

NUCLEAR REGULATORY COMMISSION

Docket No. 50-483

Union Electric Company Callaway Plant, Unit No. 1

Exemption

I. Background.

Union Electric Company, doing business as (dba) as Ameren Missouri (the licensee), is the holder of Renewed Facility Operating License No. NPF-30, which authorizes operation of the Callaway Plant, Unit No. 1 (Callaway). 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. The facility consists of a pressurized-water reactor (PWR) located in Callaway County, Missouri.

II. Request/Action.

By letter dated October 12, 2022 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML22285A115), as supplemented by letters dated December 1, 2022; May 9, 2023; June 21, 2023; and August 3, 2023 (ML22335A497, ML23129A793, ML23172A145, and ML23215A196, respectively), Ameren Missouri, submitted a license amendment request (LAR) for Callaway, proposing to load a limited number of Framatome GAIA fuel assemblies starting in operating cycle 27 to obtain incore performance data and acquire operational experience associated with the GAIA fuel design. Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.12, "Specific exemptions," the licensee also requested an exemption from certain requirements of 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems," and 10 CFR Part 50, Appendix K, "ECCS [Emergency Core Cooling Systems] Evaluation Models," for Callaway in enclosure 2 to the LAR dated October 12, 2022.

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 Callaway from requirements of 10 CFR 50.46 or 10 CFR Part 50, Appendix K, regarding acceptance criteria, evaluation model features and documentation, reporting of changes or errors, etc.

This exemption request is specific to the M5® cladding material exemption request only. The technical analysis necessary to support proposed loading of a limited number of Framatome GAIA fuel assemblies starting in operating cycle 27 is documented in the safety evaluation (SE) for the related LAR (ML23240A369).

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 rods clad with M5® at Callaway.

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) states, in part:

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 emergency core cooling system (ECCS) that must be designed so that its calculated cooling performance following postulated loss-of-coolant accidents conforms to the criteria set forth in paragraph (b) of this section. ECCS cooling performance must be calculated in accordance with an acceptable evaluation model and must be calculated for a number of postulated loss-of-coolant accidents of different sizes, locations, and other properties sufficient to provide assurance that the most severe postulated loss-of-coolant, accidents are calculated.

Since 10 CFR 50.46 specifically refers to fuel with zircaloy or ZIRLO™ cladding, its application to fuel clad with materials other than zircaloy or ZIRLO™ 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 states, in part:

The rate of energy release, hydrogen generation, and cladding oxidation from the metal/water reaction shall be calculated using the Baker-Just equation (Baker, L., Just, L.C., “Studies of Metal Water Reactions at High Temperatures, III. Experimental and Theoretical Studies of the Zirconium-Water Reaction,” [Argonne National Laboratory] ANL-6548, page 7, May 1962).

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 Commission may grant exemption from requirements of the regulations in 10 CFR Part 50 provided that (1) the exemption is authorized by law, (2) the exemption will not present an undue risk to the public health and safety, (3) the exemption is consistent with the common defense and security, and (4) special circumstances, as defined in 10 CFR 50.12(a)(2), are present. The licensee’s submittal identifies that the special circumstance associated with its exemption request is that restricting application of 10 CFR

50.46 and Appendix K to 10 CFR Part 50 to fuels clad with only zircaloy or ZIRLO™ is not necessary to achieve the purpose of these regulations.

A. The Exemption is Authorized by Law.

The NRC has authority under 10 CFR 50.12 to grant exemptions from the requirements of 10 CFR Part 50 upon demonstration of proper justification. The fuel that will be irradiated at Callaway is clad with a zirconium-based alloy that is not expressly within the scope of 10 CFR 50.46 and 10 CFR Part 50, Appendix K. However, the NRC staff considers all other aspects of these regulations (e.g., acceptance criteria, prescribed methods, reporting requirements) applicable to the M5® cladding material, and the licensee states that it will ensure that these regulations are satisfied for operation with fuel clad with M5®. As discussed below, the NRC staff determined that special circumstances exist, which support granting the proposed exemption. Furthermore, granting the 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. The Exemption Presents no Undue Risk to Public Health and Safety.

As summarized in the staff's safety evaluation supporting this exemption request (ML23234A152 (Enclosure 2)), the NRC-approved Topical Report BAW-10227P-A, Revision 1, which concerns the properties of the M5® alloy, provides assurance that predicted chemical, thermal, and mechanical characteristics of M5®-alloy cladding are acceptable under normal operation, anticipated transients, and postulated accidents. The NRC staff finds that by utilizing the methods and properties in NRC-approved TR (i.e., BAW-10227P-A), the licensee meets the acceptance criteria and analytical methods in 10 CFR 50.46 and Appendix K to 10 CFR Part 50, and thus, ensures acceptable safety margins for fuel clad with M5® that are consistent with those the NRC has established for zircaloy and ZIRLO™. Callaway cores involving M5® cladding will continue to be subject to the operating limits specified in the technical

specifications (TSs) and core operating limits report. Thus, granting this exemption request does not pose 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 an enhanced 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 addition to its review of the exemption request, the NRC staff has evaluated all licensing-basis changes necessary to support loading fuel clad with M5® in a separate SE for the related license amendment request for fuel transition. Based on these reviews, the NRC staff concludes that the use of M5® fuel rod cladding at Callaway will not significantly affect plant operations and is therefore consistent with the common defense and security.

D. Special Circumstances

Neither 10 CFR 50.46 nor 10 CFR Part 50, Appendix K explicitly applies to fuel clad with M5®. However, the underlying purpose of 10 CFR 50.46 and 10 CFR Part 50, Appendix K is to provide requirements capable of ensuring adequate core cooling following the most limiting postulated loss-of-coolant accident. As discussed above, Framatome has demonstrated in an NRC-approved TR (i.e., BAW-10227P-A) that application of the acceptance criteria and analytical methods required in 10 CFR 50.46 and 10 CFR Part 50, Appendix K to fuel clad with M5® is acceptable. The licensee stated in the exemption request that the core reload safety analyses will be used to confirm on a cycle-specific basis that there is no adverse impact on ECCS performance for Callaway. Therefore, strict application of the material-specific requirements for fuel cladding in 10 CFR 50.46 and 10 CFR Part 50, Appendix K is not necessary to achieve the underlying purpose of ensuring adequate core cooling in this instance. Furthermore, granting an exemption to allow application of the balance of these regulations to fuel clad with M5® at Callaway would be consistent with the underlying regulatory purpose.

E. Supplemental Information

For more technical details, refer to the SE associated with this exemption under ML23234A152 (Enclosure 2).

F. Environmental Considerations

As discussed in the SE associated with this exemption, 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 facility components 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 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.

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 Union Electric Company dba Ameren Missouri a one-time 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 rods clad with M5® at Callaway. As stated above, this exemption relates solely to the cladding material specified in these regulations.

Dated at Rockville, Maryland, this 5th day of October, 2023

For the Nuclear Regulatory Commission.

Bo M. Pham, Director,
Division of Operating Reactor Licensing,
Office of Nuclear Reactor Regulation.