



NUCLEAR REGULATORY COMMISSION

[Docket No. 50-423; NRC-2024-0102]

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

AGENCY: Nuclear Regulatory Commission.

ACTION: Notice; issuance.

SUMMARY: The U.S. Nuclear Regulatory Commission (NRC) has issued an exemption in response to an exemption request from Dominion Energy Nuclear Connecticut, Inc. (DENC, the licensee) submitted by letter dated May 2, 2023.

DATES: The exemption was issued on May 21, 2024.

ADDRESSES: Please refer to Docket ID **NRC-2024-0102** 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 Website:** Go to <https://www.regulations.gov> and search for Docket ID **NRC-2024-0102**. Address questions about Docket IDs in Regulations.gov to Stacy Schumann; telephone: 301-415-0624; email: Stacy.Schumann@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 <https://www.nrc.gov/reading-rm/adams.html>. To begin the search, 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, at 301-415-4737, or by email 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. The request for the exemption was submitted by letter

dated May 2, 2023 (ADAMS Accession No. ML23123A279), as supplemented by letter dated April 1, 2024 (ADAMS Accession No. ML24093A216).

- **NRC's PDR:** The PDR, where you may examine and order copies of publicly available documents, is open by appointment. To make an appointment to visit the PDR, please send an email to PDR.Resource@nrc.gov or call 1-800-397-4209 or 301-415-4737, between 8 a.m. and 4 p.m. eastern time (ET), Monday through Friday, except Federal holidays.

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

SUPPLEMENTARY INFORMATION: The licensee is the holder of Renewed Facility Operating License No. NPF-49, which authorizes operation of Millstone Power Station, Unit No. 3 (Millstone 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. By letter dated May 2, 2023, as supplemented by letter dated April 1, 2024, DENC requested an exemption to section 50.46 of title 10 of the *Code of Federal Regulations* (10 CFR), "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," and 10 CFR part 50, appendix K, "ECCS [Emergency Core Cooling Systems] Evaluation Models," for Millstone 3. The text of the exemption is attached.

Dated: May 21, 2024.

For the Nuclear Regulatory Commission.

Richard V. Guzman,
*Senior Project Manager,
Plant Licensing Branch 1,
Division of Operating Reactor Licensing,
Office of Nuclear Reactor Regulation.*

Attachment – Exemption.

NUCLEAR REGULATORY COMMISSION

Docket No. 50-423

Dominion Energy Nuclear Connecticut, Inc.,

Millstone Power Station, Unit No. 3

Exemption

I. Background.

Dominion Energy Nuclear Connecticut, Inc. (DENC, the licensee) is the holder of Renewed Facility Operating License No. NPF-49, which authorizes operation of Millstone Power Station, Unit No. 3 (Millstone 3), a pressurized-water reactor (PWR). The license provides, among other things, that the facility is subject to all rules, regulations, and orders of the U.S. Nuclear Regulatory Commission (NRC) now or hereafter in effect.

Millstone 3 shares the site with Millstone Power Station, Unit 1, a permanently defueled boiling water reactor nuclear unit, and Millstone Power Station, Unit 2, a PWR. The facility is located in Waterford, Connecticut, approximately 3.2 miles west southwest of New London, Connecticut. This exemption applies to Millstone 3 only. The other units, Units 1 and 2, are not covered by this exemption.

II. Request/Action.

By letter dated May 2, 2023 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML23123A279), as supplemented by letter dated April 1, 2024 (ML24093A216), DENC, requested an exemption to title 10 of the *Code of Federal Regulations* (10 CFR), part 50, section 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," and part 50,

Appendix K, "ECCS [Emergency Core Cooling Systems] Evaluation Models," for Millstone 3.

This exemption request relates solely to the specific types of cladding materials for which 10 CFR 50.46 and 10 CFR part 50, Appendix K, are expressly applicable, namely zircaloy and ZIRLO™. Since these regulations specifically apply only to zircaloy and ZIRLO™, an exemption would be required to apply them to fuel clad with other materials, in this case Framatome M5™. Therefore, the licensee has requested such an exemption to support the introduction of Framatome GAIA fuel with the M5™ cladding. The proposed request would not exempt Millstone 3 from other requirements of 10 CFR 50.46 or 10 CFR part 50, appendix K, such as acceptance criteria, evaluation model features and documentation, and reporting of changes or errors.

