



**Entergy Nuclear Operations, Inc.**  
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Licensing Manager

PNP 2013-038

April 23, 2013

10 CFR 50.36a

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

Subject: 2012 Annual Radioactive Effluent Release and Waste Disposal Report

Palisades Nuclear Plant  
Docket 50-255  
License No. DPR-20

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

Dear Sir or Madam:

Attached are the Entergy Nuclear Operations, Inc. 2012 Annual Radioactive Effluent Release and Waste Disposal Reports for Palisades Nuclear Plant (PNP) and Big Rock Point (BRP) Independent Spent Fuel Storage Installation (ISFSI). These reports are submitted in accordance with 10 CFR 50.36a(a)(2).

Attachment 1 contains the report for PNP. Attachment 2 contains the report for the BRP ISFSI.

These reports provide a summary of the quantities of radioactive liquid and gaseous effluent releases and solid radioactive waste processed during the period of January 1, 2012, through December 31, 2012.

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

Sincerely,

A handwritten signature in black ink, appearing to be 'OWG/bed', written in a cursive style.

OWG/bed

Attachment 1: Palisades Nuclear Plant 2012 Radioactive Effluent Release Report  
Attachment 2: Big Rock Point Independent Spent Fuel Storage Installation 2012  
Radioactive Effluent Release Report

CC Administrator, Region III, USNRC  
Project Manager, Palisades, USNRC  
Resident Inspector, Palisades, USNRC  
NRC NMSS Project Manager  
American Nuclear Insurers (ANI)

**Attachment 1**  
**Palisades Nuclear Plant 2012 Radioactive Effluent Release Report**

2012 Plant Operating History

Palisades Nuclear Plant (PNP) entered the reporting period on line on January 1, 2012, at nominal full power (NFP). PNP performed a planned shutdown on January 5, 2012, to address primary coolant system leakage through a control rod drive mechanism mechanical seal and leak-by of a pressurizer vent valve. The unit attained criticality on January 8, 2012, and returned to NFP on January 11, 2012. PNP performed a planned shutdown on April 8, 2012, to enter 1R22 refueling outage. The unit attained criticality on May 10, 2012, and returned to NFP on May 18, 2012. PNP performed a planned shutdown on June 12, 2012, to perform repairs on the safety injection refueling water tank. The unit attained criticality on July 10, 2012, and returned to NFP on July 15, 2012. PNP performed a planned shutdown on August 12, 2012, to locate and repair primary system leakage on control rod drive (CRD-24) upper housing. The unit attained criticality on August 29, 2012, and returned to NFP on August 31, 2012. PNP performed a planned shutdown on November 4, 2012, to repair a main steam leak. The unit attained criticality on November 7, 2012, and returned to NFP on November 8, 2012. PNP remained on line for the remainder of 2012. The unit generated 5,178,213 MWHrs of net electrical energy during 2012.

A. Gaseous Effluents

Tables A-1, "Gaseous Effluents – Summation of All Discharges," A-1A, "Gaseous Effluents – Ground-Level Release – Batch Mode," and A-1B, "Gaseous Effluents – Ground-Level Release – Continuous Mode," list and summarize gaseous effluents released during this reporting period.

B. Liquid Effluents

Tables A-2, "Liquid Effluents – Summation of All Discharges," A-2A, "Liquid Effluents – Batch Mode," and A-2B, "Liquid Effluents – Continuous Mode," list and summarize liquid effluents released during this reporting period.

C. Solid Waste Storage and Shipments

Table A-3, "Low-Level Waste for Waste Classification A, B and C, summarizes solid radioactive waste shipped for processing or burial in 2012 for the following waste streams: resins, filters and evaporator bottoms, dry active waste, irradiated components, other waste, and sum of all waste.

D. Dose Assessments

Tables A-4, "Dose Assessments, 10 CFR Part 50, Appendix I," and A-5, "EPA 40 CFR Part 190, Individual in the Unrestricted Area," lists annual dose to the members of the public.

## E. Supplemental Information

### 1. **Abnormal Discharges**

In December 2007, tritium was detected in a groundwater monitoring well at a level of 22,000 pCi/L. The source of the activity is leakage associated with T-91, the utility water storage tank, and associated piping. T-91 is used to store processed liquid waste prior to discharge. No radionuclides other than tritium have been detected in the groundwater.

Additional piping repair work of underground piping was performed during the spring of 2011. The overflow line to T-91 was sleeved to ensure piping integrity. This line was assumed to be dry, based on all indication, but contained highly tritiated water, of which a small amount was expelled during the sleeving operation. This resulted in an additional release of tritiated water to the groundwater which caused spiking in Monitoring Well 3. This event is further discussed under section 9, Other, Groundwater Monitoring, of this report.

Monitoring of the groundwater tritium plume continues in order to determine effectiveness of the repairs, and to ensure the accuracy of the site hydrology.

Depth to Local Water Table – The depth is approximately eight to nine feet.

Classification of Subsurface Aquifers – Not used for drinking water.

Expected Movement/Mobility of Groundwater Plume – Westerly direction down-gradient toward Lake Michigan at approximately two feet per day.

Land Use Characteristics – PNP site property, water not used for drinking or irrigation.

NRC Notification, Date and contact Organization – The NRC was notified on December 10, 2007, by PNP.

### 2. **Non-Routine Planned Discharges**

None.

### 3. **Radioactive Waste Treatment System Changes**

None.

**4. Annual Land Use Census Changes**

The garden critical receptor remains located in the southeast sector at 1.01 miles. The residence critical receptor is unchanged at 0.8 miles. Also unchanged is that there are no beef cattle or dairy cows located within five miles of the plant. There are goats located to the ENE at 2.62 miles. These goats are fed stored feed.

**5. Effluent Monitoring System Inoperability**

There was one effluent monitor that has been out of service for greater than 30 days. RIA-2320, steam generator blowdown vent, was declared inoperable on November 6, 2012, due to indicating failed. Technically, the pathway is not in service, but there is suspected valve leakage in the system, so compensatory samples are being obtained as a conservative measure as if it were in service. Work continues through the work control process to get the monitor returned to service.

**6. Offsite Dose Calculation Manual (ODCM) Changes**

There was no revision to the Offsite Dose Calculation Manual during the report period.

**7. Process Control Program Changes**

None.

**8. Errata/Corrections to Previous Reports**

None.

**9. Other**

Groundwater Monitoring

PNP installed five groundwater monitoring wells in 2007, and added an additional nine wells in 2008. These wells were strategically placed within the owner controlled area, both inside and outside the protected area to allow detection of radioactive contamination of ground water due to leaks or spills from plant systems. Monitoring well (MW) 3 is most indicative of a historic leak that continues to be monitored and addressed through piping repairs. This leak is described in the Abnormal Discharges section. Tritium levels for 2012 in MW3 ranged from less than minimum detectable activity

(MDA) to 5,233 pCi/L, down from 19,854 pCi/L in 2011. Monitoring well MW2 exhibited a spike to 8,952 in February 2012, which was caused by a leaking underground radwaste discharge line that was subsequently isolated and repaired, and levels dropped to nondetectable in June 2012. Monitoring well MW11 exhibited two detectable readings in 2012, with the highest being 792 pCi/L. Values of this magnitude may be attributed to precipitation recapture of tritium. The remaining wells showed no activity throughout the year. Well locations are depicted in Figure 1.

