLDs. There was no significant difference between the 2015 and 2016 control data.

Each TLD badge contains a 4-chip TLD that meets ANSI N545-1975 requirements.

B. Air Samples

The BRP REMP no longer requires that airborne surveillance be conducted.

C. Milk

The BRP REMP no longer requires that milk samples be collected.

D. Lake Water

The BRP REMP no longer requires that lake water samples be collected.

E. Drinking Water

The BRP REMP no longer requires that drinking water samples be collected.

F. Crops

The collection of food crops/vegetation is not required by the BRP REMP.

G. Sediment

The BRP REMP no longer requires that well water samples be collected.

H. Aquatic Biota

The collection of aquatic biota (algae and periphyton) is no longer required by the BRP REMP.

III. Assessment of BRP ISFSI Operational Environmental Impact

Review and comparison of the 2016 BRP radiological environmental monitoring data to previous data shows that the parameters analyzed support the conclusion that ISFSI operations have had minimal environmental impact.

Table 1. Sampling and Analysis Summary

<u>Medium</u>	<u>Description</u>	<u>Location(s)</u>	<u>Type of Analysis</u>	<u>Number of Samples Collected</u>	<u>Frequency of Analysis</u>
TLD	BR-5, BR-6, BR-7, BR-18-25	18-25 BRP, 5-PT, 6-BC, 7-IR	Gamma Isotopic	44	Quarterly ^a
Lake Water	1 gallon composite	1-ST	Tritium, Gamma Isotopic	0	No Longer Required
Well Water	1 gallon grab/composite	Site Well	Tritium, Gamma Isotopic	0	No Longer Required
Monitoring Wells	1 gallon grab	MW 1-9	Tritium, Gamma Isotopic	0	No Longer Required
Sediment	Grab	1-ST, 24-STS, 25-STN, 26-LP	Gamma Isotopic	0	No Longer Required
Fish	Grab	1-ST Discharge	Gamma Isotopic	0	No Longer Required

Table Notes

^a Only quarterly TLDs are required per Big Rock Point ODCM

Table 2. Sample Data Summary ^a

Medium or Pathway Sampled (Units)	Analysis Evaluated Versus Total Number Analyses Performed	Lower Limit of Detection (LLD) ^b	All Indicator Locations (Range)	Mean ^c	All Control Locations (Range)	Mean ^c	Nonroutine Measurements
<u>Direct Radiation:</u>							
TLD – Protected Area (mR) Fence	TLD (quarterly) ^{d e} 16/16	1.0	16/16	23.1 (18-35)	12/12	17.3 (15-19)	None
TLD – ISFSI Outside (mR) Perimeter	TLD (quarterly) ^{d e} 16/16	1.0	16/16	18.1 (15-23)	12/12	17.3 (15-19)	None
<u>Waterborne:</u>							
Lake Water (pCi/L)	Sample not required						
Well Water (pCi/L)	Sample not required						
<u>Lake Sediment:</u>							
Sediment (pCi/g dry)	Sample not required						
<u>Biota:</u>							
Fish (pCi/g wet)	Sample not required						
Crayfish (pCi/g wet)	Sample not required						

Table Notes:

^a Values for sample locations with the greatest annual mean are provided in Table 3.

^b Nominal LLD as defined in the Big Rock Offsite Dose Calculation Manual Section I, Table I-3 and vendor analytical capabilities.

^c Mean and range data reported are based upon detectable measurements.

^d Quarterly TLD results are normalized for 91 days net.

^e Quarterly TLDs are read quarterly. Quarterly measurements are compared to control measurements to evaluate compliance with 10 CFR 72.104. The results for the ISFSI TLDs and the average of the control TLDs measured in 2016 are summarized in the Table.

Table 3. Reporting Results Greatest Mean Sampling Location

<u>Medium</u>	<u>Type of Analysis</u>	<u>Location</u>	<u>High</u>	<u>Low</u>	<u>Mean</u>
TLD – Protected Area Fence (mR)	TLD (Quarterly) ^{a b}	BRP-23	35	26	31.5
TLD – ISFSI Outside Perimeter (mR)	TLD (Quarterly) ^{a b}	BRP-20	23	18	20.5
Lake Water (pCi/L)	No Longer Required				
Well Water (pCi/L)	No Longer Required				
Sediment (pCi/g dry)	No Longer Required				
Fish (pCi/g wet)	No Longer Required				
Crayfish (pCi/g wet)	No Longer Required				

Table Notes:

^a Quarterly TLD results are normalized for 91 days net.

^b Quarterly TLDs are read quarterly. Quarterly measurements are compared to control measurements to evaluate compliance with 10 CFR 72.104. The results for the ISFSI TLDs and the average of the control TLDs measured in 2016 are summarized in the Table.

