AmerGen

AmerGen Energy Company, LLC
Three Mile Island Unit 1
Route 441 South, P.O. Box 480
Middletown, PA 17057

Telephone: 717-944-7621

An Exelon/British Energy Company

10CFR50.90

December 20, 2000

5928-00-20248

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

Dear Sir or Madam:

SUBJECT: THREE MILE ISLAND, UNIT 1 (TMI UNIT 1)
OPERATING LICENSE NO. DPR-50
DOCKET NO. 50-289
LICENSE AMENDMENT REQUEST NO. 301 -
USE OF "M5" ADVANCED ALLOY

In accordance with 10 CFR 50.4 (b)(1), enclosed is License Amendment Request No. 301.

The purpose of this License Amendment Request is to revise the TMI Unit 1 Technical Specifications to permit use of the Framatome Cogema Fuels (FCF) "M5" advanced alloy for fuel rod cladding and fuel assembly spacer grids. The M5 alloy is a proprietary zirconium-based alloy which provides for improvements in fuel cladding corrosion, hydrogen pickup, fuel assembly growth, fuel rod growth and fuel rod cladding creep relative to the zircaloy cladding currently in use at TMI Unit 1.

Limited use of the M5 alloy in demonstration assemblies at TMI Unit 1 was previously approved by NRC in Amendment No. 194, dated July 24, 1995. NRC has since reviewed and approved the FCF Topical Report BAW-10227P-A: "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel" for referencing in license applications as documented in NRC letter to FCF dated February 4, 2000.

AmerGen intends to use the M5 alloy in 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. Use of the M5 alloy will accommodate reduced reload feed batch sizes while increasing performance margins with regard to fuel rod corrosion, fuel rod growth and fuel assembly growth. AmerGen requests that this license amendment application be approved by April 1, 2001 to support Cycle 14 core design analysis and reload report finalization.

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It is noted that Title 10 of the Code of Federal Regulations (CFR), Section 50.44, "Standards for Combustible Gas Control System in Light-Water-Cooled Power Reactors," Section 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Nuclear Power Reactors," and associated Appendix K, "ECCS Evaluation Models," presume the use of zircaloy or ZIRLO cladding. Since the chemical composition of the M5 alloy differs from the specification for zircaloy or ZIRLO, a plant-specific exemption will be required, in addition to this License Amendment, to allow the use of M5 alloy as a cladding material at TMI Unit 1. The associated exemption request is being transmitted to the NRC by separate letter (5928-00-20249).

It is noted that NRC has previously issued a similar amendment to the Davis-Besse Nuclear Power Station, Unit 1 (Amendment No. 239, dated March 15, 2000) to allow use of the FCF M5 alloy for fuel rod cladding and fuel assembly spacer grids.

Using the standards in 10 CFR 50.92, AmerGen has concluded that these proposed changes do not constitute a significant hazards consideration, as described in the enclosed analysis performed in accordance with 10 CFR 50.91 (a)(1). Pursuant to 10 CFR 50.91 (b)(1), a copy of this License Amendment Request is provided to the designated official of the Commonwealth of Pennsylvania, Bureau of Radiation Protection, as well as the chief executives of the township and county in which the facility is located.

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

Enclosures: 1) Safety Evaluation and No Significant Hazards Consideration
2) Affected TMI Unit 1 Technical Specification Pages

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
Director, Bureau of Radiation Protection - PA Department of Environmental Resources
Chairman, Board of County Commissioners of Dauphin County
Chairman, Board of Supervisors of Londonderry Township

AMERGEN ENERGY COMPANY, LLC

THREE MILE ISLAND NUCLEAR STATION, UNIT 1

Operating License No. DPR-50
Docket No. 50-289
License Amendment Request No. 301

COMMONWEALTH OF PENNSYLVANIA)
) SS:
COUNTY OF DAUPHIN)

This License Amendment Request is submitted in support of Licensee's request to change the Technical Specifications for Three Mile Island Nuclear Station, Unit 1. As a part of this request, proposed marked up pages for the TMI Unit 1 Technical Specifications are also included. All statements contained in this submittal have been reviewed, and all such statements made and matters set forth therein are true and correct to the best of my knowledge.

AmerGen Energy Company, LLC

By: Mark E Warner
Vice President, TMI Unit 1

Sworn and Subscribed to before me

this 30th 4th day of December 2000.

