



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

November 13, 2017

OMB Control No. 3150-0231

Mr. Ronald Gaston  
Acting Vice President, Regulatory  
Assurance  
Entergy Services, Inc.  
1340 Echelon Parkway  
M-ECH-62  
Jackson, MS 39213

**SUBJECT:** GRAND GULF NUCLEAR STATION, UNIT 1; INDIAN POINT NUCLEAR GENERATING UNIT NO. 3; PILGRIM NUCLEAR POWER STATION; AND WATERFORD STEAM ELECTRIC STATION, UNIT 3 - REQUEST FOR SUPPLEMENTAL INFORMATION REGARDING GENERIC LETTER 2016-01, "MONITORING OF NEUTRON ABSORBING MATERIALS IN SPENT FUEL POOLS" (CAC NOS. MF9409, MF9424, MF9433, AND MF9438; EPID L-2016-LRC-0001)

Dear Mr. Gaston:

On April 7, 2016, the U.S. Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 2016-01, "Monitoring of Neutron-Absorbing Materials in Spent Fuel Pools" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16097A169), to address the degradation of neutron absorbing materials (NAM) in wet storage systems for reactor fuel at power and non-power reactors.

GL 2016-01 requested that licensees provide information to allow the NRC staff to verify continued compliance through effective monitoring to identify and mitigate any degradation or deformation of NAM credited for criticality control in spent fuel pools.

To facilitate each licensee's response, GL 2016-01 established four categories (Category 1, Category 2, Category 3, and Category 4). Categories 1, 2, and 3 were established to identify situations where a detailed response to the GL 2016-01 would not be required. The categorization criteria were generally based on if a licensee does not credit NAM for criticality control, or if a licensee has, or will soon have, an approved monitoring program for NAM in the plant technical specifications (TSs) or as a license condition. A full description of the categories can be found in Enclosure 1.

Entergy Operations, Inc. and Entergy Nuclear Operations, Inc. (the licensees) submitted letters dated November 1, 2016, November 2, 2016, and November 3, 2016 (ADAMS Accession Nos. ML16306A433, ML16307A275, ML16319A131, ML16314E266, and ML16308A461<sup>1</sup>), providing information in response to the GL 2016-01.

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<sup>1</sup> On March 1, 2017, the NRC issued an order (ADAMS Accession No. ML17041A196) approving transfer of the James A. FitzPatrick Nuclear Power Plant Renewed Facility Operating License No. DPR 59 from Entergy Nuclear FitzPatrick, LLC and Entergy Nuclear Operations, Inc. to Exelon Generating Company, LLC. The order was executed on March 31, 2017 (ADAMS Accession No. ML17090A188).

To complete its review, the NRC staff requests the licensees to provide the supplemental information requested in Enclosures 3–6. During a discussion with your staff on October 23, 2017, it was agreed that you would provide a response for:

- Enclosures 3 and 5 within 90 days from the date of this letter; and
- Enclosures 4 and 6 by May 31, 2018.

In accordance with Title 10 of the *Code of Federal Regulations* Section 2.390, “Public inspections, exemptions, requests for withholding,” a copy of this letter will be available electronically in the NRC Library, in the ADAMS Public Documents collection from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>.

If you have any questions, please contact Scott Wall at 301-415-2855 or by e-mail at [Scott.Wall@nrc.gov](mailto:Scott.Wall@nrc.gov).

Sincerely,



Robert J. Pascarelli, Chief  
Plant Licensing Branch IV  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-286, 50-293, 50-382,  
and 50-416

Enclosures:

1. List of GL 2016-01 Categories
2. List of Plants, Incoming Letters, and CAC numbers, and EPID
3. Request for Supplemental Information Grand Gulf Nuclear Station, Unit 1
4. Request for Supplemental Information Indian Point Nuclear Generating, Unit No. 3
5. Request for Supplemental Information Pilgrim Nuclear Power Station
6. Request for Supplemental Information Waterford Steam Electric Station, Unit 3