### Carbon-14

In 2010, PNP and other facilities participated in an EPRI task force to build a model to accurately estimate gaseous C-14 releases, given some key site-specific plant parameters (mass of the primary coolant, average thermal neutron cross section, rated MW, etc). This work was completed in November 2010. The estimates for C-14 were constructed using the aforementioned EPRI methodology contained with EPRI 1021106, Estimation of Carbon-14 in Nuclear Power Plant Gaseous Effluents. Using the C-14 curie estimates, the annual dose to man was derived from guidance contained within Regulatory Guide 1.109. Because the dose contribution of C-14 from liquid radioactive waste is much less than that contributed by gaseous radioactive waste, evaluation of C-14 in liquid radioactive waste is not required. (Reg Guide 1.21 Rev 2)

Annual C-14 release PNP and subsequent doses for 2012:

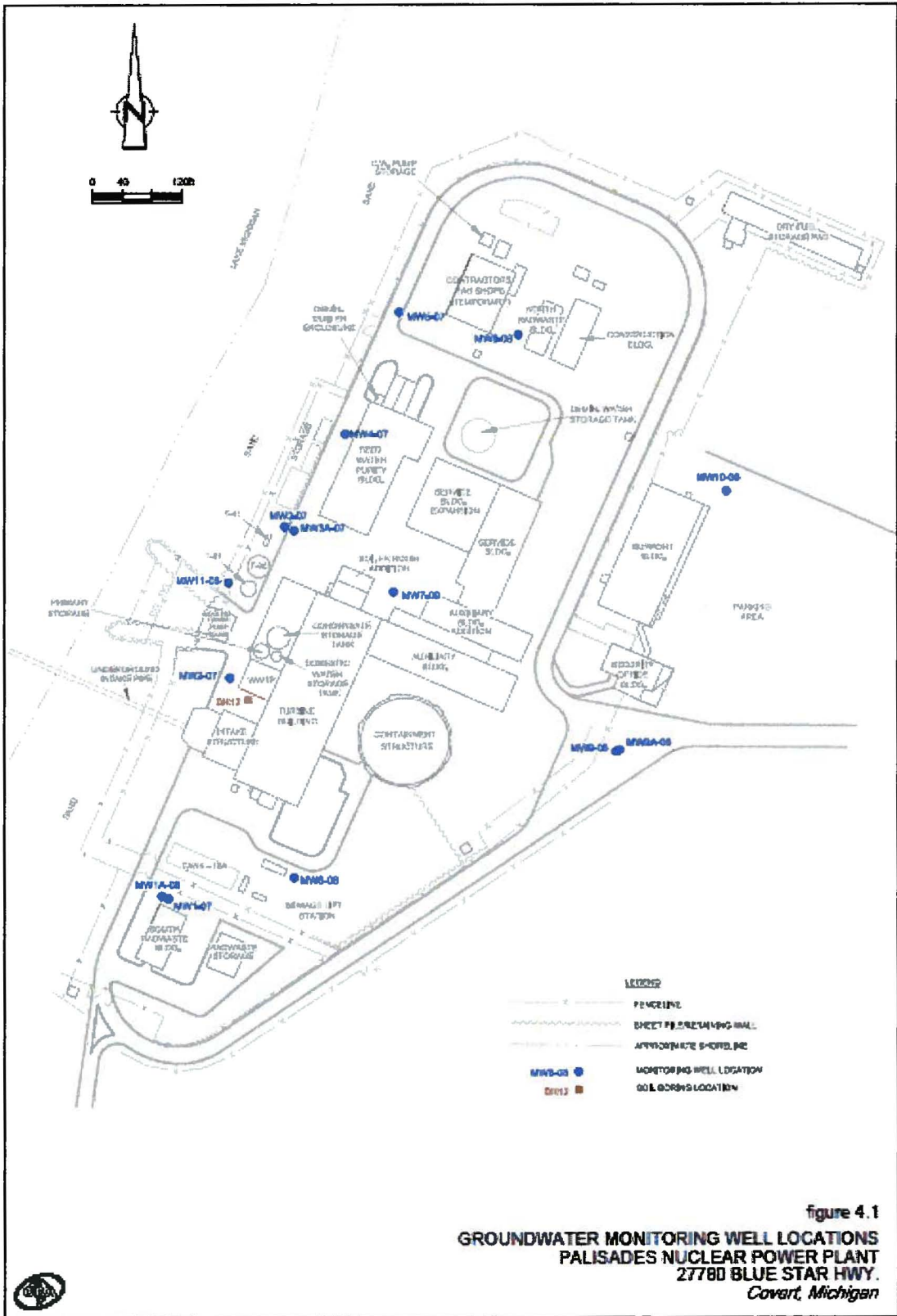
|  |        |
|--|--------|
| Total Gaseous C-14 Released Curies =   | 6.39   |
| Gaseous C-14 as CO2 Curies =           | 1.92   |
| Effective Child TB Dose, C-14 mrem =   | 0.0296 |
| Effective Child Bone Dose, C-14 mrem = | 0.148  |

The quarterly curies released are provided in Table A-1B. Airborne doses due to C-14 are grouped under the category of Particulate, Iodine, and Tritium which are contained in Table A-4.

### Safety Injection Refueling Water (SIRW) Tank

During the course of repairs to the SIRW tank during the forced outage from 6/12 to 7/12/12 there was 1.5E-5 Curies of various particulate radionuclides released from tank repair activities. These releases were quantified from sampling during the course of this work and actions were taken to mitigate these releases. The activity released is included as part of the continuous gaseous release information contained in Table A-1B. This data is also included for dose calculation purposes provided as Table A-4 of this report.