Suzanne C Miklosik
Notary Public

Notarial Seal
Suzanne C. Miklosik, Notary Public
Londonderry Twp., Dauphin County
My Commission Expires Nov. 22, 2003
Member, Pennsylvania Association of Notaries

ENCLOSURE 1

TMI Unit 1 License Amendment Request No. 301

Safety Evaluation and No Significant Hazards Consideration

I. License Amendment Request No. 301

AmerGen Energy Company, LLC (AmerGen) requests that the following changed replacement pages be inserted into the existing Technical Specification:

Revised Technical Specification pages: 2-1 and 5-4

Marked up pages showing the requested changes are provided in Enclosure 2.

II. Reason for Change

The purpose of this License Amendment Request is to revise the TMI Unit 1 Technical Specification Section 5.3.1.1 to permit the use of the Framatome Cogema Fuels (FCF) "M5" advanced alloy for fuel rod cladding and fuel assembly spacer grids. Limited use of the M5 and M4 alloy demonstration assemblies at TMI Unit 1 was previously approved by the NRC in Amendment No. 194, dated July 24, 1995. This proposed revision removes the M4 alloy provision and is intended to authorize use of the M5 alloy beyond the previously approved demonstration assemblies to full core design application for TMI Unit 1. The M4 alloy will not be used in the TMI Unit 1 core design after Cycle 13. The TMI Unit 1 Technical Specification Section 2.1 Bases is also revised to identify that the current BWC critical heat flux (CHF) correlation applies to Mark-B fuel with zircaloy or M5 intermediate spacer grids (non-mixing vane), and that the current BAW-2 CHF correlation applies to Mark-B fuel with inconel intermediate spacer grids.

AmerGen intends to use the M5 alloy in 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 of 2001. Use of the M5 alloy will result in reduced reload feed batch sizes while increasing performance margins with regard to fuel rod corrosion, fuel rod growth and fuel assembly growth.

Use of the M5 alloy at TMI Unit 1 is in accordance with the provisions of FCF Topical Report BAW - 10227P-A: "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel," which was reviewed and approved by the NRC for referencing in license applications as documented in NRC letter to FCF dated February 4, 2000.

III. Safety Evaluation Justifying Change

The proposed change revises TMI Unit 1 Technical Specification Section 5.3.1.1 (Design Features Reactor, Reactor Core) and Technical Specification Bases Section 2.1 (Safety Limits, Reactor Core - Bases) to permit the use of the FCF M5 advanced alloy as a suitable material for fuel rod cladding and fuel assembly spacer grids. The M5 alloy will also be used for fuel rod end plugs and fuel assembly guide tubes and instrument tubes. Currently, the Technical Specifications only permit the limited use of M4 or M5 alloy in demonstration assemblies, or use of zircaloy or Zirlo for such components. Use of M4 or M5 alloy in demonstration assemblies at TMI Unit 1 was previously approved by NRC in Amendment No. 194, dated July 24, 1995. The proposed change removes the M4 alloy provision since it will not be used in the TMI Unit 1 core design after Cycle 13. The proposed change is intended to authorize use of the M5 alloy beyond the previously approved demonstration assemblies to full core design application for TMI Unit 1.

Use of the M5 alloy, with its enhanced corrosion resistance and reduced growth rate, will accommodate longer fuel residence times, higher fuel burnups, and reduced reload feed batch sizes, with corresponding improvements in fuel cycle economics. Reduced feed batch sizes will also help to reduce the spent fuel storage burden at TMI Unit 1. The only systems or components affected by this proposed change are the reactor core and the nuclear fuel.

The M5 alloy is an FCF proprietary material comprised primarily of zirconium (~99 percent) and niobium (~1 percent). This composition provides for improvements in fuel cladding corrosion, hydrogen pickup, fuel assembly growth, fuel rod growth and fuel rod cladding creep relative to the Zircaloy-4 cladding currently in use at TMI Unit 1. The M5 alloy has been tested in both reactor and non-reactor environments to ascertain its mechanical and structural properties, as described in FCF Topical Report BAW-10227P-A. Use of the M5 alloy at TMI Unit 1 is in accordance with the provisions and limitations of FCF Topical Report BAW-10227P-A: "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel," as reviewed and approved by NRC for referencing in license applications, documented in NRC letter and Safety Evaluation Report to FCF dated February 4, 2000.

Reduced fuel rod growth performance will help alleviate the susceptibility to fuel assembly bowing which has contributed to control rod insertion problems as the fuel assembly is irradiated.