This exemption request is specific to the M5™ cladding material exemption request only. The technical analysis necessary to support the use of M5™ cladding in the Millstone 3 GAIA Small Break and Large Break Loss-of-Coolant Accident (SBLOCA and RLBLOCA) evaluations under Framatome methods is documented in a separate safety evaluation for the related license amendment request (ML24109A003).

III. Discussion.

Pursuant to 10 CFR 50.12, the licensee requested an exemption from the requirements of 10 CFR 50.46, and appendix K to 10 CFR part 50. The proposed exemption request would permit application of the requirements of 10 CFR 50.46 and appendix K to 10 CFR part 50 to fuel assemblies containing fuel rods fabricated with M5™ cladding material at Millstone 3.

The technical basis for the use of fuel clad with M5™ in PWRs is documented in Topical Report (TR) BAW-10227P-A, Revision 1, "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel," dated June 2003 (ADAMS Package No. ML15162B043).

This TR describes Framatome's evaluation for the use of the M5™ alloy in PWR fuel assemblies as a replacement for Zircaloy-4. This TR discusses material properties of M5™, as well as its behavior under normal operation, anticipated transients, and postulated accident conditions.

The regulation in 10 CFR 50.46(a)(1)(i) requires, in part, 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 postulated loss-of-coolant accidents conforms to the criteria set forth in 10 CFR 50.46(b). Since 10 CFR 50.46 specifically refers to fuel with zircaloy or ZIRLO™ cladding, the use of fuel with M5™ cladding requires an exemption from this section of the regulations.

Paragraph I.A.5, "Metal – Water Reaction Rate," of appendix K to 10 CFR part 50 requires the Baker-Just equation be used in the ECCS evaluation model to determine the rate of energy release, hydrogen generation, and cladding oxidation. The requirement for using the Baker-Just equation in appendix K conformant loss-of-coolant accident (LOCA) evaluation models presume use of zircaloy- or ZIRLO™-clad fuel rods. Therefore, application of 10 CFR part 50, appendix K to cladding materials other than zircaloy or ZIRLO™ also requires an exemption. Pursuant to 10 CFR 50.12, the NRC 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 the public health or safety, and are consistent with the common defense and security; and (2) when special circumstances are present. Under 10 CFR 50.12(a)(2)(ii), special circumstances include, among other things, when application of the specific regulation in the particular circumstances would not serve, or is not necessary to achieve, the underlying purpose of the rule.

A. The Exemption is Authorized by Law.

In accordance with 10 CFR 50.12, the NRC may grant an exemption from the requirements of 10 CFR part 50 if the exemption is authorized by law. The exemption

requested in this instance is authorized by law, because no other prohibition of law exists to preclude the activities which would be authorized by the exemption.

This exemption would allow the use of M5™ cladding at Millstone 3 for GAIA SBLOCA and RLBLOCA analyses performed using Framatome (FRM) methods, instead of zircaloy or ZIRLO™ cladding. Selection of a specific cladding material in 10 CFR 50, appendix K was at the discretion of the Commission consistent with its statutory authority. No statute required the NRC to adopt this specification. As stated above, 10 CFR 50.12 allows the Commission to grant exemptions from the requirements of 10 CFR part 50. The NRC staff has determined that granting of an exemption from 10 CFR part 50, appendix K related to M5™ cladding, which is neither Zircaloy nor ZIRLO, will 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. The Exemption Presents no Undue Risk to Public Health and Safety.

The 10 CFR 50.46 requirements establish acceptance criteria for ECCS performance for reactors fueled with zircaloy or ZIRLO cladding during a LOCA. The technical basis for the use of fuel clad with M5™ in PWRs is documented in NRC-approved TR BAW-10227P-A, Revision 1, "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel," dated June 2003 (ADAMS Package No. ML15162B043). In this TR, Framatome demonstrated that the effectiveness of the ECCS will not be affected by a change from zircaloy or ZIRLO fuel rod cladding to M5™ fuel rod cladding. The analysis described in the TR demonstrated that the ECCS acceptance criteria applied to reactors fueled with zircaloy or ZIRLO clad fuel are also applicable to reactors fueled with M5™ fuel rod cladding.