# FIGURE 1 GROUNDWATER MONITORING WELL LOCATIONS



**ATTACHMENT 1**  
**Palisades - Table A-1**  
**2012 Gaseous Effluents – Sum of All Releases**

| Summation of All Releases    | Units | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Total    | Uncertainty (%) |
|------------------------------|-------|-----------|-----------|-----------|-----------|----------|-----------------|
| Fission and Activation Gases | Ci    | 6.64E+00  | 3.36E+00  | 1.77E+00  | 2.08E+00  | 1.39E+01 | 4.17            |
| Average Release Rate         | μCi/s | 8.34E-01  | 4.28E-01  | 2.18E-01  | 2.45E-01  | 4.38E-01 |                 |
| % of Limit                   | %     | 9.82E-03  | 2.45E-03  | 1.13E-03  | 2.88E-03  | 4.06E-03 |                 |
| Total I-131                  | Ci    | 7.52E-05  | 1.29E-04  | 1.16E-04  | 6.97E-05  | 3.90E-04 | 5.88            |
| Average Release Rate         | μCi/s | 9.56E-06  | 1.64E-05  | 1.46E-05  | 8.76E-06  | 1.23E-05 |                 |
| % of Limit                   | %     | 1.15E-07  | 1.97E-07  | 1.76E-07  | 1.06E-07  | 1.48E-07 |                 |
| Particulates                 | Ci    | 2.63E-07  | 2.54E-05  | 3.00E-04  | 3.74E-08  | 3.26E-04 | 4.8             |
| Average Release Rate         | μCi/s | 3.34E-08  | 1.95E-06  | 3.48E-05  | 0.00E+00  | 1.03E-05 |                 |
| % of Limit                   | %     | 1.47E-07  | 3.24E-06  | 1.75E-05  | 0.00E+00  | 5.23E-06 |                 |
| Tritium                      | Ci    | 3.62E+00  | 4.47E+00  | 3.19E+00  | 3.08E+00  | 1.44E+01 | 4.18            |
| Average Release Rate         | μCi/s | 4.60E-01  | 5.69E-01  | 4.02E-01  | 3.87E-01  | 4.54E-01 |                 |
| % of Limit                   | %     | 1.11E-03  | 1.37E-03  | 9.68E-04  | 9.33E-04  | 1.09E-03 |                 |
| Gross Alpha                  | Ci    | 4.14E-07  | 4.02E-07  | ND        | 6.34E-07  | 1.45E-06 | 22.4            |
| C-14                         | Ci    | 2.02E+00  | 8.04E-01  | 1.48E+00  | 2.09E+00  | 6.39E+00 |                 |
| Average Release Rate         | μCi/s | 2.57E-01  | 1.02E-01  | 1.86E-01  | 2.63E-01  | 2.02E-01 |                 |
| % of Limit                   | %     | 2.06E-06  | 8.21E-07  | 1.49E-06  | 2.12E-06  | 1.62E-06 |                 |



**ATTACHMENT 1**  
**Palisades - Table A-1A**  
**2012 Gaseous Effluents – Ground Level Release, Batch Mode**

| Fission and Activation Gases | Units | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 |
|------------------------------|-------|-----------|-----------|-----------|-----------|
| Ar-41                        | Ci    | 6.99E-02  | ND        | ND        | ND        |
| Kr-85                        | Ci    | ND        | ND        | ND        | ND        |
| Kr-85m                       | Ci    | 8.30E-03  | ND        | ND        | ND        |
| Kr-87                        | Ci    | ND        | ND        | ND        | ND        |
| Kr-88                        | Ci    | ND        | ND        | ND        | ND        |
| Xe-131m                      | Ci    | 9.36E-03  | 1.40E-02  | 8.08E-03  | 7.39E-04  |
| Xe-133                       | Ci    | 1.67E+00  | 1.46E+00  | 6.73E-01  | 8.60E-03  |
| Xe-133m                      | Ci    | 1.77E-02  | 5.41E-03  | 6.26E-04  |           |
| Xe-135                       | Ci    | 2.26E-01  | 2.22E-02  | 8.38E-03  | 4.10E-05  |
| Xe-135m                      | Ci    | ND        | ND        | ND        | ND        |
| Xe-138                       | Ci    | ND        | ND        | ND        | ND        |
| Total                        | Ci    | 2.00E+00  | 1.50E+00  | 6.90E-01  | 9.38E-03  |

| Iodines/Halogens | Units | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 |
|------------------|-------|-----------|-----------|-----------|-----------|
| I-131            | Ci    | ND        | ND        | 9.54E-07  | 1.68E-06  |
| I-132            | Ci    | ND        | ND        | ND        | ND        |
| I-133            | Ci    | ND        | ND        | 9.21E-07  | ND        |
| I-134            | Ci    | ND        | ND        | ND        | ND        |
| I-135            | Ci    | ND        | ND        | ND        | ND        |
| Total            | Ci    | 0.00E+00  | 0.00E+00  | 1.88E-06  | 1.68E-06  |

| Particulates | Units | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 |
|--------------|-------|-----------|-----------|-----------|-----------|
| Co-58        | Ci    | ND        | ND        | 1.69E-04  | ND        |
| Co-60        | Ci    | ND        | ND        | 1.94E-05  | ND        |
| Na-24        | Ci    | ND        | ND        | 8.91E-06  | ND        |
| Cr-51        | Ci    | ND        | ND        | 6.23E-05  | ND        |
| Mn-56        | Ci    | ND        | ND        | 6.67E-06  | ND        |
| Sr-92        | Ci    | ND        | ND        | 7.54E-06  | ND        |
| Nb-95        | Ci    | ND        | ND        | 2.58E-05  | ND        |
| Zr-95        | Ci    | ND        | ND        | 1.24E-05  | ND        |
| Ag-110m      | Ci    | ND        | ND        | 1.08E-05  | ND        |
| Total        | Ci    | 0.00E+00  | 0.00E+00  | 3.23E-04  | 0.000E+00 |

|         |    |          |          |          |    |
|---------|----|----------|----------|----------|----|
| Tritium | Ci | 1.34E-02 | 9.59E-02 | 3.99E-01 | NA |
|---------|----|----------|----------|----------|----|

|             |    |    |    |    |    |
|-------------|----|----|----|----|----|
| Gross Alpha | Ci | NA | NA | NA | NA |
|-------------|----|----|----|----|----|

|      |    |    |    |    |    |
|------|----|----|----|----|----|
| C-14 | Ci | NA | NA | NA | NA |
|------|----|----|----|----|----|

ND = Measurements performed but no activity detected.

NA = Analysis not required and not performed

**ATTACHMENT 1**  
**Palisades - Table A-1B**  
**2012 Gaseous Effluents – Ground Level Release, Continuous Mode**

| Fission and Activation Gases | Units | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 |
|------------------------------|-------|-----------|-----------|-----------|-----------|
| Ar-41                        | Ci    | 2.20E+00  | 6.16E-01  | 1.66E-01  | 3.18E-01  |
| Kr-85                        | Ci    | ND        | ND        | ND        | ND        |
| Kr-85m                       | Ci    | 1.69E-02  | 3.97E-03  | 1.77E-02  | 2.03E-02  |
| Kr-87                        | Ci    | 1.49E-01  | 1.17E-02  | 5.33E-03  | 2.05E-02  |
| Kr-88                        | Ci    | 1.28E-01  | 2.78E-02  | 5.81E-02  | 1.69E-01  |
| Xe-133                       | Ci    | 1.30E-01  | 8.07E-01  | 3.78E-01  | 1.20E-02  |
| Xe-135                       | Ci    | 6.19E-01  | 2.44E-01  | 2.11E-01  | 5.89E-01  |
| Xe-135m                      | Ci    | 3.94E-01  | 5.41E-02  | 6.27E-02  | 2.34E-01  |
| Xe-138                       | Ci    | 8.28E-02  | ND        | 4.07E-02  | 1.28E-01  |
| Total                        | Ci    | 4.64E+00  | 1.86E+00  | 1.08E+00  | 2.07E+00  |