cc: Listserv

## **LIST OF GENERIC LETTER 2016-01 CATEGORIES**

- Category 1: Power reactor addressees that do not credit neutron-absorbing materials other than soluble boron in the analysis of record (AOR). In some cases, no neutron-absorbing material is present in the spent fuel storage racks, and in other cases, credit for the neutron-absorbing material has been removed through a regulatory action (e.g., approved license amendment). Those addressees may submit a response letter confirming that no neutron-absorbing materials are currently credited to meet U.S. Nuclear Regulatory Commission (NRC) subcriticality requirements in the spent fuel pool (SFP).
- Category 2: Power reactor addressees that have an approved license amendment to remove credit for existing neutron-absorbing materials and that intend to complete full implementation no later than 24 months after the issuance of this generic letter. Licensees may request extensions to this implementation timeframe if there are extenuating circumstances. Those addressees may submit a response letter affirming that they will implement the approved license amendment request within the specified time. However, they must still provide information equivalent to Category 3 or Category 4 for any other neutron-absorbing material credited in the SFP criticality AOR after the license amendment has been fully implemented.
- Category 3: Power reactor addressees that have incorporated their neutron-absorbing material monitoring programs into their licensing basis through an NRC-approved technical specification (TS) change or license condition. Those addressees may submit a response letter referencing their approved TS change or license condition and affirming that no change has been made to their neutron-absorbing material monitoring program, as described in the referenced license amendment request. If a change has been made since NRC approval of the reference, the response letter should also describe any such changes. (Licensees with a monitoring program approved as part of a license amendment request or license renewal application that was not incorporated as a TS change or license condition are considered to belong in Category 4.)
- Category 4: All other power reactor addressees. The NRC seeks information in five areas depending upon the type of neutron absorber material used by the licensee in the SFP.

**LIST OF PLANTS, INCOMING LETTERS, CAC NUMBERS, AND EPID**

<b>Plant</b>	<b>Incoming Letter (ADAMS Accession No.)</b>	<b>CAC No.</b>	<b>EPID</b>
Grand Gulf Nuclear Station, Unit 1	ML16306A433	MF9438	L-2016-LRC-0001
Indian Point Nuclear Generating Unit No. 3	ML16314E266	MF9433	L-2016-LRC-0001
Pilgrim Nuclear Power Station	ML16319A131	MF9424	L-2016-LRC-0001
Waterford Steam Electric Station, Unit 3	ML16307A275	MF9409	L-2016-LRC-0001

REQUEST FOR SUPPLEMENTAL INFORMATION

ENTERGY OPERATIONS, INC.

GRAND GULF NUCLEAR STATION, UNIT 1

DOCKET NO. 50-416

In a letter dated November 1, 2016 (Agencywide Documents Access and Management System Accession No. ML16306A433), Entergy Operations, Inc. (the licensee) provided information in response to Generic Letter (GL) 2016-01 for Grand Gulf Nuclear Station, Unit 1 (GGNS). The U.S. Nuclear Regulatory Commission (NRC) staff requests supplemental information to complete its review.

**Plant-Specific Monitoring Information**

Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.68, "Criticality accident requirements," and 10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion (GDC) 62, "Prevention of criticality in fuel storage and handling," provide the requirements for licensees with regards to maintaining subcriticality in the spent fuel pool (SFP). For licensees that utilize neutron absorbing materials (NAM) in the SFP, the boron-10 ( $^{10}\text{B}$ ) areal density (AD) of the NAM must be verified so that the assumption for the  $^{10}\text{B}$  minimum AD in the SFP criticality analysis is supported. In order for the NRC staff to verify the requirements of 10 CFR 50.68 and GDC 62 are met, the staff needs to ensure the programs in place to monitor the condition of the NAM in the SFP are appropriate for their intended purpose. In addition, the condition of the NAM must be considered in the SFP nuclear criticality safety (NCS) analysis of record (AOR). In order to verify whether or not the requirements of 10 CFR 50.68 and GDC 62 will be met, the NRC staff needs to verify that the potential reactivity changes due to degradation or physical changes to the NAM are accounted for in the SFP NCS AOR.

**GGNS-1.** In the Updated Final Safety Analysis Report (UFSAR), the licensee states that spent fuel racks are installed in the upper containment pool. The NRC staff believes that the upper containment pool racks are covered by the scope of GL 2016-01. Please provide the appropriate information requested by GL 2016-01 for the upper containment pool racks described in the UFSAR. In addition, if these racks are removable, describe any potential impacts from wetting/drying the NAM, any surveillance measures in place to detect these impacts, and any corrective actions to mitigate these impacts.

