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GNRO-2012/00014

March 21, 2012

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

SUBJECT: Supplemental Information Pertaining to License Amendment Request for Standby Liquid Control System (TAC No. ME7860)

Grand Gulf Nuclear Station, Unit 1
Docket No. 50-416
License No. NPF-29

REFERENCE: Entergy Operations, Inc. letter to the NRC (GNRO-2012/00001), *License Amendment Request – Standby Liquid Control System*, January 23, 2012 (ADAMS Accession No. ML12023A242)

Dear Sir or Madam:

In the referenced letter, Entergy Operations, Inc. (Entergy) requested approval of an amendment to Grand Gulf Nuclear Station, Unit 1 (GGNS) Technical Specification (TS) 3.1.7, "Standby Liquid Control (SLC) System." The proposed license amendment request (LAR) reflects the enrichment of the boron-10 (B-10) isotope in the sodium pentaborate (SPB) solution, which is the credited neutron absorber. Increasing the enrichment of the B-10 isotope in the SPB solution effectively increases the available negative reactivity inserted by the SLC system without having to increase the system's storage capacity.

Following communication with the NRC staff, Entergy is supplementing its LAR with additional information provided in Attachment 1. Attachments 2 and 3 provide revised marked-up and clean pages of TS 3.1.7, respectively. Attachment 4 provides a markup of the related changes to the TS Bases for information only.

The No Significant Hazards Determination and the Environmental Consideration provided in the referenced letter are not impacted by this supplemental information.

This letter contains no new commitments.

If you have any questions or require additional information, please contact Guy Davant at (601) 368-5756.

I declare under penalty of perjury that the foregoing is true and correct; executed on March 21, 2012.

Sincerely,

MAK/ghd

Attachments:

1. Supplemental Information Pertaining to License Amendment Request – Standby Liquid Control System

2. Proposed Technical Specification Changes (Mark-up)

3. Proposed Technical Specification Changes (Clean Pages)

4. Changes to Technical Specification Bases Pages – For Information Only

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**Attachment 1**

**GNRO-2012/00014**

**Grand Gulf Nuclear Station, Unit 1**

**SUPPLEMENTAL INFORMATION PERTAINING TO LICENSE AMENDMENT REQUEST STANDBY LIQUID CONTROL SYSTEM**

**SUPPLEMENTAL INFORMATION PERTAINING TO LICENSE AMENDMENT REQUEST STANDBY LIQUID CONTROL SYSTEM**

By application dated January 23, 2012, Entergy Operations, Inc. (Entergy) submitted a license amendment request (LAR) for NRC staff approval to amend the Grand Gulf Nuclear Station, Unit 1 (GGNS) Technical Specification (TS) 3.1.7, "Standby Liquid Control (SLC) System."[1] This LAR supports the use of a sodium pentaborate (SPB) solution that has been enriched with the boron-10 (B-10) isotope.

Following communication with the NRC staff, Entergy is supplementing its LAR with additional information provided below. This supplemental information results in revisions to the proposed TS. Attachments 2 and 3 contain revised marked-up and clean TS pages, respectively. Attachment 4 contains revised marked-up TS Bases pages for information only.

**Request for Information #1**

*Please define "C" and "E" in TS 3.1.7.*

**Supplemental Information**

Entergy proposes to revise Condition A, SR 3.1.7.5, and SR 3.1.7.9 to read as follows:

- Condition A

  "Product of Sodium Pentaborate concentration in weight percent (C) times Boron-10 enrichment in atom percent (E) < 420".

- SR 3.1.7.5

  "Verify the percent weight of sodium pentaborate in solution (C) is $\leq$ 9.5%."

- SR 3.1.7.9

  "Determine Boron-10 enrichment (E) in atom percent."

**Request for Information #2**

*Please address actions to ensure pump suction piping is not blocked in the event the temperature of the sodium pentaborate solution decreases below the minimum allowed temperature.*

**Supplemental Information**

Entergy proposes a new Surveillance Requirement (SR) 3.1.7.10, which requires verifying the piping between the storage tank and the pump suction is not blocked on a frequency of once within 24 hours after the temperature of the sodium pentaborate solution is restored to $\geq$ 45°F.