Paragraph I.A.5 of appendix K to 10 CFR 50 requires that the Baker-Just equation be used in the ECCS evaluation models to determine the rate of energy release, cladding oxidation, and hydrogen generation. In the NRC-approved TR BAW-10227-P-A, Revision 1, Framatome demonstrated that the Baker-Just model is

conservative in the postulated LOCA scenarios with respect to the use of the M5™ alloy as a fuel rod cladding material. The Baker-Just equation is used to calculate cladding oxidation for the SBLOCA methodologies in the NRC-approved TR EMF-2328-P-A, Revision 0 (ML011410383) for fuel with M5™ cladding. The SBLOCA analysis (Attachments 3 and 4 in the licensee's May 2, 2023, letter) using the methodologies in TR EMF-2328-P-A, Revision 0 for Millstone 3 demonstrated that the amount of hydrogen generated in an M5-clad core meets the 10 CFR 50.46 criteria.

The NRC staff has reviewed the SBLOCA and RLBLOCA analyses in Attachments 3 through 6 in the licensee's May 2, 2023, letter, and concluded in a safety evaluation (ML24109A003) that the LOCA analyses meet the applicable acceptance criteria, confirming that the use of M5™ fuel cladding at Millstone 3 would not result in an increase in the consequences of postulated LOCAs beyond the required limits. Based on these reviews, the NRC staff concludes that the exemption presents no undue risk to public health and safety.

C. The Exemption is Consistent with the Common Defense and Security.

The proposed exemption will allow the licensee to use M5™ fuel rod cladding material, an improved fuel rod cladding material relative to the zircaloy material for which the requirements of 10 CFR 50.46 and 10 CFR part 50, appendix K were originally established. In its letter dated May 2, 2023, the licensee stated that the M5™ fuel rod cladding material is similar in design to the current cladding material used in Millstone 3. The change in cladding material will not result in any changes to the security aspects associated with control of special nuclear material and is unrelated to other security issues. In addition to its review of the exemption request, the NRC staff's technical analysis necessary to support the use of M5™ cladding in the Millstone 3 GAIA SBLOCA and RLBLOCA evaluations under Framatome methods is documented in a separate safety evaluation for the related license amendment request (ML24109A003). Based on these reviews, the NRC staff concludes that the use of

M5™ fuel rod cladding at Millstone 3 will not significantly affect plant operations and is therefore consistent with the common defense and security.

D. Special Circumstances

Special circumstances, in accordance with 10 CFR 50.12(a)(2)(ii), are present whenever application of the regulation in the circumstances would not serve the purpose of the rule or is not necessary to achieve the purpose of the rule.

The underlying purpose of 10 CFR 50.46 and appendix K to 10 CFR part 50 is to establish acceptance criteria for ECCS performance to provide reasonable assurance of safety in the event of a LOCA. Although the regulations in 10 CFR 50.46 and appendix K to 10 CFR part 50 are not expressly applicable to M5™ fuel rod cladding, the evaluations described in the above section show that the purpose of the regulations are met by this exemption; specifically, the NRC-approved topical report (TR) BAW-10227-A, Revision 1 demonstrated that the effectiveness of the ECCS will not be affected by a change from zircaloy or ZIRLO fuel rod cladding to M5™ fuel rod cladding and that the ECCS acceptance criteria applied to reactors fueled with zircaloy or ZIRLO clad fuel are also applicable to reactors fueled with M5™ fuel rod cladding.

Paragraph I.A.5 of appendix K to 10 CFR 50 requires that the Baker-Just equation be used in the ECCS EMs to determine the rate of energy release, cladding oxidation, and hydrogen generation. The NRC-approved TR BAW-10227-P-A, Revision 1 demonstrated that the Baker-Just model is conservative in the postulated LOCA scenarios with respect to the use of the M5™ alloy as a fuel rod cladding material.

Neither 10 CFR 50.46 acceptance criteria nor the 10 CFR 50 appendix K requirements for use of the Baker-Just equation in the ECCS EMs allows the use of M5™ fuel rod cladding material, even though the analysis demonstrated that applying the zircaloy or ZIRLO criteria to M5™ fuel produces acceptable results. Application of the regulatory requirements of 10 CFR 50.46 and 10 CFR 50 appendix K in this circumstance is not necessary to achieve the purpose of the rule. The purpose of these

regulations is achieved through the application of the requirements to the use M5™ fuel rod cladding material. Therefore, the NRC staff determines that special circumstances for granting of an exemption, defined in 10 CFR 50.12(a)(2)(ii), exist.