REQUEST FOR SUPPLEMENTAL INFORMATION

ENTERGY NUCLEAR OPERATIONS, INC.

INDIAN POINT NUCLEAR GENERATING UNIT NO. 3

DOCKET NO. 50-286

In a letter dated November 3, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16314E266), Entergy Nuclear Operations, Inc. (the licensee) provided information in response to the Generic Letter 2016-01 for Indian Point Nuclear Generating, Unit No. 3 (IP3). The U.S. Nuclear Regulatory Commission (NRC) staff requests supplemental information to complete its review.

**Generic Boral-RAI-2**

Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.68, "Criticality accident requirements," and 10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion (GDC) 62, "Prevention of criticality in fuel storage and handling," provide the requirements for licensees with regards to maintaining subcriticality in the spent fuel pool (SFP). For licensees that utilize neutron absorbing materials (NAM) in the SFP, the properties of the NAM must be known so that the assumptions in the SFP nuclear criticality safety (NCS) analysis of record (AOR) are supported. In order to verify whether or not the requirements of 10 CFR 50.68 and GDC 62 will be met, the NRC staff needs to verify that the potential reactivity changes due to degradation or physical changes to the NAM are accounted for in the SFP NCS AOR. This includes any changes that would affect the neutron spectrum for the SFP (as opposed to the neutron spectrum used for attenuation testing purposes) in addition to any loss of neutron attenuation capability.

Industry operating experience, as described in Information Notice 2009-26, "Degradation of Neutron-Absorbing Materials in the Spent Fuel Pool," dated October 28, 2009 (ADAMS Accession No. ML092440545), has demonstrated that certain manufacturing processes and plant conditions (dose, chemistry, length of time installed, and installation configuration) have resulted in material deformation as a result of blisters associated with Boral.

IP3 has indicated that similar operating experience was identified as a result of its site-specific monitoring program. Please discuss the criticality impact due to the material deformation identified at IP3, and how it can be accommodated by the NCS AOR at IP3 without exceeding NRC subcriticality requirements.

REQUEST FOR SUPPLEMENTAL INFORMATION

ENTERGY NUCLEAR OPERATIONS, INC.

PILGRIM NUCLEAR POWER STATION

DOCKET NO. 50-293

In a letter dated November 3, 2016 (Agencywide Documents Access and Management System Accession No. ML16319A131), Entergy Nuclear Operations, Inc. (the licensee) provided information in response to the Generic Letter 2016-01 for Pilgrim Nuclear Power Station (PNPS). The U.S. Nuclear Regulatory Commission (NRC) staff requests supplemental information to complete its review.

**Plant-Specific Monitoring Information**

Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.68, "Criticality accident requirements," and 10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion (GDC) 62, "Prevention of criticality in fuel storage and handling," provide the requirements for licensees with regards to maintaining subcriticality in the spent fuel pool (SFP). For licensees that utilize neutron absorbing materials (NAM) in the SFP, the boron-10 ( $^{10}\text{B}$ ) areal density (AD) of the NAM must be verified so that the assumption for the  $^{10}\text{B}$  minimum AD in the SFP criticality analysis is supported. In order for the NRC staff to verify the requirements of 10 CFR 50.68 and GDC 62 are met, the staff needs to ensure the programs in place to monitor the condition of the NAM in the SFP are appropriate for their intended purpose. In addition, the condition of the NAM must be considered in the SFP nuclear criticality safety (NCS) analysis of record (AOR). In order to verify whether or not the requirements of 10 CFR 50.68 and GDC 62 will be met, the NRC staff needs to verify that the potential reactivity changes due to degradation or physical changes to the NAM are accounted for in the SFP NCS AOR.

**PNPS-1.** In the response to Question 1(a), the licensee states that the N1 and N2 SFP racks were installed in January of 1995. However, in the response to Question 2(b)ii.2., it states that the Boral coupons were placed in the SFP in November of 1999. Please describe how the Boral coupons are representative of the inservice material given the nearly 5-year difference in time that the material has been exposed to the SFP conditions.

REQUEST FOR SUPPLEMENTAL INFORMATION

ENTERGY OPERATIONS, INC.