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[1] Entergy letter to the NRC, *License Amendment Request – Standby Liquid Control System*, January 23, 2012

The frequency of performing SR 3.1.7.10 once within 24 hours after the temperature of the sodium pentaborate solution is restored to ≥ 45°F is acceptable in light of the daily temperature verification required by new SR 3.1.7.2 and the low probability that the piping will be blocked due to precipitation of the boron from solution.

**Request for Information #3**

*Please revise Condition C to reflect the temperature being observed is the sodium pentaborate solution temperature.*

**Supplemental Information**

Entergy proposes to revise Condition C to read as follows:

"Sodium pentaborate solution temperature < 45°F or 150°F"

**Request for Information #4**

*Please provide additional information pertaining to suppression pool pH control discussed in Section 4.1.3 of the SLC system LAR.*

**Supplemental Information**

In Grand Gulf's license amendment application of NUREG-1465, *Accident Source Terms for Light-Water Nuclear Power Plants*,[2] Entergy provided a method and associated calculation that showed the SPB solution from the SLC system was capable of controlling and maintaining long-term suppression pool water pH level at or above 7.0 throughout the entire 30-day period of a postulated accident. The NRC staff agreed with this determination, as documented in their Safety Evaluation for the amendment.[3]

Using the same methodology, Entergy has calculated the pH of the suppression pool water when enriched SPB is injected into the reactor core following an accident. This evaluation considered inputs that reflect extended power uprate conditions (i.e., operating at 4408 MWt), which are conservative to conditions when operating at the current licensed thermal power (3898 MWt). Furthermore, the calculation assumes approximately 1,400 lbs. of SPB is in the pool, which conservatively models the SLC storage tank solution at minimum volume and minimum concentration.

Thus, it can be concluded that injecting an amount of SPB solution required by the proposed TS to satisfy the shutdown requirement also is sufficient to maintain suppression pool pH greater than 7.0 for at least 30 days post-accident.

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2 Entergy letter to the NRC, *GGNS Pilot Full-Scope Application of NUREG-1465 Alternative Source Term Insights, LDC 1999-082*, January 21, 2000

3 NRC letter to Entergy, *Grand Gulf Nuclear Station (GGNS), Unit 1 – Issuance of Amendment Re: Full-Scope Implementation of an Alternative Accident Source Term (TAC No. MA8065)*, March 14, 2001

In addition, GGNS has a variety of means of introducing aqueous pH control chemicals from outside sources into the containment in the event they are necessary. GGNS Emergency Procedures currently contain instructions on how to mix up a batch of sodium pentaborate in the condensate storage tank (CST) with chemicals available in the warehouse and inject this solution into the reactor vessel with the High Pressure Core Spray (HPCS) system or the Reactor Core Isolation Cooling (RCIC) system. The HPCS system can also be aligned to inject this solution directly into the suppression pool. Entergy maintains over 7,000 lbs. each of anhydrous borax and boric acid onsite, which produces approximately 11,000 lbs. of SPB for use if needed.

**Attachment 2**

**GNRO-2012/00014**

**Grand Gulf Nuclear Station, Unit 1**

**PROPOSED TECHNICAL SPECIFICATION CHANGES (MARK-UP)**

3.1 REACTIVITY CONTROL SYSTEMS

3.1.7 Standby Liquid Control (SLC) System

LCO 3.1.7 Two SLC subsystems shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

Product of Sodium Pentaborate concentration in weight percent (C) times Boron-10 enrichment in atom percent (E) < 420

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. ~~Concentration of boron in solution in Limited Operation region.~~ | A.1 ~~Restore concentration of boron in solution to Normal Operation region.~~ | ~~72 hours~~ 8 hours |
| | ~~AND~~ Restore (C)(E) ≥ 420 | |
| | ~~A.2~~ ~~Perform SR 3.1.7.2.~~ | ~~Once per 4 hours~~ |
| D. ~~B.~~ One SLC subsystem inoperable. | ~~B.1~~ D.1 Restore SLC subsystem to OPERABLE status. | 7 days |
| E. ~~C.~~ Two SLC subsystems inoperable for reasons other than Conditions A, B or C. | ~~C.1~~ E.1 Restore one SLC subsystem to OPERABLE status. | 8 hours |
| F. ~~D.~~ Required Action and associated Completion Time not met. | ~~D.1~~ F.1 Be in MODE 3. | 12 hours |

