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GNRO-2011/00076

September 9, 2011

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

SUBJECT: License Amendment Request  
Criticality Safety Analysis and Technical Specification 4.3.1, *Criticality*  
Grand Gulf Nuclear Station, Unit 1  
Docket No. 50-416  
License No. NPF-29

Dear Sir or Madam:

Pursuant to 10 CFR 50.90, Entergy Operations, Inc. (Entergy) hereby requests approval of an amendment to the Grand Gulf Nuclear Station, Unit 1 (GGNS) Operating License (OL) and Technical Specifications (TS). The proposed amendment includes: 1) a revision to the criticality safety analysis (CSA) for the spent fuel and new fuel storage racks; 2) additional requirements for the spent fuel and new fuel storage racks in TS 4.3.1, *Criticality*; and 3) deletion of the spent fuel pool loading criteria OL condition.

The proposed changes have been evaluated in accordance with 10 CFR 50.91(a)(1) using the 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.

This letter does not contain any new commitments.

Entergy requests approval of the proposed amendment by September 30, 2012. Once approved, the amendment will be implemented within 90 days. Although this request is neither exigent nor emergency, your prompt review is requested.

If you have any questions or require additional information, please contact Jerry Burford at 601-368-5755.

I declare under penalty of perjury that the foregoing is true and correct. Executed on September 9, 2011.

Sincerely,

A handwritten signature in black ink that reads "M. A. Krupa". The signature is written in a cursive style with a large, prominent "M" and "K".

MAK/FGB/dm

Attachments:

1. Analysis of Proposed Operating License and Technical Specification Changes
2. Proposed Operating License and Technical Specification Changes (Mark-up)

cc: Mr. Elmo E. Collins, Jr.  
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NRC Senior Resident Inspector  
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**Attachment 1**

**GNRO-2011/00076**

**Grand Gulf Nuclear Station, Unit 1**

**Analysis of Proposed Operating License and Technical Specification Changes**

## 1.0 DESCRIPTION

Entergy Operations, Inc. (Entergy) requests an amendment to the Grand Gulf Nuclear Station, Unit 1 (GGNS) Operating License (OL) (NPF-29). The proposed change includes:

- a revision to the criticality safety analysis (CSA) for the spent and new fuel storage racks;
- a change to Technical Specification (TS) 4.3.1, *Criticality*; and
- deletion of the OL condition related to the loading criteria in the spent fuel pool.

## 2.0 PROPOSED CHANGE

The proposed change requests the continuing review of the CSA and the proposed TS change along with the deletion of the OL condition related to the loading criteria in the spent fuel pool. A markup of the OL condition and TS changes is provided in Attachment 2.

### 2.1 Criticality Safety Analysis

The proposed CSA was initially provided by letter dated November 23, 2010 (GNRO-2010/00073, NRC ADAMS Accession Nos. ML103330092 and ML103330093) as part of the Extended Power Uprate (EPU) license amendment request (LAR) acceptance review and is not provided again in this letter. Entergy requests that the review of the CSA that commenced with its initial submittal be continued. See discussion in the Section 3.0 for more details.

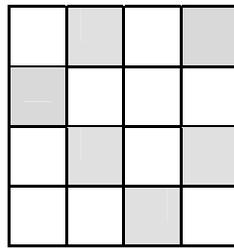
### 2.2 Technical Specification 4.3.1, Criticality

The proposed changes to TS 4.3.1 were initially submitted in response to questions from the Nuclear Regulatory Commission (NRC) received as part of the EPU LAR review and subsequently withdrawn to support the review of the CSA as a standalone amendment. As such, Entergy proposes the addition of the following requirements to TS 4.3.1.1:

- c. Fuel assemblies having a maximum k-infinity of 1.26 in the normal reactor core configuration at cold conditions;
- d. Fuel assemblies having a maximum nominal U-235 enrichment of 4.9 weight percent;
- e. Region II racks are controlled as follows:
  1. Storage cells with any Boraflex panel which has received a gamma dose in excess of  $2.3E10$  rads or which has a Boron-10 areal density less than 0.0165, which are designated within the Spent Fuel Pool Rack Boraflex Monitoring Program, are treated as Region II panels.

2. Storage cells face-adjacent to Region II panels are either restricted from fuel storage by physically blocking the isolated cells or are configured to meet, as a minimum (i.e., additional cells may be blocked), the Region II fuel storage configuration requirements in Figure 4.3-1.
3. When a 4x4 array of cells is classified as Region II and face-adjacent to another Region II 4x4 storage array, the new Region II 4x 4 array is required to be blocked in the same 6 of 16 pattern and at the same orientation as the adjacent Region II 4x4 storage configuration.

