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**Enclosure 1 contains proprietary information.**

GNRO-2011/00055

July 28, 2011

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

SUBJECT: Request for Additional Information Regarding
Extended Power Uprate
Grand Gulf Nuclear Station, Unit 1
Docket No. 50-416
License No. NPF-29

REFERENCES:
1. Email from A. Wang to F. Burford dated June 29, 2011, Grand Gulf Extended Power Uprate Instrumentation and Controls Branch Second Round Request for Information (ME4679) (NRC ADAMS Accession No. ML111801362)
2. License Amendment Request, Extended Power Uprate, dated September 8, 2010 (GNRO-2010/00056, NRC ADAMS Accession No. ML102660403)

Dear Sir or Madam:

The Nuclear Regulatory Commission (NRC) requested additional information (Reference 1) regarding certain aspects of the Grand Gulf Nuclear Station, Unit 1 (GGNS) Extended Power Uprate (EPU) License Amendment Request (LAR) (Reference 2). Attachment 1 provides responses to the additional information requested by the Instrumentation and Controls Branch.

No change is needed to the no significant hazards consideration included in the initial LAR (Reference 2) as a result of the additional information provided. There are no new commitments included in this letter.

GE-Hitachi Nuclear Energy Americas, LLC (GEH) consider portions of the information provided in support of the responses to the request for additional information (RAI) in Enclosure 1 to be proprietary and therefore exempt from public disclosure pursuant to 10 CFR 2.390. An affidavit for withholding information, executed by GEH, is provided in Attachment 2. The proprietary information was provided to Entergy in a GEH transmittal that is referenced in the affidavit. Therefore, on behalf of GEH, Entergy requests Enclosure 1 to be withheld from public disclosure in accordance with 10 CFR 2.390(b)(1). A non-proprietary version of Enclosure 1 is provided in Enclosure 2.

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 July 28, 2011.

Sincerely,

M. A. Krupa

MAK/FGB/dm

Attachments:
1. Response to Request for Additional Information, Instrumentation and Controls Branch
2. GEH Affidavit for Withholding Information from Public Disclosure

Enclosures:
1. GEH Instrument Limits Calculation (Proprietary)
2. GEH Instrument Limits Calculation (Non-Proprietary)

cc: Mr. Elmo E. Collins, Jr.
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**When Enclosure 1 is removed, the entire letter is non-proprietary.**

**Attachment 1**

**GNRO-2011/00055**

**Grand Gulf Nuclear Station Extended Power Uprate**

**Response to Request for Additional Information**

**Instrumentation and Controls Branch**

**Response to Request for Additional Information**
**Instrumentation and Controls Branch**

By letter dated September 8, 2010, Entergy Operations, Inc. (Entergy) submitted a license amendment request (LAR) for an Extended Power Uprate (EPU) for Grand Gulf Nuclear Station, Unit 1 (GGNS) (NRC ADAMS Accession No. ML102660403). By letter dated February 23, 2011, Entergy submitted responses to the initial request for additional information (RAI) from the Instrument and Controls (I&C) Branch (NRC ADAMS Accession No. ML110550318). Subsequently, the U.S. Nuclear Regulatory Commission (NRC) staff has determined that the following additional information requested by the I&C Branch (NRC ADAMS Accession No. ML111801362) is needed for the NRC staff to complete their review of the amendment. Entergy's response to each item is provided below.

**RAI # 1**

In the setpoint calculation summary for the Fixed Neutron Flux – High and APRM Flow-Biased Simulated Thermal Power – High Technical Specifications submitted with the February 23, 2011 RAI responses; certain numbered comments on the tables – specifically comments 20 and 22 – could be interpreted to indicate that GGNS intends to remove certain values from the facility Technical Specifications. Please clarify that GGNS does not intend to use the EPU LAR as a basis for removing items from the GGNS Technical Specifications. Staff understands that GGNS has amended the comments to the calculation summary to address these concerns. Please submit the latest revision of the calculation summary with amended comments.