| Iodines/Halogens | Units | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 |
|------------------|-------|-----------|-----------|-----------|-----------|
| I-131            | Ci    | 7.50E-05  | 1.28E-04  | 1.05E-04  | 6.96E-05  |
| I-132            | Ci    | ND        | 1.33E-03  | ND        | ND        |
| I-133            | Ci    | 1.57E-04  | 4.77E-05  | 1.50E-04  | 5.59E-05  |
| I-135            | Ci    | ND        | ND        | ND        | ND        |
| Total            | Ci    | 2.32E-04  | 1.50E-03  | 2.55E-04  | 1.26E-04  |

| Particulates | Units | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 |
|--------------|-------|-----------|-----------|-----------|-----------|
| Co-58        | Ci    | 2.36E-08  | 7.03E-06  | 1.51E-07  | ND        |
| Co-60        | Ci    | 2.39E-07  | 4.87E-06  | 1.87E-07  | ND        |
| Cr-51        | Ci    | ND        | 1.21E-06  | ND        | ND        |
| Mn-54        | Ci    | ND        | 1.70E-07  | ND        | ND        |
| Co-57        | Ci    | ND        | 2.47E-08  | ND        | ND        |
| Nb-95        | Ci    | ND        | 2.01E-06  | 7.42E-08  | ND        |
| Zr-95        | Ci    | ND        | 1.03E-06  | ND        | ND        |
| Ag-110m      | Ci    | ND        | 7.69E-06  | 4.31E-8   | ND        |
| Sn-113       | Ci    | ND        | 7.36E-08  | ND        | ND        |
| Sb-125       | Ci    | ND        | 1.95E-07  | ND        | ND        |
| Cs-137       | Ci    | ND        | 1.01E-06  | 2.66E-08  | 3.74E-08  |
| Ce-144       | Ci    | ND        | 1.11E-07  | ND        | ND        |
| Total        | Ci    | 2.63E-07  | 2.54E-05  | 4.82E-07  | 3.74E-08  |

|         |    |          |          |          |          |
|---------|----|----------|----------|----------|----------|
| Tritium | Ci | 3.61E+00 | 4.38E+00 | 2.79E+00 | 3.08E+00 |
|---------|----|----------|----------|----------|----------|

|             |    |          |          |    |          |
|-------------|----|----------|----------|----|----------|
| Gross Alpha | Ci | 4.14E-07 | 4.02E-07 | ND | 6.34E-07 |
|-------------|----|----------|----------|----|----------|

|      |    |          |          |          |          |
|------|----|----------|----------|----------|----------|
| C-14 | Ci | 2.02E+00 | 8.04E-01 | 1.48E+00 | 2.09E+00 |
|------|----|----------|----------|----------|----------|

ND = Measurements performed but no activity detected.

**ATTACHMENT 1**  
**Palisades - Table A-2**  
**2012 Liquid Effluents – Sum of All Releases**

| Summation of All Liquid Releases  | Units             | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Total    | Uncertainty (%) |
|---|-------------------|-----------|-----------|-----------|-----------|----------|-----------------|
| Fission and Activation Products (excluding tritium, gases, and gross alpha)                                   | Ci                | 3.22E-03  | 6.44E-03  | 6.24E-04  | 1.05E-03  | 1.13E-02 | 5.26            |
| Average Concentration   | μCi/ml            | 1.37E-10  | 2.45E-10  | 1.71E-11  | 2.77E-11  | 9.13E-11 |                 |
| % of Limit  | %                 | 1.42E-03  | 4.06E-03  | 3.42E-04  | 6.21E-04  | 1.42E-03 |                 |
| Tritium   | Ci                | 9.69E+01  | 4.04E+01  | 3.20E+01  | 1.61E+02  | 3.31E+02 | 4.02            |
| Average Concentration   | μCi/ml            | 4.12E-06  | 1.53E-06  | 8.78E-07  | 4.25E-06  | 2.66E-06 |                 |
| % of Limit  | %                 | 4.12E-01  | 1.53E-01  | 8.78E-02  | 4.25E-01  | 2.66E-01 |                 |
| Dissolved and Entrained Gases   | Ci                | 1.45E-03  | 1.08E-03  | 0.00E+00  | 8.16E-05  | 2.61E-03 | 19.6            |
| Average Concentration   | μCi/ml            | 6.15E-11  | 4.10E-11  | 0.00E+00  | 2.15E-12  | 2.10E-11 |                 |
| % Of Limit  | %                 | 3.07E-05  | 2.05E-05  | 0.00E+00  | 1.08E-06  | 1.05E-05 |                 |
| Gross Alpha   | Ci                | 0.00E+00  | 2.12E-08  | 0.00E+00  | 0.00E+00  | 2.12E-08 | 18.2            |
| Average Concentration   | μCi/ml            | 0.00E+00  | 8.04E-16  | 0.00E+00  | 0.00E+00  | 1.70E-16 |                 |
| Volume of Primary System Liquid Effluent (Before Dilution)  | Liters            | 1.09E+06  | 9.68E+05  | 3.61E+05  | 7.18E+05  | 3.13E+06 |                 |
| Dilution Water Used for Above   | Liters            | 2.35E+10  | 2.63E+10  | 3.64E+10  | 3.79E+10  | 1.24E+11 |                 |
| Volume of Secondary or Balance-of-Plant Liquid Effluent (e.g., low-activity or unprocessed) (Before Dilution) | Liters            | 2.51E+06  | 3.47E+06  | 4.87E+06  | 5.35E+06  | 1.62E+07 |                 |
| Average Stream Flow   | m <sup>3</sup> /s | 2.99E+00  | 3.35E+00  | 4.58E+00  | 4.77E+00  | 3.92E+00 |                 |

Dilution flow rate (gal/qtr) = # of Dilution pumps running x days running/qtr x 4000 gpm/pump x min/day