Attachment 1
Sample Collection Anomalies

LOCATION

TYPE

REASON

NONE TO REPORT

Attachment 2
Environmental Sample Schedule and Sample Location Maps

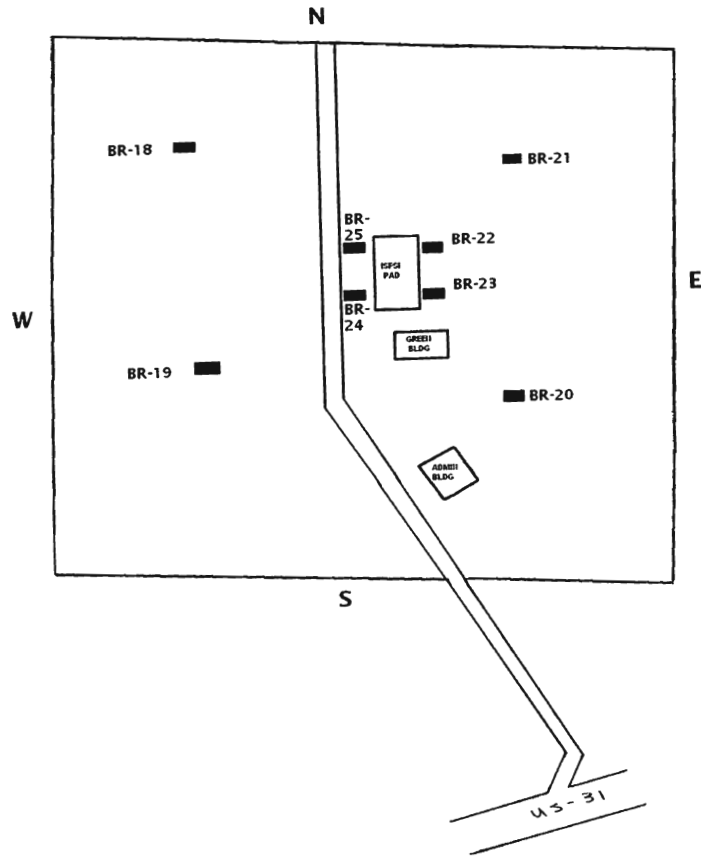
TABLE 1-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

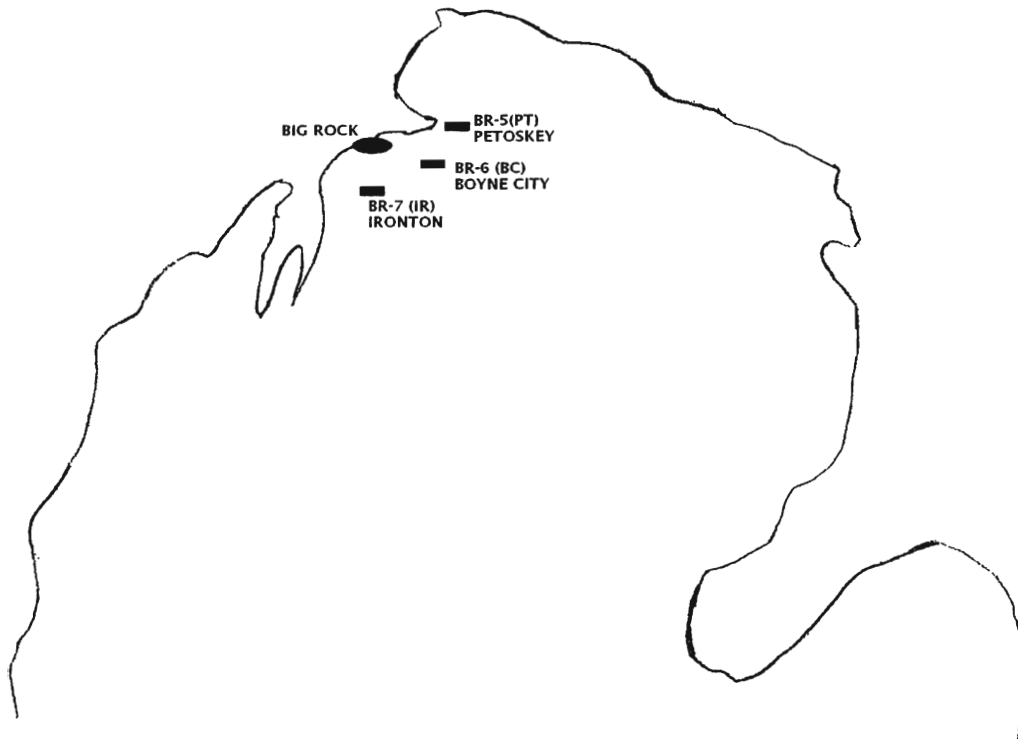
Exposure Pathway and/or Sample	Number of Representative Samples and Sample Locations ^a	Sampling and Collection Frequency	Type and frequency of Analysis
1. Direct Radiation ^b	11 monitoring stations either with two or more TLDs or one instrument for measuring and recording dose rate continuously, placed as follows ^c : a) Balance of stations (3) placed to serve as control stations b) Outside perimeter of ISFSI (4) ^d c) ISFSI protected area fence line (4) ^d	Quarterly	Gamma dose quarterly