B. Sodium pentaborate solution volume < 4,200 gallons. B.1 Restore Volume to ≥ 4,200 gallons. 8 hours

C. Sodium pentaborate solution temperature < 45°F or > 150°F. C.1 Restore temperature ≥45°F and ≤150°F. 8 hours

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.1.7.1 | Verify available volume of sodium pentaborate solution is ~~within the limits of Figure 3.1.7-1.~~ ≥ 4,200 gallons. | 24 hours |
| SR 3.1.7.2 | Verify temperature of sodium pentaborate solution is ~~within the limits of Figure 3.1.7-2.~~ ≥45°F and ≤150°F. | 24 hours |
| SR 3.1.7.3 | ~~Verify temperature of pump suction piping is ≥ 75°F and ≤ 130°F.~~ | ~~24 hours~~ 31 days |
| SR 3.1.7.4 | Verify continuity of explosive charge. | 31 days |
| SR 3.1.7.5 | ~~Verify the concentration of boron in solution is within the limits of Figures 3.1.7-1 and 3.1.7-2.~~ Verify the percent weight of sodium pentaborate in solution (C) is ≤ 9.5%. | 31 days<br>AND<br>Once within 24 hours after water or boron is added to solution<br>AND<br>Once within 24 hours after solution temperature is restored to ≥ ~~75°F~~ 45°F |

----------NOTE----------
Sodium pentaborate concentration (C), in weight percent, is determined by the performance of SR 3.1.7.5. Boron-10 enrichment (E), in atom percent, is determined by the performance of SR 3.1.7.9.
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Verify SLC System satisfies the following equation:
(C)(E) ≥ 420

(continued)

SURVEILLANCE REQUIREMENTS (continued)

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.1.7.6 | Verify each SLC subsystem manual, power operated, and automatic valve in the flow path that is not locked, sealed, or otherwise secured in position, is in the correct position, or can be aligned to the correct position. | 31 days |
| SR 3.1.7.7 | Verify each pump develops a flow rate ≥ 41.2 gpm at a discharge pressure ≥ ~~1300~~ psig. | In accordance with the Inservice Testing Program |
| SR 3.1.7.8 | Verify flow through one SLC subsystem from pump into reactor pressure vessel. | 18 months on a STAGGERED TEST BASIS |
| SR 3.1.7.9 | ~~Verify all heat traced piping between storage tank and pump suction is unblocked.~~<br>Determine Boron-10 enrichment in atom percent (E). | ~~18 months~~<br>~~AND~~<br>~~Once within 24 hours after pump suction piping temperature is restored to ≥ 75°F~~<br>Once within 24 hours after boron is added to the solution. |

1340

INSERT A - New SR 3.1.7.10



Next page is 3.1-26.

**INSERT A – New SR 3.1.7.10**

| | | |
|---|---|---|
| SR 3.1.7.10 | Verify piping between the storage tank and pump suction is not blocked. | Once within 24 hours after solution temperature is restored to ≥ 45°F |

**Attachment 3**

**GNRO-2012/00014**

**Grand Gulf Nuclear Station, Unit 1**

**PROPOSED TECHNICAL SPECIFICATION CHANGES (CLEAN PAGES)**

3.1 REACTIVITY CONTROL SYSTEMS

3.1.7 Standby Liquid Control (SLC) System

LCO 3.1.7 Two SLC subsystems shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. Product of Sodium Pentaborate concentration in weight percent(C) times Boron-10 enrichment in atom percent (E) < 420 | A.1 Restore (C)(E)≥ 420 | 8 hours |
| B. Sodium pentaborate solution volume < 4,200 gallons. | B.1 Restore volume to ≥ 4,200 gallons. | 8 hours |
| C. Sodium pentaborate solution temperature < 45°F or > 150°F. | C.1 Restore temperature to ≥ 45°F and ≤ 150°F. | 8 hours |
| D. One SLC subsystem inoperable for reasons other than Conditions A, B or C. | D.1 Restore SLC subsystem to OPERABLE status. | 7 days |
| E. Two SLC subsystems inoperable for reasons other than Conditions A, B or C. | E.1 Restore one SLC subsystem to OPERABLE status. | 8 hours |
| F. Required Action and associated Completion Time not met. | F.1 Be in MODE 3. | 12 hours |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.1.7.1 | Verify available volume of sodium pentaborate solution is ≥ 4,200 gallons. | 24 hours |
| SR 3.1.7.2 | Verify temperature of sodium pentaborate solution is ≥ 45°F and ≤ 150°F. | 24 hours |
| SR 3.1.7.3 | ----------NOTE----------<br>Sodium Pentaborate Concentration (C), in weight percent is determined by the performance of SR 3.1.7.5. Boron-10 enrichment (E), in atom percent is determined by the performance of SR 3.1.7.9.<br>----------<br>Verify SLC System satisfies the following equation: (C)(E) ≥ 420 | 31 days |
| SR 3.1.7.4 | Verify continuity of explosive charge. | 31 days |
| SR 3.1.7.5 | Verify the percent weight of sodium pentaborate in solution (C) is ≤ 9.5%. | 31 days<br>AND<br>Once within 24 hours after water or boron is added to solution<br>AND<br>Once within 24 hours after solution temperature is restored to ≥ 45°F |