**ATTACHMENT 1**  
**Palisades - Table A-2A**  
**2012 Liquid Effluents – Batch Mode**

| Fission and Activation Products | Units | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 |
|---------------------------------|-------|-----------|-----------|-----------|-----------|
| Cr-51                           | Ci    | ND        | ND        | ND        | ND        |
| Mn-54                           | Ci    | 2.63E-05  | ND        | ND        | ND        |
| Fe-55                           | Ci    | ND        | 5.31E-04  | ND        | 1.08E-04  |
| Fe-59                           | Ci    | ND        | ND        | ND        | ND        |
| Co-57                           | Ci    | ND        | ND        | ND        | ND        |
| Co-58                           | Ci    | 6.16E-04  | 1.17E-03  | 1.37E-04  | 2.03E-04  |
| Co-60                           | Ci    | 5.60E-04  | 6.57E-04  | 2.20E-04  | 3.55E-04  |
| Sr-89                           | Ci    | ND        | ND        | ND        | ND        |
| Sr-90                           | Ci    | ND        | ND        | ND        | ND        |
| Nb-95                           | Ci    | ND        | 5.83E-06  |           |           |
| Ag-110m                         | Ci    | ND        | 3.77E-03  | 2.67E-04  | 2.59E-04  |
| Sn-113                          | Ci    | ND        | ND        | ND        | ND        |
| Sb-124                          | Ci    | ND        | ND        | ND        | ND        |
| Sb-125                          | Ci    | ND        | ND        | ND        | ND        |
| I-131                           | Ci    | ND        | 2.17E-05  | ND        | ND        |
| I-133                           | Ci    | ND        | ND        | ND        | ND        |
| I-135                           | Ci    | ND        | ND        | ND        | ND        |
| Cs-134                          | Ci    | ND        | ND        | ND        | ND        |
| Cs-137                          | Ci    | 7.87E-05  | 2.35E-05  | ND        | 6.20E-05  |
| Ni-63                           | Ci    | 1.92E-03  | 1.16E-04  | ND        | 6.51E-05  |
| Zn-65                           | Ci    | ND        | ND        | ND        | ND        |
| Zr-95                           | Ci    | ND        | 2.99E-05  | ND        | ND        |
| La-140                          | Ci    | ND        | ND        | ND        | ND        |
| Totals                          | Ci    | 3.20E-03  | 6.33E-03  | 6.24E-04  | 1.05E-03  |

| Dissolved and Entrained Gases | Units | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 |
|-------------------------------|-------|-----------|-----------|-----------|-----------|
| Kr-85                         | Ci    | ND        | ND        | ND        | ND        |
| Xe-131m                       | Ci    | ND        | ND        | ND        | ND        |
| Xe-133                        | Ci    | 1.45E-03  | 1.08E-03  |           | 8.16E-05  |
| Xe-133m                       | Ci    | ND        | ND        | ND        | ND        |
| Xe-135                        | Ci    | ND        | ND        | ND        | ND        |
| Totals                        |       | 1.45E-03  | 1.08E-03  | 0.000E+00 | 8.16E-05  |

|         |    |          |          |          |          |
|---------|----|----------|----------|----------|----------|
| Tritium | Ci | 9.69E+01 | 4.04E+01 | 3.20E+01 | 1.61E+02 |
|---------|----|----------|----------|----------|----------|

|             |    |    |          |    |    |
|-------------|----|----|----------|----|----|
| Gross Alpha | Ci | ND | 7.08E-06 | ND | ND |
|-------------|----|----|----------|----|----|

ND = None Detected

**ATTACHMENT 1**  
**Palisades - Table A-2B**  
**2012 Liquid Effluents – Continuous Mode**

| Fission and Activation Products | Units | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 |
|---------------------------------|-------|-----------|-----------|-----------|-----------|
| Cr-51                           | Ci    | ND        | ND        | ND        | ND        |
| Mn-54                           | Ci    | ND        | ND        | ND        | ND        |
| Fe-55                           | Ci    | ND        | ND        | ND        | ND        |
| Co-58                           | Ci    | ND        | ND        | ND        | ND        |
| Co-60                           | Ci    | 1.13E-05  | ND        | ND        | ND        |
| Sr-89                           | Ci    | ND        | ND        | ND        | ND        |
| Sr-90                           | Ci    | ND        | ND        | ND        | ND        |
| Nb-95                           | Ci    | ND        | ND        | ND        | ND        |
| Ag-110m                         | Ci    | ND        | ND        | ND        | ND        |
| Sn-113                          | Ci    | ND        | ND        | ND        | ND        |
| Sb-124                          | Ci    | ND        | ND        | ND        | ND        |
| Sb-125                          | Ci    | ND        | ND        | ND        | ND        |
| I-131                           | Ci    | ND        | ND        | ND        | ND        |
| I-133                           | Ci    | ND        | ND        | ND        | ND        |
| I-135                           | Ci    | ND        | ND        | ND        | ND        |
| Cs-134                          | Ci    | ND        | ND        | ND        | ND        |
| Cs-137                          | Ci    | 1.79E-05  | 1.07E-04  | ND        | ND        |
| Ni-63                           | Ci    | ND        | ND        | ND        | ND        |
| Totals                          | Ci    | 1.79E-05  | 1.18E-04  | 0.00E+00  | 0.00E+00  |

| Dissolved and Entrained Gases | Units | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 |
|-------------------------------|-------|-----------|-----------|-----------|-----------|
| Kr-85                         | Ci    | ND        | ND        | ND        | ND        |
| Xe-133                        | Ci    | ND        | ND        | ND        | ND        |
| Xe-133m                       | Ci    | ND        | ND        | ND        | ND        |
| Xe-135                        | Ci    | ND        | ND        | ND        | ND        |
| Xe-135m                       | Ci    | ND        | ND        | ND        | ND        |
| Totals                        |       | 0.00E+00  | 0.00E+00  | 0.00E+00  | 0.00E+00  |

|         |    |          |          |          |          |
|---------|----|----------|----------|----------|----------|
| Tritium | Ci | 2.60E-03 | 4.90E-03 | 1.26E-02 | 4.10E-02 |
|---------|----|----------|----------|----------|----------|

|             |    |    |    |    |    |
|-------------|----|----|----|----|----|
| Gross Alpha | Ci | ND | ND | ND | ND |
|-------------|----|----|----|----|----|

ND = None Detected

**ATTACHMENT 1  
Palisades - Table A-3  
2012 Low Level Waste**

| Resins, Filters, and<br>Evaporator Bottoms | Volume          |                | Curies Shipped |
|--|-----------------|----------------|----------------|
| Waste Class                                | ft <sup>3</sup> | m <sup>3</sup> | Curies         |
| A  | 6.64E+02        | 1.88E+01       | 3.28E-02       |
| B  | 0.00E+00        | 0.00E+00       | 0.00E+00       |
| C  | 6.40E+01        | 1.81E+00       | 1.83E+01       |
| ALL  | 7.28E+02        | 2.06E+01       | 1.83E+01       |

Major Nuclides for the Above Table: H-3 (2%), Fe-55 (37%), Co-60 (43%), Ni-63 (17%), Ce-144 (1%)

| Dry Active Waste | Volume          |                | Curies Shipped |
|------------------|-----------------|----------------|----------------|
| Waste Class      | ft <sup>3</sup> | m <sup>3</sup> | Curies         |
| A                | 1.37E+04        | 3.89E+02       | 2.46E+00       |
| B                | 0.00E+00        | 0.00E+00       | 0.00E+00       |
| C                | 0.00E+00        | 0.00E+00       | 0.00E+00       |
| ALL              | 1.37E+04        | 3.89E+02       | 2.46E+00       |

