[7590-01-P]

NUCLEAR REGULATORY COMMISSION

[Docket No. 50-423; NRC-2017-0118]

Dominion Nuclear Connecticut, Inc.; Millstone Power Station, Unit No. 3;

Use of AXIOM Fuel Rod Cladding Material

AGENCY: Nuclear Regulatory Commission.

ACTION: Exemption; issuance.

SUMMARY: The U.S. Nuclear Regulatory Commission (NRC) is issuing an exemption in response to a June 30, 2016, request, as supplemented by letter dated March 27, 2017, from Dominion Nuclear Connecticut, Inc. (DNC or the licensee) in order to use AXIOM fuel rod cladding material at Millstone Power Station, Unit No. 3 (MPS-3).

DATES: The exemption was issued on May 10, 2017.

ADDRESSES: Please refer to Docket ID **NRC-2017-0118** when contacting the NRC about the availability of information regarding this document. You may obtain publicly-available information related to this document using any of the following methods:

- **Federal Rulemaking Web Site:** Go to http://www.regulations.gov and search for Docket ID **NRC-2017-0118**. Address questions about NRC dockets to Carol Gallagher; telephone: 301-415-3463; e-mail: Carol.Gallagher@nrc.gov. For technical questions, contact the individual listed in the FOR FURTHER INFORMATION CONTACT section of this document.

- **NRC's Agencywide Documents Access and Management System (ADAMS):**

You may obtain publicly-available documents online in the ADAMS Public Documents collection at http://www.nrc.gov/reading-rm/adams.html. To begin the search, select "ADAMS Public Documents" and then select "Begin Web-based ADAMS Search." For problems with ADAMS, please contact the NRC's Public Document Room (PDR) reference staff at 1-800-397-4209, 301-415-4737, or by e-mail to pdr.resource@nrc.gov. The ADAMS accession number for each document referenced (if it is available in ADAMS) is provided the first time that it is mentioned in this document.

- **NRC's PDR:** You may examine and purchase copies of public documents at the NRC's PDR, Room O1-F21, One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852.

FOR FURTHER INFORMATION CONTACT: Richard V. Guzman, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington DC 20555-0001; telephone: 301-415-1030, e-mail: Richard.Guzman@nrc.gov.

SUPPLEMENTARY INFORMATION:

I. Background

Dominion Nuclear Connecticut, Inc. is the holder of Renewed Facility Operating License No. NPF-49, which authorizes operation of MPS-3, a pressurized-water reactor. The license provides, among other things, that the facility is subject to all rules, regulations, and orders of the NRC now or hereafter in effect. Millstone Power Station, Unit No. 3, shares the site with

Millstone Power Station, Unit No. 1, a permanently defueled boiling water reactor nuclear unit, and Millstone Power Station, Unit No. 2, a pressurized-water reactor. The facility is located in Waterford, Connecticut, approximately 2.3 miles southwest of New London, Connecticut. This exemption applies to MSP-3 only. The other Millstone Power Station units, No. 1 and No. 2, are not covered by this exemption.

II. Request/Action

Pursuant to § 50.12 of title 10 of the *Code of Federal Regulations* (10 CFR), "Specific exemptions," the licensee requested, by letter dated June 30, 2016 (ADAMS Accession No. ML16189A104), as supplemented by letter dated March 27, 2017 (ADAMS Accession No. ML17090A428), an exemption from § 50.46, "Acceptance criteria for emergency core cooling systems [ECCS] for light-water nuclear power reactors," and 10 CFR part 50, appendix K, "ECCS Evaluation Models," to allow the use of fuel rod cladding with AXIOM alloy for future reload applications. The regulations in § 50.46 contain acceptance criteria for the ECCS for reactors fueled with Zircaloy or ZIRLO™ fuel rod cladding material. In addition, 10 CFR part 50, appendix K, requires that the Baker-Just equation be used to predict the rates of energy release, hydrogen concentration, and cladding oxidation from the metal/water reaction. The Baker-Just equation assumes the use of a zirconium alloy, which is a material different from AXIOM. Therefore, the strict application of these regulations does not permit the use of fuel rod cladding material other than Zircaloy or ZIRLO™. Because the material specifications of AXIOM differ from the specificaitons for Zircaloy or ZIRLO™, and the regulations specify a cladding material other than AXIOM, a plant-specific exemption is required to allow the use of, and application of these regulations to, AXIOM at MPS-3.

