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GNRO-2007/00004

January 18, 2007

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

SUBJECT: License Amendment Request
Request for a Technical Specification Change to Allow Use of Control Rod Assemblies With Different Control Material
Grand Gulf Nuclear Station, Unit 1
Docket No. 50-416
License No. NPF-29

References:

1. Letter from NRC to Frank Spangenberg, Clinton Power Station, License Amendment 75, Amendment Modifies Clinton Power Station TS Revising Specification 5.3.1, Fuel Assemblies, May 25, 1993 (ML020990472)

2. Letter from NRC to Michael D. Lyster, Perry, Unit 1, License Amendment 40, Revises TS Section 5.3.2 to Allow Use of Control Rod Designs Employing Hafnium Metal as a Neutron Absorbing Material, March 11, 1992 (ML021820557)

Dear Sir or Madam:

Pursuant to 10 CFR 50.90, Entergy Operations, Inc. (Entergy) hereby requests the following amendment to the Grand Gulf Nuclear Station, Unit 1 (GGNS) Operating License pursuant to 10 CFR 50.91(a)(6).

The proposed change will update the description of GGNS Technical Specification (TS) 4.2.2 "Control Rod Assemblies," to allow the use of hafnium as an additional type of control material. The proposed change provides for the use of NRC approved reactor control rod assemblies containing boron carbide, hafnium or both. The change is consistent with NUREG-1434 Revision 3, Standard Technical Specifications for General Electric BWR/6 Plants, for control rod assemblies. In addition, the NRC has approved similar TS changes for other nuclear power plants, including the BWR/6 units at Clinton (Reference 1) and Perry (Reference 2).

The proposed change has been evaluated in accordance with 10 CFR 50.91(a)(1) using criteria in 10 CFR 50.92(c) and it has been determined that this change involves no significant hazards consideration. The bases for these determinations are included in the attached submittal.

There are no commitments associated with this license amendment request.

Entergy requests approval of the proposed amendment by March 5, 2007 to support implementation during the upcoming Spring GGNS refueling outage. Once approved, the amendment shall be implemented within 30 days.

If you have any questions or require additional information, please contact Matt Crawford at 601-437-2334.

I declare under penalty of perjury that the foregoing is true and correct. Executed on January 18, 2007.

Sincerely,

WRB/MLC/amt

Attachments:
1. Analysis of Proposed Technical Specification Change
2. Proposed Technical Specification Changes (mark-up)

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Attachment 1

GNRO-2007/00004

Analysis of Proposed Technical Specification Change

1.0 DESCRIPTION

This letter is a request to amend Operating License NPF-29 for Grand Gulf Nuclear Station, Unit 1 (GGNS).

The proposed change will revise the description of GGNS Technical Specification (TS) 4.2.2 "Control Rod Assemblies," to allow to the use of hafnium as an additional type of control material. The proposed change provides for the use of NRC approved reactor control rod assemblies containing boron carbide, hafnium or both. The amendment is being pursued on an expeditious basis to support implementation during the upcoming Spring GGNS refueling outage. The change is consistent with the specification for control rod assemblies in NUREG-1434 Revision 3, Standard Technical Specification for General Electric BWR-6 Plants.

2.0 PROPOSED CHANGE

The proposed change will add hafnium as an acceptable neutron absorber material in GGNS TS 4.2.2 "Control Rod Assemblies." The current TS only address boron carbide as a control material in the assemblies. New control rod designs have been introduced, reviewed and accepted by the NRC, and are in use at many operating nuclear facilities. The new control rod assembly design proposed for use at GGNS includes hafnium as a control material. Thus, necessitating a revision to the TS as follows:

> *4.2.2 Control Rod Assemblies*
> *The reactor core shall contain 193 cruciform shaped control rod assemblies. The control material shall be boron carbide or hafnium metal, or both.*

In summary, this change will allow GGNS to install control rod assemblies that contain hafnium metal in addition to boron carbide.