Major Nuclides for the Above Table: H-3 (1%), C-14 (6%), Cr-51 (6%), Mn-54 (1%), Fe-55 (9%), Co-58 (20%), Co-60 (17%), Ni-63 (7%), Zr-95 (6%), Ag-110m (22%), Sb-125 (2%), Cs-134 (1%), Cs-137 (2%)

| Irradiated Components | Volume          |                | Curies Shipped |
|-----------------------|-----------------|----------------|----------------|
| Waste Class           | ft <sup>3</sup> | m <sup>3</sup> | Curies         |
| A                     | 0.00E+00        | 0.00E+00       | 0.00E+00       |
| B                     | 0.00E+00        | 0.00E+00       | 0.00E+00       |
| C                     | 0.00E+00        | 0.00E+00       | 0.00E+00       |
| ALL                   | 0.00E+00        | 0.00E+00       | 0.00E+00       |

Major Nuclides for the Above Table:

| Other Waste: Used oil & soil | Volume          |                | Curies Shipped |
|------------------------------|-----------------|----------------|----------------|
| Waste Class                  | ft <sup>3</sup> | m <sup>3</sup> | Curies         |
| A                            | 8.82E+02        | 2.50E+01       | 1.73E+00       |
| B                            | 0.00E+00        | 0.00E+00       | 0.00E+00       |
| C                            | 0.00E+00        | 0.00E+00       | 0.00E+00       |
| ALL                          | 8.82E+02        | 2.50E+01       | 1.73E+00       |

Major Nuclides for the Above Table: H-3 (1%), Mn-54 (1%), Fe-55 (8%), Co-58 (58%), Co-60 (13%), Ni-63 (13%), Ag-110m (1), Sb-125 (2%), Cs-134 (1%), Cs-137 (2%)

**ATTACHMENT 1  
Palisades - Table A-3  
2012 Low Level Waste**

| Sum of All Low-Level Waste Shipped from Site | Volume          |                | Curies Shipped |
|--|-----------------|----------------|----------------|
|  | ft <sup>3</sup> | m <sup>3</sup> | Curies         |
| A  | 1.53E+04        | 4.33E+02       | 4.22E+00       |
| B  | 0.00E+00        | 0.00E+00       | 0.00E+00       |
| C  | 6.40E+01        | 1.81E+00       | 1.83E+01       |
| ALL  | 1.53E+04        | 4.35E+02       | 2.25E+01       |

Major Nuclides for the Above Table: H-3 (2%), C-14 (1%), Cr-51 (1%), Fe-55 (32%), Co-58 (7%), Co-60 (38%), Ni-63 (16%), Zr-95 (1%), Ag110m (2%)

**ATTACHMENT 1**  
**Palisades - Table A-4**  
**2012 Dose Assessments, 10 CFR Part 50, Appendix I**

|  | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | Yearly   |
|--|-----------|-----------|-----------|-----------|----------|
| Liquid Effluent Dose Limit, Total Body   | 1.5 mrem  | 1.5 mrem  | 1.5 mrem  | 1.5 mrem  | 3 mrem   |
| Total Body Dose  | 6.26E-04  | 9.52E-04  | 1.32E-04  | 3.18E-04  | 2.03E-03 |
| % Of Limit   | 0.04%     | 0.06%     | 0.01%     | 0.02%     | 0.07%    |
| Liquid Effluent Dose Limit, Any Organ  | 5 mrem    | 5 mrem    | 5 mrem    | 5 mrem    | 10 mrem  |
| Organ Dose   | 1.04E-03  | 1.21E-03  | 1.35E-04  | 4.03E-04  | 2.79E-03 |
| % of Limit   | 0.02%     | 0.02%     | 0.00%     | 0.01%     | 0.03%    |
| Gaseous Effluent Dose Limit, Gamma Air   | 5 mrad    | 5 mrad    | 5 mrad    | 5 mrad    | 10 mrad  |
| Gamma Air Dose   | 2.76E-03  | 6.58E-04  | 3.71E-04  | 1.00E-03  | 4.79E-03 |
| % of Limit   | 0.06%     | 0.01%     | 0.01%     | 0.02%     | 0.05%    |
| Gaseous Effluent Dose Limit, Beta Air  | 10 mrad   | 10 mrad   | 10 mrad   | 10 mrad   | 20 mrad  |
| Beta Air Dose  | 1.46E-03  | 4.42E-04  | 2.82E-04  | 5.95E-04  | 2.78E-03 |
| % of Limit   | 0.015%    | 0.004%    | 0.003%    | 0.006%    | 0.014%   |
| Gaseous Effluent Dose Limit, Any Organ (Iodine, Tritium, Particulates with >8 day half-life) | 7.5 mrem  | 7.5 mrem  | 7.5 mrem  | 7.5 mrem  | 15 mrem  |
| Gaseous Effluent Organ Dose (Iodine, Tritium, Particulates with >8-Day half-life)            | 4.72E-02  | 1.88E-02  | 3.45E-02  | 4.87E-02  | 1.49E-01 |
| % of Limit   | 0.63%     | 0.25%     | 0.46%     | 0.65%     | 0.99%    |

**Palisades - Table A-5**  
**2012 EPA 40 CFR Part 190, Individual in the Unrestricted Area**

|            | Whole Body | Thyroid  | Any Other Organ |
|------------|------------|----------|-----------------|
| Dose Limit | 25 mrem    | 75 mrem  | 25 mrem         |
| Dose       | 8.53E-02   | 1.39E-02 | 2.79E-03        |
| % of Limit | 0.34%      | 0.02%    | 0.01%           |



**ATTACHMENT 2**  
**BIG ROCK POINT INDEPENDENT SPENT FUEL STORAGE INSTALLATION**  
**2012 RADIOACTIVE EFFLUENT RELEASE REPORT**

This report provides information relating to radioactive effluent releases and solid radioactive waste disposal at Big Rock Point (BRP) for the year 2012. The report format is detailed in the BRP Offsite Dose Calculation Manual (ODCM). Effluent releases from BRP are controlled by the Defueled Technical Specifications and the ODCM requirements. The ODCM was not revised in 2012.

2012 Operating History

On January 8, 2007, the Nuclear Regulatory Commission (NRC) approved release of the former BRP Nuclear Plant property for unrestricted use in accordance with the BRP License Termination Plan<sup>1</sup>. On April 11, 2007, the license for BRP, DPR-06, was transferred to Entergy Nuclear Operations, Inc.

During 2012, normal Independent Spent Fuel Storage Installation (ISFSI) operations continued. There were no operational activities that generated any solid radioactive waste.

Liquid and gaseous effluent monitoring is no longer conducted as the former BRP nuclear plant property has been released from the license. Short-lived radionuclides, including iodines and noble gas, are neither expected nor reported.

1. Supplemental Information

A. Batch Releases

There were no batch releases of gaseous or liquid effluents during 2012. All batch releases of radioactive liquids as described in the ODCM ceased in 2004.

B. Abnormal Releases

There were no abnormal releases from BRP during 2012.