**Response**

The current GGNS Technical Specifications (TS) for the Flow Biased Simulated Thermal Power (STP) Scram states that the Allowable Value (AV) is specified in the Core Operating Limits Report (COLR). This was a consideration in Comment 22 of the summary Average Power Range Monitor (APRM) Instruments Limits Calculation document. However, note that the GGNS Power Range Neutron Monitoring (PRNM) System LAR (NRC ADAMS Accession No. ML093140463) revised the TS to insert the AV for this function into TS Table 3.3.1.1-1, Reactor Protection System Instrumentation. The EPU LAR carries this change forward, revising the AV only as appropriate to reflect EPU operating conditions. Entergy is not proposing to remove any AVs from the GGNS TS in the EPU LAR.

The PRNM system Average Power Range Monitor (APRM) Instruments Limits Calculation for the EPU project was revised by GEH in May 2011 (Reference 1). The revised document is included as Enclosure 1 (Proprietary) and Enclosure 2 (Non-proprietary) to this Attachment. Comments 6 and 20 were revised to acknowledge the APRM Scrams for GGNS are safety functions. The comments also clarify that there are no Analytical Limits (AL) for the APRM Flow Biased STP Scram and Setdown Scram functions because they are not directly credited in any safety analyses.

The revised EPU document was available during the USNRC audit of the setpoint calculations on May 24, 2011.

**RAI # 2**

During discussions regarding the GGNS setpoint calculations on May 24, 2011, the licensee noted that the setpoint calculations were being performed with uncertainty values that assumed a 24-month refueling cycle (rather than the current 18 month cycle currently in place at GGNS). While this assumption may be appropriate for calculation of setpoints, it could potentially lead to larger than appropriate values being used in the as-left and as-found calculations. In order to ensure that as-left and as-found values for GGNS setpoints are appropriately determined, the staff needs to understand how the 24-month refueling cycle assumption impacts the calculation of the as-left and as-found values. Please provide a description of your methodology for such determination.

**Response**

The USNRC criterion and allowance for acceptable performance is based on expected errors during calibration and is given in Technical Specification Task Force (TSTF) report TSTF-493 Revision 4 (henceforth referred to as TSTF-493 in this response) (Reference 2). When the as-found value is within the as-found tolerance (AFT), the instrument is performing acceptably. Note that from the performance monitoring point of view a smaller AFT means that performance is controlled more tightly.

Attachment A of Reference 2 identifies the functions to which the TSTF-493 guidance is to be implemented. Of those listed for BWR/6 plants, only the functions below are also affected by the GGNS EPU. Thus, the EPU LAR implements the appropriate TSTF-493 notes for those functions.

- APRM Neutron Flux – High, Setdown (Scram)
- APRM Flow Biased STP – High (Scram)
- APRM Fixed Neutron Flux – High (Scram)

Note that while the Oscillation Power Range Monitor (OPRM) Upscale function is not included in Attachment A of TSTF-493, GGNS has also applied the two footnotes recommended by the TSTF to this function. The TS Bases changes for Main Steam Line Flow – High (Group 1 Isolation) have been applied as recommended by TSTF-493.

Potential As-Left Tolerance (ALT) Impact from Change in GGNS Refuel Cycle Length:

The ALT is a two-sided tolerance (i.e., the setpoint can be set at the nominal trip setpoint (NTSP) ± ALT after calibration). The ALT margin by TSTF-493 methodology is based on the following errors applicable during calibrations:

- Accuracy under calibration conditions ($A_C$)
- TSTF-493 Calibration error ($C_{TSTF}$) - includes Measurement and Test Equipment Accuracy (M&TE) and M&TE Readability Error (M&TEr)

The ALT values by GEH methodology are never larger than the ALT values based on TSTF-493 methodology. The GEH ALT is an input to the setpoint calculation and is typically a function of the Accuracy under calibration conditions ($A_C$) only. For PRNM, the final APRM NTSP is set in firmware and does not drift once it is set; the ALT values are less than the specified accuracy and are built-into the equipment.

There is no time dependent Drift error included in either the GEH or the TSTF-493 determination of ALT. Therefore, there is no impact on the ALTs for a change in the Refueling Cycle interval from 18-Months to 24-Months.