The exemption request relates solely to the cladding material specified in these regulations (i.e., fuel rods with Zircaloy or ZIRLO™ cladding material). This exemption would allow application of the acceptance criteria of § 50.46 and appendix K to 10 CFR part 50, for fuel assembly designs using AXIOM fuel rod cladding material. The licensee is not seeking an exemption from the acceptance and analytical criteria of these regulations. The intent of the request is to allow the use of the criteria set forth in these regulations for application of the AXIOM fuel road cladding material at MPS-3.

III. Discussion

Pursuant to 10 CFR 50.12, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR part 50 when: (1) the exemptions are authorized by law, will not present an undue risk to public health or safety, and are consistent with the common defense and security; and (2) when special circumstances are present. Under § 50.12(a)(2), special circumstances include, among other things, when application of the specific regulation in the particular circumstance would not serve, or is not necessary to achieve, the underlying purpose of the rule.

A. Authorized by Law

This exemption would allow the use of AXIOM fuel rod cladding material for future reload applications at MPS-3. As stated above, 10 CFR 50.12 allows the NRC to grant exemptions from the requirements of 10 CFR part 50. The NRC staff has determined that special circumstances exist to grant the requested exemption and that granting the licensee's requested

exemption would not result in a violation of the Atomic Energy Act of 1954, as amended, or the Commission's regulations. Therefore, the exemption is authorized by law.

B. No Undue Risk to Public Health and Safety

Section 50.46 requires that each boiling or pressurized light-water nuclear power reactor fueled with uranium oxide pellets within cylindrical Zircaloy or ZIRLO™ cladding must be provided with an ECCS that must be designed so that its calculated cooling performance following a postulated loss-of-coolant accident (LOCA) conforms to the criteria set forth in § 50.46(b). The underlying purpose of § 50.46 is to establish acceptance criteria for adequate ECCS performance in response to LOCAs.

The licensee states that there will be up to eight lead test assemblies (LTAs) containing fuel rods fabricated with AXIOM cladding inserted into the core for MPS-3, Cycle 19. These LTAs will be placed in non-limiting locations. Westinghouse performed preliminary high temperature steam oxidation tests on AXIOM cladding and confirmed that AXIOM cladding exhibits a ductile response to ring compression tests for peak cladding temperature and equivalent cladding reacted values up to and beyond the §§ 50.46(b)(1) and (b)(2) acceptance criteria, therefore satisfying the underlying cladding performance metric used to judge ECCS performance. This evidence supports the use of the existing acceptance criteria for fuel rods fabricated with AXIOM cladding.

Paragraph I.A.5 of appendix K to 10 CFR part 50 states that the rates of energy, hydrogen concentration, and cladding oxidation from the metal-water reaction shall be calculated using the Baker-Just equation. Since the Baker-Just equation presumes the use of Zircaloy clad fuel, strict application of the rule would not permit use of the equation for AXIOM cladding. The Baker-Just equation predicts conservatively high oxidation rates compared with

modern correlations (i.e., Cathcart-Pawell) and has been shown to remain conservative and applicable for many modern zirconium alloys. The licensee provided the nominal alloying composition for ZIRLO™, Optimized ZIRLO™, and AXIOM cladding material. The licensee provided evidence that the Baker-Just equation conservatively predicts the rate of energy release, hydrogen generation, and cladding oxidation for the AXIOM material. Based upon similar material composition, the high temperature metal-water reaction rates are expected to be similar, and the continued use of the Baker-Just equation is judged by the NRC staff to be acceptable. Additionally, the licensee performs cycle-specific reload evaluations to assure that § 50.46 acceptance criteria are satisfied and will include the LTAs in such analysis. Therefore, the NRC staff determined that the application of paragraph I.A.5 of 10 CFR part 50, appendix K, related to cladding material is not necessary to achieve the underlying purpose of the rule in these circumstances. Since these evaluations demonstrate that the underlying purpose of the rule will be met, there will be no undue risk to the public health and safety. Based on the regulatory review of the exemption request, the NRC staff concludes that the intent of § 50.46 and 10 CFR part 50, appendix K, will continue to be satisfied for the planned operation of MPS-3 with Westinghouse AXIOM fuel cladding and fuel assembly material used for non-limiting LTAs.