(continued)

SURVEILLANCE REQUIREMENTS (continued)

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.1.7.6 | Verify each SLC subsystem manual, power operated, and automatic valve in the flow path that is not locked, sealed, or otherwise secured in position, is in the correct position, or can be aligned to the correct position. | 31 days |
| SR 3.1.7.7 | Verify each pump develops a flow rate ≥ 41.2 gpm at a discharge pressure ≥ 1340 psig. | In accordance with the Inservice Testing Program |
| SR 3.1.7.8 | Verify flow through one SLC subsystem from pump into reactor pressure vessel. | 18 months on a STAGGERED TEST BASIS |
| SR 3.1.7.9 | Determine Boron-10 enrichment in atom percent (E). | Once within 24 hours after boron is added to the solution. |
| SR 3.1.7.10 | Verify piping between the storage tank and the pump suction is not blocked. | Once within 24 hours after solution temperature is restored to ≥ 45°F |

**Attachment 4**

**GNRO-2012/00014**

**Grand Gulf Nuclear Station, Unit 1**

**CHANGES TO TECHNICAL SPECIFICATION BASES PAGES**
**FOR INFORMATION ONLY**

BASES

SURVEILLANCE REQUIREMENTS

~~SR 3.1.7.8 and SR 3.1.7.9 (continued)~~

~~Demonstrating that all heat traced piping between the boron solution storage tank and the suction inlet to the injection pumps is unblocked ensures that there is a functioning flow path for injecting the sodium pentaborate solution. An acceptable method for verifying that the suction piping is unblocked is to pump from the storage tank to the test tank and then draining and flushing the piping with demineralized water. The 18 month Frequency is acceptable since there is a low probability that the subject piping will be blocked due to precipitation of the boron from solution in the heat traced piping. This is especially true in light of the daily temperature verification of this piping required by SR 3.1.7.3. However, if, in performing SR 3.1.7.3, it is determined that the temperature of this piping has fallen below the specified minimum, SR 3.1.7.9 must be performed once within 24 hours after the piping temperature is restored ≥ 75°F after the piping temperature has been < 75°F.~~

Enriched sodium pentaborate solution is made by mixing granular, enriched sodium pentaborate with water. Isotopic tests on the sodium pentaborate solution to determine the actual B-10 enrichment must be performed once within 24 hours after boron is added to the solution in order to ensure that the B-10 enrichment is adequate. Enrichment testing is only required when boron addition is made since enrichment change cannot occur by any other processes.

REFERENCES

1. 10 CFR 50.62.

2. UFSAR, Section 9.3.5.3.

3. GNRI-91/00153, Issuance of Amendment No. 79 to Facility Operating License No. NPF-29 - Grand Gulf Nuclear Station, Unit 1, Regarding Standby Liquid Control System Technical Specifications, dated July 30, 1991.

SR 3.1.7.10

Demonstrating that the piping between the boron solution tank and the suction inlet to the injection pumps is not blocked ensures there is a functioning flow path for injecting the sodium pentaborate solution. An acceptable method for verifying the suction piping is not blocked is to pump from the storage tank to the test tank and then drain and flush the piping with demineralized water. If in performing SR 3.1.7.2, the temperature of the sodium pentaborate solution is found to have fallen below the specified minimum of 45°F, SR 3.1.7.10 must be performed once within 24 hours after the temperature is restored ≥ 45°F.