3.0 BACKGROUND

The current control rod assemblies are described in the GGNS UFSAR Section 4.2.2.4, Reactivity Control Assembly. The control rods in the GGNS reactor perform the dual function of power shaping and reactivity control. Power distribution in the core is controlled during operation of the reactor by manipulating selected patterns of control rods. Control rod displacement tends to counterbalance steam void effects at the top of the core and results in significant power flattening.

The current GGNS control rod design consists of a sheathed cruciform with four blades. Each blade of the cruciform consists of a U-shaped sheath that contained 18 to 21 cylindrical absorber tubes of high-purity Type 304 stainless steel filled with compacted B_4C powder. The U-shaped sheaths are welded to a center post, a handle, and castings, to form the housing for the B_4C-filled absorber rods. The B_4C is hermetically sealed in the cylindrical absorber tube by plugs welded into each end to contain both the B_4C and the helium gas produced during irradiation. The control rods are cooled by the core bypass flow. The U-shaped sheaths are perforated to allow the coolant to circulate freely about the absorber tubes. Four fuel assemblies surround each control rod.

The General Electric Company (GE) submitted to the NRC a topical report entitled "GE Marathon Control Rod Assembly," NEDE–31758P-A (Reference 1) and obtained approval. This report presents the information required to support the licensing basis for the implementation of the GE Marathon control rod assembly in GE boiling water reactor (BWR) cores. This new control rod assembly has been designed to be compatible with and a replacement for any of the current control rod assemblies in the BWR/6 S lattice core configurations. The Marathon control rod assembly has a higher worth and a higher boron-10 capture (burnup) level than previous designs.

The primary difference between the Marathon control rod and the previously approved designs is the use of externally square absorber tubes that are welded full length to each other to form the four wings of the Marathon control rod. Each wing is comprised of either 14 or 17 absorber tubes with each tube sized to hold the helium released from the B_4C. The four wings of 14 or 17 absorber tubes are welded to the tie rod to form the cruciform-shaped member of the control rod.

The square absorber tubes are circular inside and are loaded with either B_4C in thin-walled capsules or hafnium metal rods of varying lengths. The square absorber tubes that contain B_4C capsules are also loaded with empty capsules to accommodate the helium release from the B_4C. The square absorber tubes are made with a high-purity RAD RESIST 304S stainless-steel material that is similar to the material used in current GE designs except that two alloying components, Niobium and Tantalum, are added to provide additional resistance to irradiation-assisted corrosion cracking. B_4C powder is compacted into thin-walled, stainless-steel capsules with stainless-steel end caps to prevent B_4C migration but to allow helium release from the capsule into the absorber tube. The B_4C capsules have been sized to allow for B_4C swelling in the square absorber tube to prevent excessive absorber tube strains.

4.0 TECHNICAL ANALYSIS

Entergy plans to replace eight control rods at GGNS during the upcoming spring refueling outage. GGNS intends to use the GE Marathon control rod design, which incorporates many enhancements. The new rods will be interchangeable with the existing control assemblies and compatible with the existing hardware. The use of the Marathon control rods has been reviewed and approved by the NRC Staff as documented in Reference 1.

GGNS TS 4.2.2 states that the neutron absorber or control material for the 193 cruciform-shaped control rods is composed of boron carbide. The lack of a reference to other neutron absorbing materials precludes the use of control rods having designs utilizing a different composition of control materials, such as hafnium metal. The ability to utilize different control rod designs containing hafnium would be beneficial in that longer control rod lifetimes could be achieved, thus resulting in a smaller number of control rods having to be replaced over the life of the plant. This change would reduce the amount of radioactive waste handling required, as well as reduce the overall volume of radioactive waste being generated, stored on-site, and ultimately shipped off-site for disposal. Also, the amount of fuel movement and core component handling associated with blade replacement activities will be reduced, resulting in an overall improvement in refuel outage safety.

In order to make use of the new control rod designs being offered by GE, Entergy proposes that GGNS TS 4.2.2 be modified to add hafnium as an absorber material.