E. Environmental Considerations

With respect to its impact on the quality of the human environment, the NRC has determined that the issuance of the exemption discussed herein meets the eligibility criteria for categorical exclusion set forth in 10 CFR 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 issuance 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 10 CFR 51.22(b), no environmental impact statement or environmental assessment need 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 10 CFR 51.22(c)(9)(i) – (iii).

Requirements in 10 CFR 51.22(c)(9)(i)

The NRC evaluated whether the exemption involves no significant hazards consideration using the standards described in 10 CFR 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 the use of M5™ cladding at Millstone 3 for

GAIA SBLOCA and RLBLOCA analyses performed using FRM methods. The NRC approved topical reports cited above demonstrate that M5™ cladding has similar properties as the currently licensed Zircaloy. The fuel cladding itself is not a postulated initiator of previously evaluated accidents; thus, fuel cladding material does not affect the probability of occurrence of any accident. The consequences of none of the previously evaluated accidents were affected by fuel cladding material, and M5™ fuel cladding, likewise, is not expected to have any effect on the consequences of any previously evaluated accidents.

Therefore, the proposed exemption 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 use of M5™ fuel rod cladding material will not result in changes in the operation or configuration of the facility. The above cited topical reports demonstrated that the material properties of M5™ cladding are similar to those of standard Zircaloy. Therefore, M5™ fuel cladding material will perform similarly to those fabricated from standard Zircaloy. The fuel cladding itself is not a postulated initiator of previously evaluated accidents and does not create the possibility of a new or different kind of accident.

Therefore, the proposed exemption 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 will not involve a significant reduction in the margin of safety because it has been demonstrated that the material properties of the M5™ cladding is not significantly different from those of the standard Zircaloy. M5™ fuel cladding material is expected to perform similarly to standard Zircaloy for all normal operating and accident scenarios. Use of M5™ cladding does not require changing any of the current regulatory acceptance criteria, or relaxation of the methods of analysis.

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

Based on the above evaluation of the standards set forth in 10 CFR 50.92(c), the NRC staff concludes that the proposed exemption involves no significant hazards consideration. Accordingly, the requirements of 10 CFR 51.22(c)(9)(i) are met.

Requirements in 10 CFR 51.22(c)(9)(ii)

The proposed exemption would allow the use of M5™ cladding at Millstone 3 for GAIA SBLOCA and RLBLOCA analyses performed using FRM methods. M5™ cladding has similar properties and performance characteristics as the currently licensed Zircaloy cladding. Thus, the use of M5™ fuel cladding material will not significantly increase the amount of effluents that may be released offsite. Therefore, the requirements of 10 CFR 51.22(c)(9)(ii) are met.

Requirements in 10 CFR 51.22(c)(9)(iii)

The proposed exemption would allow the use of M5™ cladding at Millstone 3 for GAIA SBLOCA and RLBLOCA analyses performed using FRM methods. M5™ cladding has similar properties and performance characteristics as the currently licensed Zircaloy cladding. Thus, the use of M5™ fuel cladding material will not significantly increase individual occupational radiation exposure, or significantly increase cumulative occupational radiation exposure. Therefore, the requirements of 10 CFR 51.22(c)(9)(iii) are met.

Based on the above, the NRC staff concludes that the proposed exemption meets the eligibility criteria for the categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, in accordance with 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the NRC's issuance of this exemption.

IV. Conclusions.

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 DENC an exemption from the requirements of 10 CFR 50.46 and 10 CFR part 50, appendix K. The proposed exemption request would permit application of the requirements of 10 CFR 50.46 and appendix K to fuel rod cladding with M5™ at Millstone 3. As stated above, this exemption relates solely to the cladding material specified in these regulations.

Dated at Rockville, Maryland, this 21st day of May, 2024.

For the Nuclear Regulatory Commission.

Jamie Pelton,
Deputy Director,
Division of Operating Reactor Licensing,
Office of Nuclear Reactor Regulation.