C. Consistent with the Common Defense and Security

The licensee's exemption request is to allow the application of the aforementioned regulations to an improved fuel rod cladding material. In its letter dated June 30, 2016, the licensee stated that all the requirements and acceptance criteria will be maintained. The licensee is required to handle and control special nuclear material in these assemblies in accordance with its approved procedures. The use of LTAs with AXIOM fuel rod cladding in the

MPS-3 core is not related to and does not raise security issues. Therefore, the NRC staff has determined that this exemption does not impact common defense and security.

D. Special Circumstances

Special circumstances, in accordance with § 50.12(a)(2)(ii), are present whenever application of the regulation in the particular circumstances is not necessary to achieve the underlying purpose of the rule. The underlying purpose of § 50.46 and 10 CFR part 50, appendix K, is to establish acceptance criteria for ECCS performance to provide reasonable assurance of safety in the event of a LOCA. The regulations in § 50.46 and 10 CFR part 50, appendix K, are not directly applicable to AXIOM, even though the evaluations described in the following sections of this exemption show that the intent of the regulation is met. Therefore, since the underlying purposes of § 50.46 and 10 CFR part 50, appendix K, are achieved through the use of AXIOM fuel rod cladding material, the special circumstances required by § 50.12(a)(2)(ii) for the granting of an exemption exist.

E. Environmental Considerations

The NRC staff determined that the exemption discussed herein meets the eligibility criteria for the categorical exclusion set forth in § 51.22(c)(9) because it is related to a requirement concerning the installation or use of a facility component located within the restricted area, as defined in 10 CFR part 20, and the granting of this exemption involves: (i) no significant hazards consideration, (ii) no significant change in the types or a significant increase in the amounts of any effluents that may be released offsite, and (iii) no significant increase in individual or cumulative occupational radiation exposure. Therefore, in accordance with § 51.22(b), no environmental impact statement or environmental assessment need to be

prepared in connection with the NRC's consideration of this exemption request. The basis for the NRC staff's determination is discussed as follows with an evaluation against each of the requirements in § 51.22(c)(9).

Requirements in § 51.22(c)(9)(i)

The NRC staff evaluated the issue of no significant hazards consideration, using the standards described in § 50.92(c), as presented below:

1. Does the proposed exemption involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No.

The proposed exemption would allow DNC to insert up to eight LTAs with AXIOM fuel rod cladding at MPS-3. The proposed exemption from the requirements of § 50.46 and 10 CFR part 50, appendix K, to permit the use of the AXIOM cladding material in the MPS-3 core does not adversely affect any fission product barrier, nor does it alter the safety function of safety systems, structures, or components, or their roles in accident prevention or mitigation. AXIOM cladding material is not an accident initiator. The response of the fuel to an accident is analyzed using conservative techniques, and the results are compared to NRC-approved acceptance criteria. Reload specific analyses conducted by DNC and the fuel vendor demonstrate that the design limits of the fuel cladding are met. Station operation and analysis will continue to be in compliance with NRC regulations. Westinghouse will perform a cycle-specific analysis of the MPS-3 core using LOCA methods approved for the site to ensure that assemblies with AXIOM fuel rod cladding material meet the LOCA safety criteria. Therefore, the plant will continue to meet applicable design criteria and safety analysis acceptance criteria.

Consequently, permitting the insertion of up to eight LTAs with AXIOM fuel rod cladding in the MPS-3 core does not affect the probability of an accident or the consequences thereof.

Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed exemption create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No.

