AmerGen

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An Exelon/British Energy Company

10 CFR 50.12

MB0787

December 20, 2000

5928-00-20249

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Dear Sir/Madam:

SUBJECT: THREE MILE ISLAND, UNIT 1 (TMI UNIT 1)
OPERATING LICENSE NO. DPR-50
DOCKET NO. 50-289
REQUEST FOR EXEMPTION FROM 10 CFR 50.46,
10 CFR 50.44, AND 10 CFR 50 APPENDIX K,
REGARDING THE PROPOSED USE OF THE "M5"
ADVANCED ALLOY FOR FUEL ROD CLADDING

This letter requests an exemption from Title 10 of the Code of Federal Regulations (CFR), Section 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Nuclear Power Reactors," Section 50.44, "Standards for Combustible Gas Control System in Light-Water-Cooled Power Reactors," and associated Appendix K, "ECCS Evaluation Models." These 10 CFR Part 50 references currently presume the use of zircaloy or ZIRLO fuel rod cladding.

Pending approval of this exemption request and an associated license amendment application, TMI Unit 1 intends to use the Framatome Cogema Fuels (FCF) "M5" advanced alloy for fuel rod cladding. The M5 alloy is a proprietary zirconium-based alloy. 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 at TMI Unit 1.

The above-mentioned license amendment application, License Amendment Request (LAR) No. 301 was transmitted to the NRC by AmerGen letter dated December 20, 2000 (5928-00-20248).

Information supporting this exemption request is contained in the attachment. AmerGen has concluded that for the reasons specified in the attachment, special circumstances as defined in 10 CFR 50.12 exist and that the granting of the requested exemption will not present an undue risk to the health and safety of the public and is consistent with the common defense and security.

AmerGen intends to use the M5 alloy in TMI Unit 1 Operating Cycle 14. Fuel assemblies for Cycle 14 are presently scheduled to be delivered to TMI Unit 1 in July of 2001 and loaded into the core in September 2001. In order to allow for completion of the design and analysis activities associated with this schedule, AmerGen requests that the NRC issue the proposed exemption by April 1, 2001, in conjunction with issuance of the associated license amendment.

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It is noted that NRC has previously issued a similar exemption to the Davis-Besse Nuclear Power Station, Unit 1, dated March 15, 2000, to allow use of the FCF M5 alloy for fuel rod cladding.

If any additional information is needed, please contact David J. Distel at (610) 765-5517.

Very truly yours,

Mark E. Warner
Vice President, TMI Unit 1

MEW/djd

Attachment

cc: H. J. Miller, Administrator, USNRC Region I
T. G. Colburn, USNRC Senior Project Manager, TMI Unit 1
J. D. Orr, USNRC Senior Resident Inspector, TMI Unit 1
File No. 00097

ATTACHMENT

REQUEST FOR EXEMPTION
FROM
10 CFR 50.46, 10 CFR 50.44, AND
10 CFR PART 50 APPENDIX K PARAGRAPH I.A.5
REGARDING THE PROPOSED USE OF THE "M5" ADVANCED ALLOY
FOR FUEL ROD CLADDING

In accordance with 10 CFR 50.12, "Specific Exemptions," AmerGen Energy Company, LLC (AmerGen) requests an exemption for TMI Unit 1 from the requirements specified in 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Nuclear Power Reactors," 10 CFR 50.44, "Standards for Combustible Gas Control System in Light-Water-Cooled Power Reactors," and 10 CFR 50 Appendix K, "ECCS Evaluation Models," Paragraph I.A.5, regarding the use of zircaloy or ZIRLO as a fuel rod cladding material. This exemption request pertains to the proposed use of the M5 advanced zirconium alloy for TMI Unit 1 fuel rod cladding.

Background

10 CFR 50.46 and 10 CFR 50.44 provide various requirements for light water reactor system performance during and following a postulated loss of coolant accident (LOCA) for reactors containing oxide fuel pellets clad in either zircaloy or ZIRLO. 10 CFR 50 Appendix K, Paragraph I.A.5, requires that the Baker-Just equation be used in emergency core cooling system (ECCS) evaluation models for determining the rate of energy release, hydrogen generation, and cladding oxidation for fuel rod cladding. All three of these regulations, either implicitly or explicitly, assume that either zircaloy or ZIRLO shall be used as the fuel rod cladding material.

