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NUCLEAR REGULATORY COMMISSION

CALVERT CLIFFS NUCLEAR POWER PLANT, LLC

CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NOS. 1 AND 2

DOCKET NOS. 50-317 AND 50-318

[NRC-2011-0004]

EXEMPTION

1.0 BACKGROUND

Calvert Cliffs Nuclear Power Plant, LLC, the licensee, is the holder of Facility Operating License Nos. DPR-53 and DPR-69 which authorizes operation of the Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2 (Calvert Cliffs). The license provides, among other things, that the facility is subject to all rules, regulations, and orders of the Nuclear Regulatory Commission (NRC, the Commission) now or hereafter in effect.

The facility consists of two pressurized-water reactors (PWRs) located in Calvert County, Maryland.

2.0 REQUEST/ACTION

Title 10 of the *Code of Federal Regulations* (10 CFR) 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," requires, among other items, that "[e]ach 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 [(LOCAs)] conforms to the criteria set forth in paragraph (b) of this section." Appendix K to 10 CFR Part 50, "ECCS Evaluation Models," requires, among other items, that the rate of energy release, hydrogen generation, and cladding oxidation from the metal/water reaction shall be calculated using the Baker-Just equation. The

regulations of 10 CFR 50.46 and 10 CFR Part 50, Appendix K, make no provisions for use of fuel rods clad in a material other than zircaloy or ZIRLO.

Calvert Cliffs intends to transition from the Westinghouse Turbo 14x14 fuel assembly design to the AREVA Advanced CE-14 HTP fuel assembly design beginning in 2011 for Unit No. 2 and 2012 for Unit No. 1. The AREVA fuel design consists of low enriched uranium oxide fuel within M5 zirconium alloy cladding. Since the chemical composition of the M5 alloy differs from the specifications for zircaloy or ZIRLO, a plant-specific exemption is required to allow the use of the M5 alloy as a cladding material or in other assembly structural components. Therefore, by letter dated November 23, 2009, the licensee requested an exemption in order to use M5 advanced alloy for fuel rod cladding and other assembly structural components at Calvert Cliffs.

3.0 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.

Authorized by Law

This exemption results in changes to the operation of the plant by allowing the use of the M5 alloy as fuel cladding material or for other assembly structural components in lieu of zircaloy or ZIRLO. As stated above, 10 CFR 50.12 allows the NRC to grant exemptions from the requirements of 10 CFR Part 50. The NRC staff has determined that granting of the licensee=s proposed exemption 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.

No Undue Risk to Public Health and Safety

The underlying purposes of 10 CFR 50.46 and 10 CFR Part 50, Appendix K, are to ensure that facilities have adequate acceptance criteria for the ECCS, and to ensure that cladding oxidation and hydrogen generation are appropriately limited during a LOCA and conservatively accounted for in the ECCS evaluation model, respectively. Topical Reports (TRs) BAW-10227(P)-A, "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel," which was approved by the NRC in February 2000, and BAW-10240(P)-A, “Incorporation of M5 Properties in Framatome ANP Approved Methods,” which was approved by the NRC in May 2004, demonstrated that the effectiveness of the ECCS will not be affected by a change from zircaloy to M5. In addition, the TRs also demonstrated that the Baker-Just equation (used in the ECCS evaluation model to determine the rate of energy release, cladding oxidation, and hydrogen generation) is conservative in all post-LOCA scenarios with respect to the use of M5 advanced alloy as a fuel rod cladding material or in other assembly structural components. Based on the above, no new accident precursors are created by using M5 advanced alloy, thus, the probability of postulated accidents is not increased. Also, based on the above, the consequences of postulated accidents are not increased. In addition, the licensee will use NRC-approved methods for the reload design process for Calvert Cliffs reloads with M5. Therefore, there is no undue risk to public health and safety due to using M5.

Consistent with Common Defense and Security

The proposed exemption results in changes to the operation of the plant by allowing the use of the M5 alloy as fuel cladding material or in other assembly structural components in lieu of zircaloy or ZIRLO. This change to the fuel material used in the plant has no relation to security issues. Therefore, the common defense and security are not impacted by this exemption request.

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 would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule. In this circumstance neither 10 CFR 50.46 nor 10 CFR Part 50, Appendix K, explicitly allows the use of M5 as a fuel rod cladding material or in use of other assembly structural components.

The underlying purpose of 10 CFR 50.46 is to ensure that facilities have adequate acceptance criteria for the ECCS. The staff's review and approval of TR BAW-10227(P)-A addressed all of the important aspects of M5 with respect to ECCS Performance Requirements: (1) applicability of 10 CFR 50.46(b) fuel acceptance criteria, (2) M5 material properties including fuel rod ballooning and rupture strains, and (3) steam oxidation kinetics and applicability of Baker-Just weight gain correlation. A subsequent NRC approved TR, BAW-10240(P)-A, further addressed M5 material properties with respect to LOCA applications.

The underlying purpose of 10 CFR Part 50, 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. 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. In TR BAW-10227(P)-A, Framatome demonstrated 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 or in other assembly structural components, and that the amount of hydrogen generated in an M5 core during a LOCA will remain within the Calvert Cliffs design basis.

The M5 alloy is a proprietary zirconium-based alloy comprised of primarily zirconium (~99 percent) and niobium (~1 percent). The elimination of tin has resulted in superior corrosion

resistance and reduced irradiation-induced growth relative to both standard zircaloy (1.7 percent tin) and low-tin zircaloy (1.2 percent tin). The addition of niobium increases ductility, which is desirable to avoid brittle failures.

The NRC staff has reviewed the licensee's advanced cladding material, M5, for PWR fuel mechanical designs as described in TR BAW-10227(P)-A. In the safety evaluation for TR BAW-10227(P)-A, the staff concluded that, to the extent specified in the staff's evaluation, the M5 properties and mechanical design methodology are acceptable for referencing in fuel reload licensing applications. Therefore, since the underlying purposes of 10 CFR 50.46 and 10 CFR Part 50, Appendix K, Paragraph I.A.5 are achieved through the use of the M5 advanced alloy as a fuel rod cladding material or in other assembly structural components, the special circumstances required by 10 CFR 50.12(a)(2)(ii) for the granting of an exemption from 10 CFR 50.46 and 10 CFR Part 50, Appendix K, exist.

Summary

The NRC staff has reviewed the licensee's request to use the M5 advanced alloy for fuel rod cladding and in other assembly structural components in lieu of zircaloy or ZIRLO. Based on the NRC staff's evaluation, as set forth above, the NRC staff concludes that the exemption is authorized by law, will not present an undue risk to public health and safety, and is consistent with the common defense and security. In addition, the NRC staff concludes that the underlying purposes of 10 CFR 50.46 and 10 CFR Part 50, Appendix K, are achieved through the use of the M5 advanced alloy. Therefore, pursuant to 10 CFR 50.12(a), the NRC staff concludes that the use of the M5 advanced alloy for fuel rod cladding and in other assembly structural components is acceptable and the exemption from 10 CFR 50.46 and 10 CFR Part 50, Appendix K, is justified.

4.0 CONCLUSION

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, and is consistent with the common defense and security. Also, special circumstances are present. Therefore, the Commission hereby grants the licensee an exemption from the requirements of 10 CFR 50.46 and 10 CFR Part 50, Appendix K, for Calvert Cliffs.

Pursuant to 10 CFR 51.32, the Commission has determined that the granting of this exemption will not have a significant impact on the quality of the human environment (76 FR 1469); published on January 10, 2011.

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 13th day of January 2011.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

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