C. Radioactive Effluent Monitoring Instrumentation

BRP ODCM currently specifies required actions when less than the minimum number of radioactive effluent monitoring instrument channels are operable. The ODCM also specifies these actions be taken when installed effluent monitoring systems are removed from service for decommissioning.

All plant-installed liquid and gaseous radioactive effluent monitoring instrument channels have been permanently removed and dismantled.

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<sup>1</sup> Letter from the USNRC dated January 8, 2007, "Release of Land from Part 50 License for Unrestricted Use"

2. Gaseous Effluents

Although there were no gaseous effluents released during 2012, Table 2 provides a summary of all gaseous radioactive effluent monitoring conducted during the reporting period as required by the ODCM.

3. Liquid Effluents

There were no liquid effluent batch releases during 2012. Table 3 lists and summarizes liquid effluent releases in accordance with the ODCM.

4. Solid Waste

There was no solid radioactive waste generated or shipped during 2012.

5. Summary of Radiological Impact on Man

The ODCM specifies that the annual effluent release report provide potential dose calculations based on measured effluent to liquid and gaseous pathways, if estimates of dose exceed one millirem to an organ or total body of any individual or more than one person-rem to the population within 50 miles. During 2012, there were no releases. Therefore, no calculations were required.

6. Offsite Dose Calculation Manual

The ODCM describes the radiological release requirements for the BRP site. There were no revisions to the ODCM in 2012.

7. Process Control Program (PCP)

The Process Control Program (PCP) describes solid waste processing and disposal methods utilized at the BRP site. The PCP was not revised during 2012.

**TABLE 1**  
**Big Rock Point**  
**Batch Releases**  
 January 1, 2012 to December 31, 2012

**A. GASEOUS**

| <b>B. LIQUID</b>     | Units   | 1ST QTR | 2ND QTR | 3RD QTR | 4TH QTR |
|----------------------|---------|---------|---------|---------|---------|
| Number of Releases   |         | N/A     | N/A     | N/A     | N/A     |
| Total Release Time   | Minutes | N/A     | N/A     | N/A     | N/A     |
| Maximum Release Time | Minutes | N/A     | N/A     | N/A     | N/A     |
| Average Release Time | Minutes | N/A     | N/A     | N/A     | N/A     |
| Minimum Release Time | Minutes | N/A     | N/A     | N/A     | N/A     |

**TABLE 2**  
**Big Rock Point**  
**Gaseous Effluent Releases**  
January 1, 2012 to December 31, 2012

| <b>A. FISSION AND ACTIVATION GASES</b> | Units   | 1ST QTR | 2ND QTR | 3RD QTR | 4TH QTR | Est Total Error % |
|--|---------|---------|---------|---------|---------|-------------------|
| 1. Total release                       | Ci      | N/A     | N/A     | N/A     | N/A     | N/A               |
| 2. Average release rate for period     | μCi/sec | N/A     | N/A     | N/A     | N/A     |                   |
| 3. Percent of annual avg EC            | %       | N/A     | N/A     | N/A     | N/A     |                   |

| <b>B. IODINES</b>                  | Units   | 1ST QTR | 2ND QTR | 3RD QTR | 4TH QTR | Est Total Error % |
|------------------------------------|---------|---------|---------|---------|---------|-------------------|
| 1. Total iodine                    | Ci      | N/A     | N/A     | N/A     | N/A     | N/A               |
| 2. Average release rate for period | μCi/sec | N/A     | N/A     | N/A     | N/A     |                   |
| 3. Percent of annual avg EC        | %       | N/A     | N/A     | N/A     | N/A     |                   |

| <b>C. PARTICULATES</b>                | Units   | 1ST QTR | 2ND QTR | 3RD QTR | 4TH QTR | Est Total Error % |
|---------------------------------------|---------|---------|---------|---------|---------|-------------------|
| 1. Particulates with half-life >8 day | Ci      | N/A     | N/A     | N/A     | N/A     | N/A               |
| 2. Average release rate for period    | μCi/sec | N/A     | N/A     | N/A     | N/A     |                   |
| 3. Percent of annual avg EC           | %       | N/A     | N/A     | N/A     | N/A     |                   |
| 4. Gross alpha radioactivity          | Ci      | N/A     | N/A     | N/A     | N/A     |                   |

| <b>D. TRITIUM</b>                  | Units   | 1ST QTR | 2ND QTR | 3RD QTR | 4TH QTR | Est Total Error % |
|------------------------------------|---------|---------|---------|---------|---------|-------------------|
| 1. Total Release                   | Ci      | N/A     | N/A     | N/A     | N/A     | N/A               |
| 2. Average release rate for period | μCi/sec | N/A     | N/A     | N/A     | N/A     |                   |
| 3. Percent of annual avg EC        | %       | N/A     | N/A     | N/A     | N/A     |                   |

| <b>E. WHOLE BODY DOSE</b>  | Units | 1ST QTR | 2ND QTR | 3RD QTR | 4TH QTR | Est Total Error % |
|--|-------|---------|---------|---------|---------|-------------------|
| 1. Beta Air dose at Site Boundary due to Noble Gases (ODCM Section 1, 1.3.2 a (1) (2)) | mrad  | N/A     | N/A     | N/A     | N/A     | N/A               |
| 2. Percent limit   | %     | N/A     | N/A     | N/A     | N/A     |                   |
| 3. Gamma Air dose at Site Boundary due to Noble Gas (ODCM Section 1, 1.3.2 a (1) (2))  | mrad  | N/A     | N/A     | N/A     | N/A     |                   |
| 4. Percent limit   | %     | N/A     | N/A     | N/A     | N/A     |                   |

| <b>F. ORGAN DOSE (ODCM Section 1, 1.3.2b (1) (2))</b>                    | Units | 1ST QTR | 2ND QTR | 3RD QTR | 4TH QTR | Est Total Error % |
|--|-------|---------|---------|---------|---------|-------------------|
| 1. Maximum organ dose to public based on Critical Receptors (child bone) | mrem  | N/A     | N/A     | N/A     | N/A     | N/A               |
| 2. Percent of limit (7.5 mrem/quarter)                                   | %     | N/A     | N/A     | N/A     | N/A     |                   |