Figure 4.3-1  
Region II 4X4 Storage Configuration



Fuel Assembly  
Storage Location



Location Physically Blocked to Prevent  
Storage

Entergy also proposes the following additions to TS 4.3.1.2:

- c. Fuel assemblies having a maximum k-infinity of 1.26 in the normal reactor core configuration at cold conditions;
- d. Fuel assemblies having a maximum nominal U-235 enrichment of 4.9 weight percent.

### 2.3 Spent Fuel Pool Loading Criteria License Condition

As described above, Entergy is requesting a review of the CSA and associated TS changes as a standalone application, separate from the EPU LAR review. Based on the approval of the CSA and associated TS changes, Entergy is also requesting the deletion of the EPU OL condition associated with the spent fuel pool loading pattern.

### **3.0 BACKGROUND**

The CSA for the spent and new fuel storage racks was initially submitted as part of the GGNS EPU LAR acceptance review (See NRC ADAMS Accession Nos. ML103330092 and ML103330093 for CSA and ML102660403 for EPU LAR). While reviewing the EPU LAR, the Steam Generator Tube Integrity and Chemical Engineering and Reactor Systems Branches of the NRC requested additional information related to the CSA. Entergy provided responses to these questions by letters dated March 9, 2011, April 21, 2011, and May 3, 2011 (See NRC ADAMS Accession Nos. ML110680507, ML111120329, and ML111240288, respectively).

The change to the requirements for the spent fuel storage racks (TS 4.3.1.1) and for the new fuel storage racks (TS 4.3.1.2) were initially proposed in the response to questions from the Reactor Systems Branch by letter dated April 21, 2011 (See NRC ADAMS Accession No. ML111120329).

Based on further communications with the NRC, Entergy proposed an Operating License condition related to the loading criteria in the spent fuel pool and the withdrawal of the associated TS (GNRO-2011/00033, dated September 9, 2011) to allow a separate review of the CSA and associated TS changes from the review of the EPU LAR.

### **4.0 TECHNICAL ANALYSIS**

#### **4.1 Criticality Safety Analysis**

The CSA was submitted as supplemental information during the acceptance review of the EPU LAR. An OL condition governing the loading criteria for the spent fuel pool was provided in the EPU LAR. This condition provided conservative margin to the proposed CSA and allowed the NRC to perform their technical review of the CSA portion of the EPU LAR separate from the remainder of the original EPU LAR submittal. As previously stated, the NRC review of the CSA was started as part of the EPU LAR submittal. No new technical information is provided in this request.

#### **4.2 Technical Specification 4.3.1, Criticality**

The proposed changes to TS 4.3.1, *Criticality*, which were originally submitted as part of the EPU LAR review and subsequently withdrawn, are requested to be reviewed as part of the CSA standalone review. The proposed changes add requirements for two parameters for both the spent fuel storage racks (TS 4.3.1.1) and the new fuel storage racks (TS 4.3.1.2):

- Fuel assembly maximum k-infinity (1.26) in the normal reactor core configuration at cold conditions.
- Maximum nominal U-235 enrichment (4.9 weight percent).

The values for these parameters are consistent with NEDC-33621P, Revision 0, *Grand Gulf Nuclear Station Fuel Storage Criticality Safety Analysis of Spent and New Fuel Storage Racks*, submitted by letter dated November 23, 2010 to the NRC (NRC ADAMS Accession No. ML103330093).

In addition to the above parameters, the spent fuel pool storage configuration requirements to account for potential degradation of Boraflex are specified in TS 4.3.1.1. The storage cells with degraded Boraflex are designated as Region II cells and are those cells that have at least one panel that has either a lower areal density or a higher accumulated dose that exceed the Region I storage requirements. As demonstrated in the responses to questions from the Steam Generator and Chemical Engineering Branch (NRC ADAMS Accession No. ML110680507), the dose threshold in the analysis is a significant indicator associated with transition to high Boraflex loss.

The proposed figure establishes the requirement that at least 6 of 16 Region II fuel assembly storage locations are physically blocked in the designated configuration. Since the Boraflex in Region II is not credited, additional locations within the 4 x 4 Region II storage array may be conservatively blocked without compromising the minimum 6 x 16 configuration. The orientation of any adjacent Region II 4x4 array is required to be consistent with the existing Region II 4x4 array. Cells face-adjacent to isolated panels that meet the Region II threshold are physically blocked from storing any fuel assemblies. The Region II storage configurations designated in the Technical Specifications are consistent with the Spent Fuel Pool Criticality Safety Analysis.