FCF Topical Report BAW-10227P-A demonstrates acceptable performance of the M5 alloy material properties and FCF correlations to model material property changes up to currently approved burnup levels and demonstrates the applicability of FCF analysis methods, analyses and design criteria for the M5 alloy with respect to fuel system damage mechanisms, fuel rod failure mechanisms and fuel coolability up to currently approved burnup levels.

As described in FCF Topical Report BAW-10227P-A, generic LOCA analyses using M5-specific material properties have demonstrated that the LOCA acceptance criteria of 10CFR50.46 are readily met in cores using M5 cladding; that the use of M5 cladding will not require any reductions in LOCA linear heat rate limits in a core mixed with M5 and Zircaloy-4 clad assemblies; and that there are no adverse LOCA related issues that would prevent the acceptable use of M5 cladding. A plant-specific LOCA reanalysis will be performed for TMI Unit 1 prior to the use of the M5 alloy in fuel assemblies in batch quantities, and the results of that analysis will be documented in the cycle-specific reload report associated with the first M5 fuel batch supporting the TMI Unit 1 Core Operating Limits Report.

Also, as described in FCF Topical Report BAW-10227P-A, for other design basis accidents which result in radionuclide release, the use of M5 cladding and structural components will have no adverse impact on radiological doses. This is due to the similar material properties and similar DNB performance of both M5 and Zircaloy-4 during these accident scenarios.

NRC Safety Evaluation Report dated February 4, 2000, identifies that the FCF Topical Report BAW-10227P-A is approved for fuel reload licensing applications up to rod average burnup levels of 62,000 MWd/MTU for Mark B fuel designs. It is noted that a separate amendment request is being submitted to authorize use of four (4) existing fuel rods with M5 cladding beyond 62,000 MWd/MTU as a lead test assembly (LTA) for TMI Unit 1 Cycle 14.

Therefore, the proposed change in the TMI Unit 1 Technical Specifications to allow use of the M5 alloy does not adversely affect nuclear safety or safe plant operation.

IV. No Significant Hazards Consideration

AmerGen has determined that this License Amendment Request poses no significant hazards considerations as defined by 10 CFR 50.92.

1. Operation of the facility in accordance with the proposed amendment would not involve a significant increase in the probability of occurrence or the consequences of an accident previously evaluated. It has been demonstrated that the material properties of the M5 alloy are not significantly different from those of Zircaloy-4. Further, there are no evaluated accidents in which the fuel cladding or fuel assembly structural components are assumed to arbitrarily fail as an accident initiator. The fuel handling accident assumes that the cladding does, in fact, fail as a result of an undefined fuel handling event. However, the probability of that undefined initiating event is independent of the properties of the fuel rod cladding. Additionally, in both LOCA and non-LOCA accident scenarios, there will be no significant increase in cladding failure or fission product release, since it has been demonstrated that the material properties of the M5 alloy are not significantly different from those of Zircaloy-4. Therefore, this activity does not involve a significant increase in the probability of occurrence or the consequences of an accident previously evaluated.

2. Operation of the facility in accordance with the proposed amendment would not create the possibility of a new or different kind of accident from any previously evaluated. It has been demonstrated that the material properties of the M5 alloy are not significantly different from those of Zircaloy-4. Therefore, M5 fuel cladding and the fuel assembly structural components will perform similarly to those fabricated from Zircaloy-4, thus, precluding the possibility of the fuel becoming an accident initiator. Therefore, this activity does not create the possibility of a new or different kind of accident from any previously evaluated.

3. Operation of the facility in accordance with the proposed amendment would not involve a significant reduction in a margin of safety. The material properties of the M5 alloy are not significantly different from those of Zircaloy-4 for all normal operating and accident scenarios, including both LOCA and non-LOCA scenarios. Plant-specific LOCA reanalysis performed prior to use of the M5 alloy in fuel assemblies in batch quantities, and documented in the cycle-specific reload report, will either demonstrate that all current, applicable, and appropriate margins of safety will be maintained during the use of the M5 alloy or their results will be submitted for NRC review and approval prior to use of the M5 alloy. Therefore, this activity does not involve a significant reduction in a margin of safety.

V. Implementation

AmerGen requests that the amendment authorizing this change become effective immediately upon issuance, to be fully implemented no later than startup of Cycle 14, approximately October 1, 2001.