In order to accommodate the high fuel rod burnups that are required for today's modern fuel management schemes and core designs, Framatome developed the M5 advanced fuel rod cladding and fuel assembly structural material. M5 is an alloy comprised primarily of zirconium (~99 percent) and niobium (~1percent) that has demonstrated superior corrosion resistance and reduced irradiation induced growth relative to both standard and low-tin zircaloy.

The M5 alloy is to be used at TMI Unit 1 for fuel rod cladding, as well as for fuel assembly spacer grids, fuel rod end plugs, and fuel assembly guide and instrument tubes. Such use of the M5 alloy at TMI Unit 1 will accommodate longer fuel residence times, higher fuel burnups, and reduced reload feed batch sizes, with corresponding improvements in fuel cycle economics, all while

increasing performance margins with regard to fuel rod corrosion, fuel rod growth and fuel assembly growth. Reduced feed batch sizes will also help to reduce the spent fuel storage burden at TMI Unit 1.

The chemical composition of the M5 advanced alloy differs from the specifications for either zircaloy or ZIRLO. Therefore, absent the requested exemption, use of the M5 advanced alloy falls outside of the strict interpretation of the wording of 10 CFR 50.46, 10 CFR 50.44, and 10 CFR 50 Appendix K Paragraph I.A.5. Approval of this exemption request will allow the use of the M5 advanced alloy as a fuel rod cladding material at TMI Unit 1.

Basis for Exemption Request

10 CFR 50.12 permits the Nuclear Regulatory Commission (NRC) to grant exemptions which are authorized by law, will not present an undue risk to the public health and safety, and are consistent with the common defense and security, provided that special circumstances are present. Special circumstances are present whenever application of the regulation in the particular circumstances is not necessary to achieve the underlying purpose of the rule (50.12(a)(2)(ii)). AmerGen believes, for the reasons described below, that the use of the M5 advanced alloy as a fuel rod cladding material achieves the underlying purposes of 10 CFR 50.46, 10 CFR 50.44, and 10 CFR 50 Appendix K Paragraph I.A.5.

The underlying purpose of 10 CFR 50.46 is to ensure that facilities have adequate acceptance criteria for ECCS. Framatome Cogema Fuels (FCF) demonstrates in its topical report BAW-10227P-A, "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel" (Reference 1), submitted to the NRC for review and approval on September 30, 1997, and approved by NRC in letter dated February 4, 2000 (Reference 2), 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 Reference 1 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. Therefore, since the underlying purpose of 10 CFR 50.46 is achieved through the use of the M5 advanced alloy as a fuel rod cladding material, the special circumstances required by 10 CFR 50.12(a)(2)(ii) for the granting of an exemption to 10 CFR 50.46 do exist.

The underlying purposes of 10 CFR 50.44 and 10 CFR 50 Appendix K Paragraph I.A.5 are 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. FCF demonstrates, in Appendix D of Reference 1, 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, and that the amount of hydrogen generated in an M5-clad core during a LOCA will remain within the design basis. Therefore, since the underlying purposes of 10 CFR 50.44 and 10 CFR 50 Appendix K Paragraph I.A.5 are achieved through the use of the M5 advanced alloy as a fuel rod cladding material, the special circumstances required by 10 CFR 50.12(a)(2)(ii) for the granting of exemptions to 10 CFR 50.44 and 10 CFR 50 Appendix K Paragraph I.A.5 do exist.

Conclusions

Based on the above, the underlying purposes of 10 CFR 50.46, 10 CFR 50.44, and 10 CFR 50 Appendix K Paragraph I.A.5, which are to provide adequate acceptance criteria for ECCS and to ensure that cladding oxidation and hydrogen generation are appropriately limited and accounted for during LOCA evaluation, are accomplished through the use of the M5 advanced alloy as a fuel rod cladding material.

The granting of this exemption request would have no impact on plant radiological effluents, non-radiological effluents or radiation exposure.

Because these underlying purposes have been preserved, AmerGen concludes that the proposed exemption does not present an undue risk to the public health and safety and is consistent with the common defense and security.

Reference

1. Framatome Cogema Fuels (FCF) Topical Report BAW-10227P-A, "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel," February, 2000.

2. USNRC Letter to Framatome Cogema Fuels, dated February 4, 2000, Revised Safety Evaluation (SE) For Topical Report BAW-10227P: "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel."