[7590-01-P]

NUCLEAR REGULATORY COMMISSION

[Docket Nos. 50-280 and 50-281 NRC-2016-0105]

Virginia Electric Power Company; Surry Power Station, Unit Nos. 1 and 2; Use of AREVA's M5® Alloy 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 September 30, 2016, request from Virginia Electric Power Company (Dominion or the licensee) in order to use AREVA's M5® alloy fuel rod cladding material at Surry Power Station, Unit Nos. 1 and 2 (SPS).

DATE: The exemption was issued on July 27, 2016.

ADDRESSES: Please refer to Docket ID NRC-2016-0105 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-2016-0105. 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 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: Karen R. Cotton, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington DC 20555-0001; telephone: 301-415-1438, e-mail: Karen.Cotton@nrc.gov.

SUPPLEMENTARY INFORMATION:

I. Background

Dominion is the holder of Facility Operating License Nos. DPR-32 and DPR-37, which authorize operation of SPS. The licenses provide, among other things, that the facility is subject to all rules, regulations, and orders of the NRC now or hereafter in effect.

The facility consists of two pressurized-water reactors (PWR) located in Surry County, Virginia.

II. Request/Action

Pursuant to § 50.12 of title 10 of the *Code of Federal Regulations* (10 CFR), "Specific exemptions," the licensee has requested, by letter dated September 30, 2015 (ADAMS Accession No. ML15282A036), 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 rods clad with AREVA's M5® alloy. The regulations in 10 CFR 50.46 require that the calculated cooling performance following postulated loss-of-coolant accidents (LOCAs) at reactors fueled with zircaloy or ZIRLO™ cladding conforms to the criteria set forth in 10 CFR 50.46(b). In addition, 10 CFR part 50, appendix K, requires, in part, 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 zircaloy or ZIRLO™ materials that have different chemical compositions from AREVA's M5® alloy. As written, these regulations presume only the use of zircaloy or ZIRLO™ fuel rod cladding and do not contain provisions for use of fuel rods with other cladding materials. Therefore, an exemption from the requirements of 10 CFR 50.46 and 10 CFR part 50, appendix K, is needed to support the use of a different fuel cladding material. Accordingly, the licensee requested an exemption that would allow the use of fuel rods clad with AREVA's M5® alloy to be loaded into the SPS reactor cores as non-limiting lead test assemblies (LTAs) in up to eight locations.

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 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. However, 10 CFR 50.12(a)(2) states that the Commission will not consider granting an exemption unless special circumstances are present as set forth in 10 CFR 50.12(a)(2). Under 10 CFR 50.12(a)(2)(ii), special circumstances are present when application of the regulation in the particular circumstances 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 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 special circumstance that necessitates the request for exemption to 10 CFR 50.46 and 10 CFR 50, appendix K, is that neither of these regulations explicitly allows the use of AREVA's M5® alloy fuel rod cladding material. The ultimate objective of 10 CFR 50.46 is to ensure that nuclear power reactors fueled with uranium oxide pellets within zircaloy or ZIRLO™ cladding must be provided with an ECCS that is designed to provide core cooling following a postulated LOCA. AREVA NP, in its NRC-approved Topical Report BAW-10227-A, "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel," February 2000 (ADAMS Accession No. ML003686365), has demonstrated that the effectiveness of the ECCS will not be affected by a change from zircaloy or ZIRLO™ clad fuel to fuel rods clad with AREVA's M5® alloy. Normal reload safety analyses will confirm that there is no adverse impact on ECCS performance.

The objective of 10 CFR 50.46(b)(2) and (b)(3), and 10 CFR part 50, appendix K I.A.5, is to ensure that cladding oxidation and hydrogen generation are appropriately limited during a LOCA and conservatively accounted for in the ECCS evaluation model. Appendix K of 10 CFR part 50 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. AREVA NP has shown in an appendix of Topical Report BAW-10227-A that the Baker-Just model is conservative in all post-LOCA scenarios with respect to the use of AREVA's M5® alloy fuel rod cladding material.