ENCLOSURE 2

Affected TMI Unit 1 Technical Specification Pages

CONTROLLED COPY

2. SAFETY LIMITS AND LIMITING SAFETY SYSTEM SETTINGS

2.1 SAFETY LIMITS, REACTOR CORE

Applicability

Applies to reactor thermal power, axial power imbalance, reactor coolant system pressure, coolant temperature, and coolant flow during power operation of the plant.

Objective

To maintain the integrity of the fuel cladding.

Specification

2.1.1 The combination of the reactor system pressure and coolant temperature shall not exceed the safety limit as defined by the locus of points established in Figure 2.1-1. If the actual pressure/temperature point is below and to the right of the line, the safety limit is exceeded.

2.1.2 The combination of reactor thermal power and axial power imbalance (power in the top half of core minus the power in the bottom half of the core expressed as a percentage of the rated power) shall not exceed the protective limit as defined by the locus of points (solid line) for the specified flow set forth in the Axial Power Imbalance Protective Limits given in the Core Operating Limits Report (COLR). If the actual-reactor-thermal-power/axial-power-imbalance point is above the line for the specified flow, the protective limit is exceeded.

Bases

To maintain the integrity of the fuel cladding and to prevent fission product release, it is necessary to prevent overheating of the cladding under normal operating conditions. This is accomplished by operating within the nucleate boiling regime of heat transfer, wherein the heat transfer coefficient is large enough so that the clad surface temperature is only slightly greater than the coolant temperature. The upper boundary of the nucleate boiling regime is termed, departure from nucleate boiling (DNB). At this point there is a sharp reduction of the heat transfer coefficient, which could result in excessive cladding temperature and the possibility of cladding failure. Although DNB is not an observable parameter during reactor operation, the observable parameters of neutron power, reactor coolant flow, temperature, and pressure can be related to DNB through the use of a critical heat flux (CHF) correlation. The BAW-2 (Reference 1) and BWC (Reference 2) correlations have been developed to predict DNB and the location of DNB for axially uniform and non-uniform heat flux distributions. The BAW-2 correlation applies to Mark-B fuel [with inconel intermediate spacer grids] and the BWC correlation applies to ~~Mark-BZ type fuel~~ [Mark-B fuel with zircaloy or M5 intermediate spacer grids (non-mixing vane).] The local DNB ratio (DNBR), defined as the ratio of the heat flux that would cause DNB at a particular core location to the actual heat flux, is indicative of the margin to DNB. The minimum value of the DNBR, during steady-state operation, normal

5.3 REACTOR

Applicability

Applies to the design features of the reactor core and reactor coolant system.

Objective

To define the significant design features of the reactor core and reactor coolant system.

Specification

5.3.1 REACTOR CORE

5.3.1.1 A fuel assembly normally contains 208 fuel rods arranged in a 15 by 15 lattice. The reactor shall contain 177 fuel assemblies. Fuel rods shall be clad with zircaloy, ZIRLO, or ~~BWFC~~ zirconium-based ~~M5~~ M5 alloy materials and contain an initial composition of natural or slightly enriched uranium dioxide as fuel material. Limited substitutions of zirconium alloy or stainless steel filler rods for fuel rods, in accordance with NRC-approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff-approved codes and methods, and shown by tests or analyses to comply with all fuel safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in non-limiting core regions. The details of the fuel assembly design are described in TMI-1 UFSAR Chapter 3.

5.3.1.2 The reactor core shall approximate a right circular cylinder with an equivalent diameter of 128.9 inches. The active fuel height is defined in TMI-1 UFSAR Chapter 3.

5.3.1.3 The core average and individual batch enrichments for the present cycle are described in TMI-1 UFSAR Chapter 3.

5.3.1.4 The control rod assemblies (CRA) and axial power shaping rod assemblies (APSRA) are distributed in the reactor core as shown in TMI-1 FSAR Chapter 3. The CRA and APSRA design data are also described in the UFSAR.

5.3.1.5 The TMI-1 core may contain burnable poison rod assemblies (BPRA) and gadolinia-urania integral burnable poison fuel pellets as described in TMI-1 UFSAR Chapter 3.

5.3.1.6 Reload fuel assemblies and rods shall conform to design and evaluation data described in the UFSAR. Enrichment shall not exceed a nominal 5.0 weight percent of U_{235}.

5.3.2 REACTOR COOLANT SYSTEM

5.3.2.1 The reactor coolant system shall be designed and constructed in accordance with code requirements. (Refer to UFSAR Chapter 4 for details of design and operation.)