

ENCLOSURE 2

EXEMPTION REQUEST

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In accordance with 10 CFR 50.12, "Specific exemptions," Ameren Missouri requests exemptions from the requirements specified in 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," and 10 CFR 50 Appendix K, "ECCS Evaluation Models," paragraph I.A.5, regarding the use of zircaloy or ZIRLO¹ as a fuel rod cladding material at Callaway Plant Unit 1. This request would not exempt Callaway Plant Unit 1 from any other 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.

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..."

10 CFR 50 Appendix K, Paragraph I.A.5, 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, Ill. Experimental and Theoretical Studies of the Zirconium-Water Reaction," ANL-6548, page 7, May 1962)..."

Both of these regulatory requirements, either explicitly or implicitly, state or assume that either zircaloy or ZIRLO is to be used as the fuel rod cladding material. This exemption request pertains to the proposed use of the M5² zirconium alloy for fuel rod cladding.

10 CFR 50.12 states that the Commission may grant an exemption from requirements contained in 10 CFR 50 provided that: 1) the exemption is authorized by law, 2) the exemption will not result in an undue risk to 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 requested exemption to allow the use of M5 in addition to zircaloy or ZIRLO for fuel cladding material at Callaway Plant Unit 1 satisfies these requirements as described below.

1. The requested exemption is authorized by law.

The fuel that will be irradiated at Callaway Plant Unit 1 contains cladding material that does not conform to the cladding material designations explicitly identified in 10 CFR 50.46 and 10 CFR 50, Appendix K. However, the criteria of these sections will continue to be satisfied for the operation of the Callaway Plant Unit 1 core containing M5 fuel rod cladding material. Transition to an alternate, but equivalent fuel product is not precluded by law. As stated above, 10 CFR 50.12 allows the NRC to grant exemptions from the requirements of 10 CFR 50, and

¹ ZIRLO is a registered trademark of Westinghouse Electric Co.

² M5 is a registered trademark of Framatome, Inc.

granting the proposed 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.

2. The requested exemption does not present an undue risk to the public health and safety.

The use of the M5 material as fuel rod cladding follows the NRC approved evaluation process for its implementation by the fuel vendor, as done for the zircaloy and ZIRLO fuel rod cladding, to confirm that operation of this fuel product does not increase the probability of occurrence or the consequences of an accident, and does not create any new or different type of accident that could pose a risk to public health and safety. Ameren Missouri, in conjunction with Framatome, will utilize NRC approved methods for the reload design process, for Callaway Plant Unit 1 reload cores containing M5 fuel rod cladding, to ensure safety analysis limits are met for operation within the operating limits specified in the Technical Specifications. Thus, granting of this exemption request will not present an undue risk to the public health and safety.

3. The requested exemption will not endanger the common defense and security.

The M5 fuel rod cladding is similar in design to the zircaloy fuel rod cladding material used at Callaway Plant Unit 1. The special nuclear material in this fuel product will continue to be handled and controlled in accordance with approved plant procedures. Therefore, the requested exemption for the proposed use of M5 as fuel rod cladding will not endanger the common defense and security.

4. Special circumstances are present which necessitate the request of an exemption to the regulations of 10 CFR 50.46 and 10 CFR 50 Appendix K.

The current 10 CFR 50.46 and 10 CFR 50 Appendix K regulations do not explicitly allow the use of M5 fuel rod cladding material. The chemical composition of the M5 advanced alloy differs from the specifications for either zircaloy or ZIRLO. Therefore, in the absence of the requested exemption, use of the M5 advanced alloy falls outside the language and intent of 10 CFR 50.46 and 10 CFR 50 Appendix K, Paragraph I.A.5.

The M5 advanced fuel rod cladding is designed to accommodate the high fuel rod burnups that are required for today's modern fuel management schemes and core designs. M5 is an alloy composed primarily of zirconium and niobium that has demonstrated superior corrosion resistance and reduced irradiation induced growth relative to both standard and low-tin Zircaloy. The resulting alloy microstructure is highly stable under irradiation and provides superior in-reactor performance of any zirconium alloy. These improvements permit higher burnup of the fuel in conjunction with improved thermal and mechanical performance. The M5 alloy has been tested in both reactor and non-reactor environments to determine its mechanical and structural properties as described in NRC-approved Topical Report BAW-10227-P-A (Reference 1). Topical Report BAW-10227-P-A provides assurance that predicted chemical, thermal, and mechanical characteristics of M5 alloy cladding are acceptable under

normal operation, anticipated transients, and postulated accidents. The M5 alloy is planned to be used at Callaway Plant Unit 1 for fuel rod cladding subject to the operating limits specified in the Technical Specifications and core operating limits report. When used as fuel rod cladding, the M5 alloy will provide increased performance margins with regard to fuel rod corrosion and fuel rod growth.

10 CFR 50.12 states that the Commission will not grant an exemption from requirements contained in 10 CFR 50 unless special circumstances, as defined in 10 CFR 50.12(a)(2) are present. The requested exemption meets the special requirements of 10 CFR 50.12(a)(2)(ii) that "application of the regulation ... is not necessary to achieve the underlying purpose of the rule." For the reasons described below, the use of the M5 advanced alloy as a fuel rod cladding material achieves the underlying purposes of 10 CFR 50.46 and paragraph I.A.5 of 10 CFR 50 Appendix K.

- The underlying purpose of 10 CFR 50.46 is to ensure that facilities have adequate acceptance criteria for the ECCS. Reference 1 demonstrates that the effectiveness of the ECCS will not be affected by a change from zircaloy fuel rod cladding to M5 fuel rod cladding. Analysis described in the reference also demonstrates that the ECCS acceptance criteria applied to reactors fueled with zircaloy clad fuel are also applicable to reactors fueled with M5 fuel rod cladding.

Because the underlying purpose of 10 CFR 50.46 is achieved through the use of the M5 advanced alloy as a fuel rod cladding material, special circumstances are present under 10 CFR 50.12(a)(2)(ii) for granting an exemption to 10 CFR 50.46.

- The underlying purpose of 10 CFR Appendix K, Paragraph 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. Specifically, 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. Appendix D of Reference 1 demonstrates that the Baker-Just model is conservative in all post-LOCA scenarios with respect to the use of the M5 advanced alloy as a fuel rod cladding material.

Because the underlying purpose of 10 CFR 50 Appendix K, Paragraph I.A.5 is achieved through the use of the M5 advanced alloy as a fuel rod cladding material, special circumstances are present under 10 CFR 50.12(a)(2)(ii) for granting exemptions to 10 CFR 50 Appendix K, Paragraph I.A.5.

In summary, the intent of 10 CFR 50.46 and 10 CFR 50, Appendix K will continue to be satisfied for the planned operation with M5 fuel rod cladding. Issuance of an exemption from the criteria of these regulations for the use of M5 fuel rod cladding in the Callaway Plant Unit 1 reload cores will not compromise the safe operation of the reactor. Approval of this exemption request will allow the use of M5 advanced alloy and will improve reactor performance at Callaway Plant Unit 1.

Reference:

1. BAW-10227P-A Revision 1, "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel," June 2003.