The NRC approved GE Marathon design control rod is based on a high-purity, low-cobalt hollow stainless steel tube with a square outer envelope. Tubes are mated edge-to-edge vertically and laser welded to form the control rod's cruciform shape. Within these stainless steel tubes are placed either B_4C capsules or, at the outer 2 or 3 edge rows of each blade wing, hafnium rodlets.

Marathon control rod's structural design improvements reduce both the surface area and volume of stainless steel in the irradiation zone (the reason for the elimination of the sheath). Two additional alloy components, Niobium and Tantalum, permit the reduction of cobalt and provide a stainless steel that is less susceptible to radiation induced cracking. This reduced volume of stainless steel, combined with the use of low-cobalt, radiation resistant stainless steel reduces the amount of cobalt 60 released to the coolant and therefore reduces radiation levels in plant piping systems. As indicated previously, the longer control rod life reduces the number of rods which must be replaced and disposed.

The use of control rods containing hafnium does not significantly change the neutronic or mechanical characteristics of the control rod. The primary reason for choosing hafnium as a partial substitute for boron carbide is that the reactivity life of the hafnium is longer than boron carbide as it transmutes to other high absorption cross section isotopes, leading to longer blade life.

The proposed Technical Specification change will not modify the existing requirement to have 193 cruciform-shaped control rods installed in the core as described within the Design Features Section (TS 4.2.2), nor does it affect any of the other Technical Specifications associated with the control rods. For example, the required control rod scram insertion times will be unchanged and must still be met for any control rod to be considered operable.

5.0 REGULATORY ANALYSIS

5.1 Applicable Regulatory Requirements/Criteria

The proposed changes have been evaluated to determine whether applicable regulations and requirements continue to be met. The changes will maintain compliance with 10 CFR 50 Appendix A, General Design Criteria (GDC) 25, 26, 27, 28 and 29. Entergy has determined that the proposed changes do not require any exemptions or relief from regulatory requirements, other than the TS, and do not affect conformance with any GDC described in the Updated Final Safety Analysis Report (UFSAR.)

5.2 No Significant Hazards Consideration

Entergy Operations, Inc. (Entergy) has evaluated whether or not a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of Amendment," as discussed below:

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No.

   The NRC has specifically approved the use of hafnium as neutron absorbing material for use in BWR control rod assemblies. The use of hafnium in control rods as a neutron absorber material does not significantly alter the neutronic or mechanical functional characteristics of the control rods. Control rod designs using hafnium have been successfully used in other BWRs. Since control rods that utilize hafnium have a longer lifetime, the probability of some accidents involving the handling, on-site storage, and shipping of irradiated rods will actually be reduced. The proposed change does not alter the required number of control rods nor does it affect any of the specifications related to the control rods (e.g., the shutdown margin and scram timing requirements are unaffected).

   Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No.

   The application of a control rod design using hafnium as an absorber material does not produce any new mode of plant operation or alter the control rods in such a way as to affect their function or operability since the new control rods are designed to be compatible with the existing control rods.

   Therefore, the proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. Does the proposed change involve a significant reduction in a margin of safety?

   Response: No.

   The proposed change does not significantly affect the neutronic or mechanical characteristics of the control rods since the hafnium containing controls rods are designed to be compatible with the existing design and reload licensing criteria; therefore, there is no significant change in the margin of safety. It does not change the required number of existing control rods. It does not affect the existing Technical Specifications related to control rods (e.g., required shutdown margin and scram time, etc.).

   Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above, Entergy concludes that the proposed amendment presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

5.3 Environmental Considerations

The proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

6.0 PRECEDENCE

There is precedence for requesting changes to the description of control rod assemblies to address the use of hafnium as a neutron absorber material at nuclear power plants. Refer to the approved amendment packages provided in References 2, 3, 4 and 5 below. The change is consistent with NUREG-1434 Revision 3, Standard Technical Specifications for General Electric BWR/6 Plants, for control rod assemblies.