WATERFORD STEAM ELECTRIC STATION, UNIT 3

DOCKET NO. 50-382

In a letter dated November 2, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16307A275), Entergy Operations, Inc. (the licensee) provided information in response to Generic Letter (GL) 2016-01 for Waterford Steam Electric Station, Unit 3 (Waterford). The U.S. Nuclear Regulatory Commission (NRC) staff requests supplemental information to complete its review.

**Generic Boral-RAI-2**

Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.68, "Criticality accident requirements," and 10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion (GDC) 62, "Prevention of criticality in fuel storage and handling," provide the requirements for licensees with regards to maintaining subcriticality in the spent fuel pool (SFP). For licensees that utilize neutron absorbing materials (NAM) in the SFP, the properties of the NAM must be known so that the assumptions in the SFP nuclear criticality safety (NCS) analysis of record (AOR) are supported. In order to verify whether or not the requirements of 10 CFR 50.68 and GDC 62 will be met, the NRC staff needs to verify that the potential reactivity changes due to degradation or physical changes to the NAM are accounted for in the SFP NCS AOR. This includes any changes that would affect the neutron spectrum for the SFP (as opposed to the neutron spectrum used for attenuation testing purposes) in addition to any loss of neutron attenuation capability.

Industry operating experience, as described in Information Notice 2009-26, "Degradation of Neutron-Absorbing Materials in the Spent Fuel Pool," dated October 28, 2009 (ADAMS Accession No. ML092440545), has demonstrated that certain manufacturing processes and plant conditions (dose, chemistry, length of time installed, and installation configuration) have resulted in material deformation as a result of blisters associated with Boral.

Waterford has indicated that similar operating experience was identified as a result of its site-specific monitoring program. Please discuss the criticality impact due to the material deformation identified at Waterford, and how it can be accommodated by the NCS AOR at Waterford without exceeding NRC subcriticality requirements.

**Plant-Specific Monitoring Information**

The regulations in 10 CFR 50.68 and GDC 62 provide the requirements for licensees with regards to maintaining subcriticality in the SFP. For licensees that utilize NAM in the SFP, the boron-10 ( $^{10}\text{B}$ ) areal density (AD) of the NAM must be verified so that the assumption for the  $^{10}\text{B}$  minimum AD in the SFP criticality analysis is supported. In order for the NRC staff to verify the requirements of 10 CFR 50.68 and GDC 62 are met, the staff needs to ensure the programs in place to monitor the condition of the NAM in the SFP are appropriate for their intended purpose. In addition, the condition of the NAM must be considered in the SFP NCS AOR. In order to verify whether or not the requirements of 10 CFR 50.68 and GDC 62 will be met, the



NRC staff needs to verify that the potential reactivity changes due to degradation or physical changes to the NAM are accounted for in the SFP NCS AOR.

**Waterford-1.** During the review of the response to GL 2016-01, the NRC staff compared the information provided to the information in the Waterford License Renewal Application (LRA) to ensure consistency. The NRC staff noted that the LRA contained additional operating experience that was not included in the response to GL 2016-01. Specifically, the operating experience that showed in 2001 black deposits were found on both sides of a coupon. The licensee stated, in part, in the LRA that it "...appeared to be pieces of boron carbide which had broken through the aluminum skin of Boral."

- a. Was this coupon subject to further testing to determine the composition of the black deposits?
- b. If so, were the black deposits in fact boron carbide that had broken through the aluminum skin of the Boral?
- c. If the black deposits were boron carbide, please describe how this potential degradation mechanism was treated in the site monitoring program (i.e. any corrective actions taken).

**SUBJECT:** GRAND GULF NUCLEAR STATION, UNIT 1; INDIAN POINT NUCLEAR GENERATING UNIT NO. 3; PILGRIM NUCLEAR POWER STATION; AND WATERFORD STEAM ELECTRIC STATION, UNIT 3 - REQUEST FOR SUPPLEMENTAL INFORMATION REGARDING GENERIC LETTER 2016-01, "MONITORING OF NEUTRON ABSORBING MATERIALS IN SPENT FUEL POOLS" (CAC NOS. MF9409, MF9424, MF9433, AND MF9438; EPID L-2016-LRC-0001) DATED NOVEMBER 13, 2017

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