**TABLE 2**  
**Big Rock Point**  
**Gaseous Effluent Releases**  
 January 1, 2012 to December 31, 2012

| <b>1. FISSION GASES</b> | Units | 1ST QTR | 2ND QTR | 3RD QTR | 4TH QTR |
|-------------------------|-------|---------|---------|---------|---------|
| Krypton-85m             | Ci    | N/A     | N/A     | N/A     | N/A     |
| Krypton-87              | Ci    | N/A     | N/A     | N/A     | N/A     |
| Krypton-88              | Ci    | N/A     | N/A     | N/A     | N/A     |
| Xenon-133               | Ci    | N/A     | N/A     | N/A     | N/A     |
| Xenon-133m              | Ci    | N/A     | N/A     | N/A     | N/A     |
| Xenon-135               | Ci    | N/A     | N/A     | N/A     | N/A     |
| Xenon-135m              | Ci    | N/A     | N/A     | N/A     | N/A     |
| Xenon-138               | Ci    | N/A     | N/A     | N/A     | N/A     |
| Total for Period        | Ci    | N/A     | N/A     | N/A     | N/A     |

| <b>2. IODINES</b> |    |     |     |     |     |
|-------------------|----|-----|-----|-----|-----|
| Iodine-131        | Ci | N/A | N/A | N/A | N/A |
| Iodine-132        | Ci | N/A | N/A | N/A | N/A |
| Iodine-133        | Ci | N/A | N/A | N/A | N/A |
| Iodine-134        | Ci | N/A | N/A | N/A | N/A |
| Iodine-135        | Ci | N/A | N/A | N/A | N/A |
| Total for Period  | Ci | N/A | N/A | N/A | N/A |

**TABLE 2**  
**Big Rock Point**  
**Gaseous Effluent Releases**  
January 1, 2012 to December 31, 2012

| <b>3. PARTICULATES*</b> | Units | 1ST QTR | 2ND QTR | 3RD QTR | 4TH QTR |
|-------------------------|-------|---------|---------|---------|---------|
| Chromium-51             | Ci    | N/A     | N/A     | N/A     | N/A     |
| Manganese-54            | Ci    | N/A     | N/A     | N/A     | N/A     |
| Cobalt-58               | Ci    | N/A     | N/A     | N/A     | N/A     |
| Iron-59                 | Ci    | N/A     | N/A     | N/A     | N/A     |
| Cobalt-60               | Ci    | N/A     | N/A     | N/A     | N/A     |
| Zinc-65                 | Ci    | N/A     | N/A     | N/A     | N/A     |
| Silver-110m             | Ci    | N/A     | N/A     | N/A     | N/A     |
| Cesium-134              | Ci    | N/A     | N/A     | N/A     | N/A     |
| Cesium-137              | Ci    | N/A     | N/A     | N/A     | N/A     |
| Barium-140              | Ci    | N/A     | N/A     | N/A     | N/A     |
| Europium-152            | Ci    | N/A     | N/A     | N/A     | N/A     |
| Strontium-89            | Ci    | N/A     | N/A     | N/A     | N/A     |
| Strontium-90            | Ci    | N/A     | N/A     | N/A     | N/A     |
| Net unidentified beta   | Ci    | N/A     | N/A     | N/A     | N/A     |
| Total                   | Ci    | N/A     | N/A     | N/A     | N/A     |

\* Particulates with half-life >8 days

**TABLE 3**  
**Big Rock Point**  
**Liquid Effluent Releases**  
 January 1, 2012 to December 31, 2012

| <b>A. FISSION AND ACTIVATION PRODUCTS</b>                 | Units  | 1ST QTR | 2ND QTR | 3RD QTR | 4TH QTR | Est Total Error % |
|---|--------|---------|---------|---------|---------|-------------------|
| 1. Total release (not including tritium, gases, alpha)    | Ci     | N/A     | N/A     | N/A     | N/A     | N/A               |
| 2. Average diluted concentration during period            | μCi/ml | N/A     | N/A     | N/A     | N/A     |                   |
| 3. Percent of EC  | %      | N/A     | N/A     | N/A     | N/A     |                   |
| <b>B. TRITIUM</b>   |        |         |         |         |         |                   |
| 1. Total release  | Ci     | N/A     | N/A     | N/A     | N/A     | N/A               |
| 2. Average diluted concentration during period            | μCi/ml | N/A     | N/A     | N/A     | N/A     |                   |
| 3. Percent of EC  | %      | N/A     | N/A     | N/A     | N/A     |                   |
| <b>C. DISSOLVED AND ENTRAINED GASES</b>                   |        |         |         |         |         |                   |
| 1. Total release  | Ci     | N/A     | N/A     | N/A     | N/A     | N/A               |
| 2. Average diluted concentration during period            | μCi/ml | N/A     | N/A     | N/A     | N/A     |                   |
| 3. Percent of EC  | %      | N/A     | N/A     | N/A     | N/A     |                   |
| <b>D. GROSS ALPHA RADIOACTIVITY</b>                       | Ci     | N/A     | N/A     | N/A     | N/A     |                   |
| <b>E. VOLUME OF WASTE RELEASED</b><br>(Prior to dilution) | Liters | N/A     | N/A     | N/A     | N/A     |                   |
| <b>F. VOLUME OF DILUTION WATER USED DURING PERIOD</b>     | Liters | N/A     | N/A     | N/A     | N/A     |                   |
| <b>G. MAXIMUM DOSE COMMITMENT WHOLEBODY</b>               | mrem   | N/A     | N/A     | N/A     | N/A     |                   |
| Percent of ODCM Section 1, 2.3.2 a (1.5 mrem)             | %      | N/A     | N/A     | N/A     | N/A     |                   |
| <b>H. MAXIMUM DOSE COMMITMENT – ORGAN</b>                 | Mrem   | N/A     | N/A     | N/A     | N/A     |                   |
| Percent of ODCM Section 1, 2.3.2 b (3.0 mrem)             | %      | N/A     | N/A     | N/A     | N/A     |                   |

**TABLE 3**  
**Big Rock Point**  
**Liquid Effluent Releases**  
January 1, 2012 to December 31, 2012

| 1. NUCLIDES RELEASED               | Units | 1ST QTR | 2ND QTR | 3RD QTR | 4TH QTR |
|------------------------------------|-------|---------|---------|---------|---------|
| Chromium-51                        | Ci    | --      | --      | --      | --      |
| Manganese 54                       | Ci    | --      | --      | --      | --      |
| Cobalt-58                          | Ci    | --      | --      | --      | --      |
| Iron-59                            | Ci    | --      | --      | --      | --      |
| Cobalt-60                          | Ci    | --      | --      | --      | --      |
| Zinc-65                            | Ci    | --      | --      | --      | --      |
| Strontium-89                       | Ci    | --      | --      | --      | --      |
| Strontium-90                       | Ci    | --      | --      | --      | --      |
| Molybdenum-99                      | Ci    | --      | --      | --      | --      |
| Silver-110m                        | Ci    | --      | --      | --      | --      |
| Iodine-131                         | Ci    | --      | --      | --      | --      |
| Cesium-134                         | Ci    | --      | --      | --      | --      |
| Cesium-137                         | Ci    | --      | --      | --      | --      |
| Antimony-125                       | Ci    | --      | --      | --      | --      |
| Tin-113                            | Ci    | --      | --      | --      | --      |
| Net Unidentified Beta              | Ci    | --      | --      | --      | --      |
| Fission & Activation Product Total | Ci    | --      | --      | --      | --      |
| Xenon-133                          | Ci    | --      | --      | --      | --      |
| Tritium                            | Ci    | --      | --      | --      | --      |
| Grand Total                        | Ci    | --      | --      | --      | --      |