This amendment request will provide for the use of hafnium in the GGNS reactor control rod assemblies in a similar manner to those BWRs referenced below.

7.0 REFERENCES

1. GE Topical Report, NEDE-31758P-A, "GE Marathon Control Rod Assembly," October 1991.

2. Letter from NRC to William S. Orser, Fermi-2, License Amendment 66, Revises TS Description of Control Rod Assembly to Address the Use of Hafnium as a Neutron Absorber Material Amendment, April 11, 1991, (ML020720221).

3. Letter from NRC to Frank Spangenberg, Clinton Power Station, License Amendment 75, Amendment Modifies Clinton Power Station TS Revising Specification 5.3.1, Fuel Assemblies, May 25,1993, (ML020990472).

4. Letter from NRC to Michael D. Lyster, Perry, Unit 1, License Amendment 40, Revises TS Section 5.3.2 to Allow Use of Control Rod Designs Employing Hafnium Metal as a Neutron Absorbing Material, March 11, 1992, (ML021820557).

5. Letter from NRC to James M. Lydon, Pilgrim Nuclear Station, Issuance of Amendment 98, Regarding Hybrid Control Rod Blades, February 27, 1987, (ML011920446).

Attachment 2

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Proposed Technical Specification Changes (mark-up)

4.0 DESIGN FEATURES

4.1 Site Location

The site for Grand Gulf Nuclear Station is located in Claiborne County, Mississippi on the east bank of the Mississippi River, approximately 25 miles south of Vicksburg and 37 miles north-northeast of Natchez. The exclusion area boundary shall have a radius of 696 meters from the centerline of the reactor.

4.2 Reactor Core

4.2.1 Fuel Assemblies

The reactor shall contain 800 fuel assemblies. Each assembly shall consist of a matrix of Zircaloy or ZIRLO clad fuel rods with an initial composition of natural or slightly enriched uranium dioxide (UO_2) as fuel material, and water rods. Limited substitutions of zirconium alloy or stainless steel filler rods for fuel rods, in accordance with 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 safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions.

4.2.2 Control Rod Assemblies

The reactor core shall contain 193 cruciform shaped control rod assemblies. The control material shall be boron carbide or hafnium metal, or both

4.3 Fuel Storage

4.3.1 Criticality

4.3.1.1 The spent fuel storage racks are designed and shall be maintained with:

a. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 9.1.2 of the UFSAR;

b. A nominal fuel assembly center to center storage spacing of 6.26 inches in the storage racks.

(continued)

(b) SERI is required to notify the NRC in writing prior to any change in (i) the terms or conditions of any new or existing sale or lease agreements executed as part of the above authorized financial transactions, (ii) the GGNS Unit 1 operating agreement, (iii) the existing property insurance coverage for GGNS Unit 1 that would materially alter the representations and conditions set forth in the Staff's Safety Evaluation Report dated December 19, 1988 attached to Amendment No. 54. In addition, SERI is required to notify the NRC of any action by a lessor or other successor in interest to SERI that may have an effect on the operation of the facility.

C. The license shall be deemed to contain and is subject to the conditions specified in the Commission's regulations set forth in 10CFR Chapter I and is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Maximum Power Level

Entergy Operations, Inc. is authorized to operate the facility at reactor core power levels not in excess of 3898 megawatts thermal (100 percent power) in accordance with the conditions specified herein.

(2) Technical Specifications

The Technical Specifications contained in Appendix A and the Environmental Protection Plan contained in Appendix B, as revised through Amendment No. ~~169~~ are hereby incorporated into this license. Entergy Operations, Inc. shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

Insert New Amendment No.

The Surveillance Requirements (SRs) for Diesel Generator 12 contained in the Technical Specifications and listed below, are not required to be performed immediately upon implementation of Amendment No. 169. The SRs listed below shall be successfully demonstrated at the next regularly scheduled performance.

SR 3.8.1.9,
SR 3.8.1.10, and
SR 3.8.1.14