#### 4.3 Spent Fuel Pool Loading Criteria Operating License Condition

With the review of the CSA and associated TS change, Entergy is also requesting the deletion of the spent fuel pool loading criteria OL condition. The OL condition, which specified that it was applicable on an interim basis pending the completion of the review of the CSA, was proposed during the EPU review. Therefore, this is an administrative change since the loading criteria in the proposed CSA will supersede the interim criteria stated in the OL condition. (Note, the markup in Attachment 2 reflects conditions 44 and 45, which were also proposed for the EPU and have not yet been approved.)

### **5.0 REGULATORY ANALYSIS**

The proposed changes to the Grand Gulf Nuclear Station (GGNS) Operating License (OL) and Technical Specifications (TS) support: 1) a revision to the criticality safety analysis (CSA) for the spent and new fuel storage racks; 2) a proposed change to the requirements of TS 4.3.1, *Criticality*; and 3) the deletion of an OL condition related to spent fuel pool loading criteria. Entergy Operations, Inc. has evaluated whether or not a significant hazards consideration is involved with the proposed changes by focusing on the three standards set forth in 10 CFR 50.92, *Issuance of amendment*, as discussed below:

### 5.1 Applicable Regulatory Requirements / Criteria

The proposed change has been evaluated to determine whether applicable regulations and requirements continue to be met. Entergy has determined that the proposed change does not require any exemptions or relief from regulatory requirements, other than the TS, and does not affect conformance with any General Design Criterion (GDC) differently than described in the Grand Gulf Nuclear Station, Unit 1(GGNS) Updated Final Safety Analysis Report (UFSAR).

### 5.2 No Significant Hazards Consideration

Entergy Operations, Inc. has evaluated whether or not a significant hazards consideration is involved with the proposed request 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 proposed change involves a revision to the GGNS CSA. The revised CSA does not involve a physical change to any plant systems nor does it involve a change to any of the accident mitigation features previously evaluated. The proposed CSA demonstrates adequate margin to criticality for spent fuel storage rack cells.

The proposed changes to the requirements specified in TS 4.3.1.1 for spent fuel storage racks and TS 4.3.1.2 for new fuel storage racks are consistent with the revised CSA and impose additional requirements currently not included in the Technical Specifications.

There is no dose consequence associated with an abnormal condition since the CSA acceptance criteria preclude criticality and do not involve a radiological release.

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 proposed change involves: 1) a revision to the CSA; 2) the addition of new requirements in the TSs, which are consistent with the CSA; and 3) the deletion of an OL condition, that is superseded upon approval of the proposed CSA. Neither the SFP CSA nor the proposed changes to the TS affect the method of spent or new fuel movement or storage. No physical changes are required to any plant systems in support of the revised CSA or the proposed TS changes.

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:

10 CFR 50.68, Criticality Accident Requirements, requires the spent and fresh fuel storage racks to maintain the effective neutron multiplication factor,  $K_{eff}$ , less than or equal to 0.95 when fully flooded with unborated water, which includes an allowance for uncertainties. Therefore, for criticality, the required safety margin is 5%, including a conservative margin to account for engineering and manufacturing uncertainties. The revised CSA and proposed TS changes continue to satisfy this requirement.

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

### 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.

**Attachment 2**

**GNRO-2011/00076**

**Grand Gulf Nuclear Station, Unit 1**

**Proposed Operating License and Technical Specification Changes (Mark-up)**

- (b) The first performance of the periodic assessment of CRE habitability, Specification 5.5.13.c.(ii), shall be within 3 years, plus the 9-month allowance of SR 3.0.2, as measured from March 2005, the date of the most recent successful tracer gas test, as stated in the June 30, 2005 letter response to Generic Letter 2003-01, or within the next 9 months if the time period since the most recent successful tracer gas test is greater than 3 years.
- (c) The first performance of the periodic assessment of the CRE boundary, Specification 5.5.13.d, shall be within the next 18 months, plus the 136 days allowed by SR 3.0.2, as measured from the date of issuance of this amendment.