The proposed exemption from the requirements of § 50.46 and 10 CFR part 50, appendix K, does not impact the plant configuration or system performance. The proposed exemption does not modify any interfaces with existing equipment, change the equipment's function, or change the method of operating the equipment. Use of the AXIOM fuel rod cladding material in the MPS-3 core does not adversely affect any fission product barrier, nor does it alter the safety function of safety systems, structures, or components, or their roles in accident prevention or mitigation. Westinghouse will perform a cycle-specific analysis of the MPS-3 core using LOCA methods approved for the site to ensure that assemblies with AXIOM fuel rod cladding material meet the LOCA safety criteria. Prior to each cycle, the AXIOM LTAs will be evaluated to ensure that current design criteria are met for the projected burnup. Current NRC-approved models will be conservatively applied to bound AXIOM cladding material properties and expected behavior. If any current design criteria are not met, the LTAs with AXIOM fuel rod cladding will not be inserted into the core. The proposed exemption assures there is adequate margin available to meet safety analysis criteria and does not introduce any failure modes, accident initiators, or equipment malfunctions that would cause a new or different kind of accident.

Therefore, the proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. Does the proposed exemption involve a significant reduction in a margin of safety?

Response: No.

The proposed exemption from the requirements of § 50.46 and 10 CFR part 50, appendix K, does not impact the plant configuration or system performance, and use of the AXIOM cladding material in the MPS-3 core does not adversely affect any fission product barrier. Current NRC-approved models will be conservatively applied to bound AXIOM cladding material properties and expected behavior to ensure the plant continues to meet applicable design criteria and safety analysis acceptance criteria. The proposed exemption does not alter the manner in which safety limits, limiting safety system settings, or limiting conditions for operation are determined, and the dose analysis acceptance criteria are not affected. The proposed exemption does not result in plant operation in a configuration outside the analysis or design basis and does not adversely affect systems that respond to safely shut down the plant and maintain the plant in a safe shutdown condition. Westinghouse will perform a cycle-specific analysis of the MPS-3 core using LOCA methods approved for the site to ensure that assemblies with AXIOM fuel rod cladding material meet the LOCA safety criteria. Prior to each cycle, the AXIOM LTAs will be evaluated to ensure that current design criteria are met for the projected burnup. Current NRC-approved models will be conservatively applied to bound AXIOM cladding material properties and expected behavior. If any current design criteria are not met, the AXIOM cladding LTAs will not be inserted into the core.

Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above, the NRC staff concludes that the proposed exemption presents no significant hazards consideration under the standards set forth in § 50.92(c), and, accordingly, a finding of no significant hazards consideration is justified (i.e., satisfies the provisions of § 51.22(c)(9)(i)).

Requirements in § 51.22(c)(9)(ii)

The proposed exemption would allow the use of AXIOM fuel rod cladding material in the MPS-3 reactor. AXIOM material has essentially the same properties as the currently licensed Optimized ZIRLO™ cladding and standard ZIRLO™ alloys. The use of the AXIOM fuel rod cladding material will not significantly change the types of effluents that may be released offsite or significantly increase the amount of effluents that may be released offsite. Therefore, the provisions of § 51.22(c)(9)(ii) are satisfied.

Requirements in § 51.22(c)(9)(iii)

The proposed exemption would allow the use of AXIOM fuel rod cladding material in the reactors. AXIOM material has essentially the same properties as the currently licensed Optimized ZIRLO™ cladding and standard ZIRLO™ alloys. The use of the AXIOM fuel rod cladding material will not significantly increase individual occupational radiation exposure or significantly increase cumulative occupational radiation exposure. Therefore, the provisions of § 51.22(c)(9)(iii) are satisfied.

Conclusion

Based on the above, the NRC staff concludes that the proposed exemption meets the eligibility criteria for the categorical exclusion set forth in § 51.22(c)(9). Therefore, in

accordance with § 51.22(b), no environmental impact statement or environmental assessment need to be prepared in connection with the NRC's proposed issuance of this exemption.

IV. Conclusion

Accordingly, the Commission has determined that pursuant to 10 CFR 50.12, the exemption is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security. Also, special circumstances are present. Therefore, the Commission hereby grants DNC an exemption from the requirements of 10 CFR 50.46 and appendix K of 10 CFR part 50, to allow the use of AXIOM fuel rod cladding material at MPS-3. As stated above, this exemption relates solely to the cladding material specified in these regulations.

Dated at Rockville, Maryland, this 10th day of May 2017.

For the Nuclear Regulatory Commission.

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Office of Nuclear Reactor Regulation.

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