



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

May 12, 2015

Mr. David A. Heacock
President and Chief Nuclear Officer
Dominion Nuclear Connecticut, Inc.
Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, VA 23060-6711

SUBJECT: MILLSTONE POWER STATION, UNIT NO. 2 - EXEMPTION FROM 10 CFR
50.46 AND APPENDIX K TO ALLOW USE OF M5TM ALLOY FOR FUEL
CLADDING (TAC NO. MF3917)

Dear Mr. Heacock:

The U.S. Nuclear Regulatory Commission has approved the enclosed exemption from specific requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," and paragraph I.A.5 of Appendix K to 10 CFR Part 50, "ECCS Evaluation Models," for Millstone Power Station, Unit No. 2. This action is in response to your letter dated April 11, 2014, for an exemption and amendment regarding the use of M5TM alloy fuel rod cladding material.

Your letter also requested an amendment regarding the same M5TM alloy fuel cladding material. That amendment is addressed by separate correspondence.

A copy of the exemption is enclosed. The exemption has been forwarded to the Office of the Federal Register for publication.

Sincerely,

A handwritten signature in cursive script, appearing to read "R. Guzman", followed by a horizontal line.

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

Docket No. 50-336

Enclosure: Exemption

cc w/encl: Distribution via Listserv

NUCLEAR REGULATORY COMMISSION

[Docket No. 50-336; NRC-2015-____]

Exemption for Dominion Nuclear Connecticut, Inc.

Millstone Power Station, Unit 2

AGENCY: Nuclear Regulatory Commission.

ACTION: Exemption; issuance.

SUMMARY: The U.S. Nuclear Regulatory Commission (NRC) is issuing an exemption in response to an April 11, 2014, request from Dominion Nuclear Connecticut, Inc., requesting an exemption to use a different fuel rod cladding material (M5™, hereafter referred as M5).

ADDRESSES: Please refer to Docket ID NRC-2015-____ when contacting the NRC about the availability of information regarding this document. You may access 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-2015-____. Address questions about NRC dockets to Carol Gallagher; telephone: 301-287-3422; 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 access publicly available documents online in the NRC Library 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 pdresource@nrc.gov. The ADAMS Accession number for each document referenced in this document (if that document is available in ADAMS) is provided the first time that a document is referenced.

- **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, telephone: 301-415-1030; e-mail: Richard.guzman@nrc.gov U.S. Nuclear Regulatory Commission, Washington DC 20555-0001.

I. Background.

Dominion Nuclear Connecticut, Inc. (the licensee) is the holder of Renewed Facility Operating License No. DPR-65, which authorizes operation of Millstone Power Station, Unit 2 (MPS2), 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.

MPS2 shares the site with Millstone Power Station, Unit 1, a permanently defueled boiling water reactor nuclear unit, and Millstone Power Station, Unit 3, a pressurized water reactor. The facility is located in Waterford, Connecticut, approximately 3.2 miles west southwest of New London, Connecticut. This exemption applies to MPS2 only. The other units, Units 1 and 3, are not covered by this exemption.

II. Request/Action.

Pursuant to Section 50.12 of Title 10 of the *Code of Federal Regulations* (10 CFR), "Specific exemptions," the licensee has, by letter dated April 11, 2014 (ADAMS Accession No. ML14112A072), requested an exemption from 10 CFR 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 M5 alloy for future reload applications. The regulations in 10 CFR 50.46 contain acceptance criteria for the ECCS for reactors fueled with Zircaloy or ZIRLO[®] fuel rod cladding material. In addition, paragraph I.A.5 of Appendix K to 10 CFR Part 50 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 M5. Thus, 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 M5 differ from the specifications for Zircaloy or ZIRLO[®], and the regulations specify a cladding material other than M5, a plant-specific exemption is required to allow the use of, and application of these regulations to, M5 at MPS2.

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 10 CFR 50.46 and Appendix K to 10 CFR Part 50, to fuel assembly designs using M5 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 the use of M5 fuel rod cladding material at MPS2. The detailed technical basis of the licensee's proposed use of M5 cladding is being addressed by the Nuclear Regulatory Commission staff under a proposed

amendment to the MPS2 operating license; the amendment is issued concurrently with the issuance of this exemption.

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 10 CFR 50.12(a)(2)(ii), 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. Special Circumstances

Special circumstances, in accordance with 10 CFR 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 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 loss-of-coolant accident (LOCA). Although the regulations in 10 CFR 50.46 and Appendix K to 10 CFR Part 50 are not expressly applicable to M5 alloy cladding, the evaluations described in the following sections of this exemption show that the purpose of the regulations are met by this exemption, in that the effectiveness of the ECCS will not be affected by a change from Zircaloy or ZIRLO[®] clad fuel rod to M5 clad fuel rod. Normal reload safety analyses will confirm that there is no adverse impact on ECCS performance. Thus, a strict application of the rule (which would preclude the applicability of ECCS performance acceptance criteria to, and the use of, M5 fuel cladding material) is not necessary to achieve the underlying purposes of 10 CFR 50.46 and Appendix K to 10 CFR Part 50. The

purpose of these regulations is achieved through application of the requirements to the use of M5 fuel rod clad material. Therefore, the special circumstances required by 10 CFR 50.12(a)(2)(ii) for the granting of an exemption exist.