- a. Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment and other legitimate reasons. If specimens are unobtainable due to sampling equipment malfunction, every effort shall be made to complete corrective action prior to the end of the next sampling period. All deviations from the sampling schedule shall be documented in the Annual Radiological Environmental Operating Report pursuant to the Reporting Requirements of ODCM. Alternative media and locations may be chosen for any particular pathway if designated locations or media are not available, and appropriate substitutions are made within 30 days in the radiological environmental monitoring program.
- b. One or more instruments, such as a pressurized ion chamber, for measuring and recording dose rate continuously may be used in place of, or in addition to, integrating dosimeters. The background dosimetry requirement also may be met through use of dosimeters shared with another facility, or from data provided by another entity, such as the State of Michigan, as appropriate for this site.
- c. For the purposes of this table, a TLD is considered to be one phosphor; two or more phosphors or phosphor readout zones in a packet are considered as two or more dosimeters.
- d. TLDs designated for ISFSI only operation.

Big Rock Point
Environmental Sample Location Map



**BIG ROCK POINT
CONTROL TLD LOCATIONS**



Attachment 3

**Radiological Environmental Monitoring Program (REMP) Data for
Big Rock Point (BRP) Independent Spent Fuel Storage Installation (ISFSI)**



Global Dosimetry Solutions Environmental Report

Account	89567	RSCS
Location	00000DPT	
Monitoring Period	1/1/2016	
Process	0229661	

Badge Number	Name	Exposure mR ²
	CONTROL	12
1	BR-5	16
2	BR-6	15
3	BR-7	16
4	BR-18	15
5	BR-19	17
6	BR-20	18
7	BR-22	19
8	BR-23	35
9	BR-24	21
10	BR-25	18
11	BR-SH1	12
12	BR-SH2	11
13	BR-CTRL1	11
14	BR-CTRL2	11
15	BR-21	15
16	BR-SP2	11
17	BR-SP1	12

*. No control exposures have been subtracted, and only element, reader and fade corrections have been made.



Global Dosimetry Solutions Environmental Report

Account	89567	RSCS
Location	00000DPT	
Monitoring Period	4/1/2016	
Process	0230776	

Badge Number	Name	Exposure mR*
	CONTROL	14
1	BR-5	17
2	BR-6	17
3	BR-7	18
4	BR-18	16
5	BR-19	18
6	BR-20	19
7	BR-22	20
8	BR-23	26
9	BR-24	21
10	BR-25	19
11	BR-SH1	13
12	BR-SH2	13
13	BR-CTRL1	12
14	BR-CTRL2	13
15	BR-21	16
16	BR-SP2	13
17	BR-SP1	13

* - No control exposures have been subtracted, and only element, reader and fade corrections have been made.



Global Dosimetry Solutions Environmental Report

Account	89567	RSCS
Location	00000DPT	
Monitoring Period	7/1/2016	
Process	0231893	

Badge Number	Name	Exposure mR [*]
	CONTROL	14
1	BR-5	17
2	BR-6	18
3	BR-7	19
4	BR-18	19
5	BR-19	19
6	BR-20	23
7	BR-22	20
8	BR-23	34
9	BR-24	21
10	BR-25	19
11	BR-SH1	13
12	BR-SH2	14
13	BR-CTRL1	13
14	BR-CTRL2	13
15	BR-21	17
16	BR-SP2	13
17	BR-SP1	13

*- No control exposures have been subtracted, and only element, reader and fade corrections have been made.



Global Dosimetry Solutions Environmental Report

Account	89567	RSCS
Location	00000DPT	
Monitoring Period	10/1/2016	
Process	0233017	

Badge Number	Name	Exposure mR*
	CONTROL	13
1	BR-5	18
2	BR-6	18
3	BR-7	19
4	BR-18	18
5	BR-19	22
6	BR-20	22
7	BR-22	21
8	BR-23	31
9	BR-24	24
10	BR-25	21
11	BR-SH1	14
12	BR-SH2	+
13	BR-CTRL1	13
14	BR-CTRL2	13
15	BR-21	10
16	BR-SP2	13
17	BR-SP1	12

* - No control exposures have been subtracted, and only element, reader and fade corrections have been made.

+ - Unusual element result observed. □ - Element damaged and cannot be evaluated.