- D. The facility required exemptions from certain requirements of Appendices A and J to 10 CFR Part 50 and from certain requirements of 10 CFR Part 100. These include: (a) exemption from General Design Criterion 17 of Appendix A until startup following the first refueling outage, for (1) the emergency override of the test mode for the Division 3 diesel engine, (2) the second level undervoltage protection for the Division 3 diesel engine, and (3) the generator ground over current trip function for the Division 1 and 2 diesel generators (Section 8.3.1 of SSER #7) and (b) exemption from the requirements of Paragraph III.D.2(b)(ii) of Appendix J for the containment airlock testing following normal door opening when containment integrity is not required (Section 6.2.6 of SSER #7). These exemptions are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest. In addition, by exemption dated December 20, 1986, the Commission exempted licensees from 10 CFR 100.11(a)(1), insofar as it incorporates the definition of exclusion area in 10 CFR 100.3(a), until April 30, 1987 regarding demonstration of authority to control all activities within the exclusion area (safety evaluation accompanying Amendment No. 27 to License (NPF-29). This exemption is authorized by law, and will not present an undue risk to the public health and safety, and is consistent with the common defense and security. In addition, special circumstances have been found justifying the exemption. Therefore, these exemptions are hereby granted pursuant to 10 CFR 50.12. with the granting of these exemptions, the facility will operate, to the extent authorized herein, in conformity with the application, as amended, the provisions of the Act and the rules and regulations of the Commission.
- E. The licensee shall fully implement and maintain in effect all provision of the Commission-approved physical security, training and qualification, and safeguards contingency plans including amendments made pursuant to provisions of the Miscellaneous Amendments and Search Requirements revisions to 10 CFR 73.55 (51 FR 27817 and 27822) and to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The plans, which contain Safeguards Information protected under 10 CFR 73.21, are entitled: "Physical Security, Safeguards Contingency and Training and Qualification Plan," and were submitted to the NRC on May 18, 2006.

(44) Leak rate tests associated with Surveillance Requirements (SR) 3.6.1.1.1, 3.6.1.3.5, and 3.6.1.3.9, as required by TS 5.5.12 and in accordance with 10 CFR 50, Appendix J, Option B, and SRs 3.6.5.1.1 and 3.6.5.1.2 are not required to be performed until their next scheduled performance dates. The tests will be performed at the EPU calculated peak containment pressure or within EPU drywell bypass leakage limits, as appropriate.

(45) EOI will not operate GGNS at a thermal power level above 3,898 MWt until the Power Range Neutron Monitoring System license amendment request is approved by the NRC.

(46) Deleted

## 4.0 DESIGN FEATURES

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### 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.

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### 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.

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### 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.

Insert 1



(continued)

#### 4.0 DESIGN FEATURES (continued)

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4.3.1.2 The new fuel storage racks are designed and shall be maintained with:

- a.  $k_{off} \leq 0.95$  if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 9.1.1 of the UFSAR;
- b. A nominal fuel assembly center to center storage spacing of 6.535 inches within rows and 11.875 inches between rows in the new fuel storage racks.

Insert 2



#### 4.3.2 Drainage

The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 202 ft 5.25 inches.

#### 4.3.3 Capacity

- 4.3.3.1 The spent fuel storage pool shall be maintained with a storage capacity limited to no more than 4348 fuel assemblies.
  - 4.3.3.2 No more than 800 fuel assemblies may be stored in the upper containment pool.
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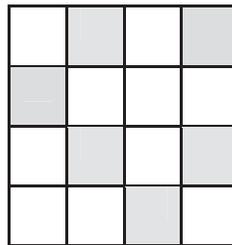
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**Insert 1**

TS 4.3.1.1 .....

- c. Fuel assemblies having a maximum k-infinity of 1.26 in the normal reactor core configuration at cold conditions;
- d. Fuel assemblies having a maximum nominal U-235 enrichment of 4.9 weight percent;
- e. Region II racks are controlled as follows:
  - 1. Storage cells with any Boraflex panel which has received a gamma dose in excess of  $2.3E10$  rads or which has a Boron-10 areal density less than 0.0165, which are designated within the Spent Fuel Pool Rack Boraflex Monitoring Program, are treated as Region II panels.
  - 2. Storage cells face-adjacent to Region II panels are either restricted from fuel storage by physically blocking the isolated cells or are configured to meet, as a minimum (i.e., additional cells may be blocked), the Region II fuel storage configuration requirements in Figure 4.3-1.
  - 3. When a 4x4 array of cells is classified as Region II and face-adjacent to another Region II 4x4 storage array, the new Region II 4x 4 array is required to be blocked in the same 6 of 16 pattern and at the same orientation as the adjacent Region II 4x4 storage configuration.

Figure 4.3-1  
Region II 4X4 Storage Configuration



Fuel Assembly  
Storage Location



Location Physically Blocked to Prevent  
Storage

**Insert 2**

TS 4.3.1.2:

- c. Fuel assemblies having a maximum k-infinity of 1.26 in the normal reactor core configuration at cold conditions;
- d. Fuel assemblies having a maximum nominal U-235 enrichment of 4.9 weight percent.