B. Authorized by Law

This exemption would allow the use of M5 fuel rod cladding material for future reload operations at MPS2. As stated above, 10 CFR 50.12 allows the NRC to grant exemptions from the requirements of 10 CFR Part 50 provided that special circumstances are present. As described above, the NRC staff has determined that special circumstances exist to grant the requested exemption. In addition, granting the exemption will not result in a violation any part of the Atomic Energy Act of 1954, as amended, or the Commission's regulations. Therefore, the exemption is authorized by law.

C. No Undue Risk to Public Health and Safety

Section 10 CFR 50.46 requires that each boiling or pressurized light-water nuclear power reactor fueled with uranium dioxide 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 LOCA conforms to the criteria set forth in paragraph (B) of this section. The underlying purpose of 10 CFR 50.46 is to establish acceptance criteria for adequate ECCS performance.

The NRC-approved topical report BAW-10227(P)-A, "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel" (ADAMS Accession No. ML003686365) has demonstrated that predicted chemical, mechanical, and material performance characteristics of the M5 alloy cladding are bound for those approved for Zircaloy under anticipated operational occurrences and postulated accidents. The NRC staff's Safety Evaluation (ADAMS Accession

No. ML003671021) evaluating this topical report concluded that the M5 properties and mechanical design methodology are acceptable for fuel reload licensing applications. Topical report BAW-10227(P)-A also confirms that no new or different type of accident will be initiated that could pose a risk to public health and safety.

The NRC-approved topical Report BAW-10240(P)-A, Revision 0, "Incorporation of M5 Properties in Framatome-ANP Approved Methods" (ADAMS Accession No. ML042800314) describes the incorporation of the NRC-approved M5 material properties in a set of mechanical analyses, small-break loss-of-coolant accident (SBLOCA) and non-LOCA methodologies. This topical report demonstrates that the effectiveness of the ECCS will not be affected by changing the cladding from Zircaloy to M5 alloy.

The objective of 10 CFR 50.46(b)(2) and (b)(3), and Appendix K to 10 CFR Part 50, paragraph I.A.5 is to ensure that cladding oxidation and hydrogen generation are appropriately limited during a LOCA and conservatively accounted for in a plant's ECCS evaluation model. Paragraph I.A.5 of Appendix K requires that the Baker-Just equation be used in the ECCS evaluation model to determine the rate of energy release, cladding oxidation, and hydrogen generation. Based on the above, the NRC staff concludes that the intent of 10 CFR 50.46 and Appendix K to 10 CFR Part 50 will continue to be satisfied for the planned operation of MPS2 with M5 alloy fuel cladding and fuel assembly material.

D. Consistent with the Common Defense and Security

The M5 cladding material is similar in design to Zircaloy, the current cladding material used at MPS2. Thus, the change in cladding material from Zircaloy to M5 will not require any change to the security and control of special nuclear material. The licensee will continue to be required to handle and control special nuclear material in these assemblies in accordance with its approved procedures. This change to reactor core internals is adequately controlled by NRC

requirements and is not related to security issues. Therefore, the NRC staff determined that this exemption does not impact, and thus is consistent with, the common defense and security.

E. Environmental Considerations

The NRC staff determined that the exemption discussed herein meets the eligibility criteria for the 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 staff 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 fuel rod cladding material in the MPS2 reactor. The NRC approved topical reports cited above demonstrate that M5 alloy 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, 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 are similar to those of standard Zircaloy. Therefore, M5 fuel rod 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 alloy are not significantly different from those of standard Zircaloy. M5 alloy is expected to perform similarly to standard Zircaloy for all normal operating and accident scenarios. Use of M5 alloy 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 fuel rod cladding material in the MPS2 reactor. M5 alloy has similar material properties and performance characteristics as the currently licensed Zircaloy cladding. Thus, the use of M5 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 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 fuel rod cladding material in the reactors. M5 alloy has similar material properties and performance characteristics as the currently licensed Zircaloy cladding. Thus, the use of M5 fuel rod 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.

Conclusion

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 proposed 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 pursuant to 10 CFR 50.12(a)(2)(ii) are present. Therefore, the Commission hereby grants Dominion Nuclear Connecticut, Inc., an exemption from the requirements of 10 CFR 50.46 and Appendix K to 10 CFR Part 50, to allow the application of those criteria to, and the use of, M5 fuel rod cladding material at MPS2.

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 12th Day of May, 2015.

FOR THE NUCLEAR REGULATORY COMMISSION

A handwritten signature in cursive script that reads "Louise Lund".

Louise Lund, Acting Director
Division of Operating Reactor Licensing,
Office of Nuclear Reactor Regulation.

May 12, 2015

Mr. David A. Heacock
President and Chief Nuclear Officer
Dominion Nuclear Connecticut, Inc.
Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, VA 23060-6711

SUBJECT: MILLSTONE POWER STATION, UNIT NO. 2 - EXEMPTION FROM 10 CFR
50.46 AND APPENDIX K TO ALLOW USE OF M5™ ALLOY FOR FUEL
CLADDING (TAC NO. MF3917)

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A copy of the exemption is enclosed. The exemption has been forwarded to the Office of the Federal Register for publication.

Sincerely,

/RA/

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

Docket No. 50-336
Enclosure: Exemption
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ADAMS Accession Nos.: PKG: **ML15093A504**

Letter: **ML15093A497**

Exemption: **ML15093A275**

*See memo dated 3/18/15, ML15056A282

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