Based on the regulatory review of the exemption request, the NRC staff concludes that the intent of 10 CFR 50.46 and 10 CFR part 50, appendix K, will continue to be satisfied for the planned operation of SPS with AREVA's M5® alloy fuel rod cladding material used for non-limiting LTAs and the special circumstance required by 10 CFR 50.12(a)(2)(ii) for granting of an exemption exists.

B. Authorized by Law

This exemption would allow the use of fuel rods clad with AREVA's M5® alloy in up to eight fuel assemblies at SPS. The regulations in 10 CFR 50.12 allow the NRC to grant exemptions from the requirements of 10 CFR part 50 provided that the exemptions are authorized by law. The NRC staff determined that special circumstances exist to grant the proposed exemption and that granting the exemption would not result in a violation of the Atomic Energy Act of 1954, as amended. Therefore, the exemption is authorized by law.

C. No Undue Risk to Public Health and Safety

The provisions of 10 CFR 50.46 establish acceptance criteria for ECCS performance. Topical Report BAW-10227-A contains the justification to use AREVA's M5® alloy fuel rod cladding material, a proprietary variant of Zr1Nb, to replace Zircaloy-4 in the construction of fuel assembly components such as fuel rod cladding, guide tubes, and spacer grids. This justification is required to support the request by Dominion for an exemption to 10 CFR 50.46 to permit the use of AREVA's M5® alloy fuel rod cladding material, in addition to Zircaloy-4 and ZIRLO™. AREVA's M5® alloy is an AREVA NP proprietary material composed of 1.0 percent niobium, 0.125 percent oxygen, and the balance zirconium. AREVA's M5® alloy fuel rod cladding provides improved performance in fuel cladding corrosion and hydrogen pickup.

An AREVA NP LOCA evaluation showed compliance with 10 CFR 50.46. Topical Report BAW-10227-A has addressed all of the important aspects of AREVA's M5® alloy fuel rod cladding material with respect to ECCS performance requirements, as follows:

- Since the material properties of AREVA's M5® alloy are similar to those of zirconium-based materials, the NRC staff found it appropriately conservative to apply the criteria in 10 CFR 50.46 and 10 CFR part 50, appendix K.
- Material properties of AREVA's M5® alloy, including cladding thermal conductivity, cladding creep, clad swelling, rupture deformation, and temperature, were found to be very similar to those of Zircaloy-4.
- The retention of the Baker-Just equation for the calculation of metal-water reaction rate specified in 10 CFR part 50, appendix K, is justified to be suitably conservative.

Based on the NRC staff's evaluation of the exemption request, the staff concludes that the intent of 10 CFR 50.46 and 10 CFR part 50, appendix K, will continue to be satisfied for the

planned operation of SPS, with AREVA's M5® alloy fuel rod cladding material used in up to eight non-limiting LTAs. The probability of postulated accidents is not increased. Also, based on the NRC staff's evaluation of the exemption request, the consequences of postulated accidents are not increased. Therefore, there is no undue risk to public health and safety due to using M5® alloy fuel cladding and fuel assembly material in up to eight non-limiting LTAs.

D. Consistent with the Common Defense and Security

The proposed exemption would allow the use of AREVA's M5® alloy fuel rod cladding material at SPS. This change to the plant configuration is adequately controlled by technical specification requirements and is not related to security issues. Because the common defense and security is not impacted by this exemption, the exemption is consistent with the common defense and security.

IV. Conclusions

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12(a), the exemption is authorized by law, will not present an undue risk to the public health and safety, is consistent with the common defense and security, and that special circumstances are present to warrant issuance of the exemption. Therefore, the Commission hereby grants SPS an exemption from the requirements of 10 CFR 50.46 and 10 CFR part 50, appendix K, paragraph I.A.5, to allow the use of AREVA's M5® alloy fuel rod cladding material in up to eight non-limiting LTAs at SPS.

Pursuant to 10 CFR 51.32, an environmental assessment and finding of no significant impact related to this exemption was published in the *Federal Register* on May 31, 2016 (81 FR 34382). Based upon the environmental assessment, the Commission has determined that issuance of this exemption will not have a significant effect on the quality of the human environment.

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 27th day of July 2016.

For the Nuclear Regulatory Commission.

/RA/

Anne T. Boland, Director,
Division of Operating Reactor Licensing,
Office of Nuclear Reactor Regulation.