Potential AFT Impact from Change in GGNS Refuel Cycle Length:

The AFT is a two-sided tolerance; as-found values outside AFT on either side of the setpoint are to be dispositioned as described in TSTF-493. The AFT margin by TSTF-493 methodology is based on all the errors applicable during calibrations. This includes the following error components:

- Accuracy under calibration conditions ($A_C$)
- Drift (D) between calibrations
- TSTF-493 Calibration error ($C_{TSTF}$) - includes M&TE and M&TEr

The expected loop error components are combined statistically by GEH methodology and provide a loop AFT value that is generally smaller than (or it is adjusted equal to) the AFT value determined using the TSTF-493 guidance. Performance monitoring is thus compliant with TSTF-493.

As shown there is a time dependent Drift error included in both the GEH and the TSTF-493 determinations of the AFT. Therefore, there is a potential impact on the AFTs for a change in the Refuel Cycle length from 18-Months to 24-Months. It is expected that a longer calibration interval will potentially involve a larger Drift error term and potentially result in a larger AFT. Any AFTs implemented in support of the EPU changes, which are based on an 18-month fuel cycle, are expected to be smaller than those that would support a 24-month cycle. Note that from the performance monitoring point of view a smaller AFT means that performance is controlled more tightly. This is addressed from two perspectives, one for PRNM System and one more generally, below.

PRNM System: Section 8.3.4.3.2 of the Nuclear Measurement Analysis and Control (NUMAC) PRNM Licensing Topical Report (Reference 3) provides justification for performing channel calibrations on new and existing APRM Functions 2.a, 2.b, 2.d, and 2.f once every 24 months, without regard to the cycle length. On that basis, Entergy proposed in the PRNM System LAR to extend the surveillance interval for the APRM channel calibration (SR 3.3.1.1.10) to 24 months. Therefore, the change in the Refuel Cycle length from 18-months to 24-months would not impact the AFT for these devices.

General: GGNS plans to submit an LAR requesting approval to extend the surveillance intervals based on a 24-month refueling cycle. While evaluations of system and equipment performance at EPU conditions have been performed based on a 24-month cycle, they were done to provide conservative assessments that encompassed the planned change in cycle length; the currently approved fuel cycle length is 18-months. Thus, for any EPU-affected devices where the calibration interval is dependent on the fuel cycle length (i.e., has a current surveillance interval of 18-months), the AFT is potentially affected by the cycle length. For these cases, the EPU LAR will be implemented based on the 18-month cycle. Later, once GGNS has received approval for the cycle length extension, that LAR can be implemented incorporating the appropriate AFTs.

**RAI # 3**

During the May 24, 2011 audit of the setpoint calculations, the staff noted that the spreadsheet and calculation summary documents showed that the temperature effect and humidity effect errors for the NUMAC equipment were “included within the NUMAC accuracy performance specification.” Upon review of a copy of a design calculation for the NUMAC performance, and its reference specifications, it was noted that a calculation had been performed to demonstrate the negligible magnitude of the temperature effect specification, but no calculation had been performed for the humidity effect specification. The calculation summary merely stated that the humidity effect was enveloped without providing a calculation to demonstrate that it was, as it had done for the temperature effect. The staff noted that this appeared to be an unverified assumption, which would need further amplification or a statement as to why it is considered negligible. Please provide an explanation as to what engineering judgment was used to provide confidence that this assumption (i.e., that the humidity effect has been bounded by other uncertainties) is justified.

**Response**

A NUMAC PRNM Requirement Specification was discussed during the audit with the USNRC on May 24, 2011, rather than a Performance Specification. The applicable NUMAC PRNM Performance Specification (Reference 4) for the GGNS PRNM system, which was not referenced in the Instrument Limit Calculation document (Reference 1), states (see Section 4.3.3.2) that the PRNM accuracies would not deviate from the stated values “over the control room normal environmental range.”

Section 7.1 of Reference 4 shows the Temperature and Humidity Limitations for the PRNM equipment. The APRM instrument performance specifications for the temperature and humidity ranges and associated parameters for the GGNS Control Room, where the PRNM electronics will be located, are provided in Table 1. It can be seen that the equipment will be operating within the stated limitations.

**Table 1**

| Performance Specification Requirement (From Reference 4) | GGNS Environment in Control Room | Limitation Met Y/N |
|---|---|---|
| 4.44 $^{O}$C ≤ Temperature ≤ 50 $^{O}$C (40 $^{O}$F to 122 $^{O}$F) | 60 $^{O}$F to 90 $^{O}$F | Y |
| 20 % ≤ Relative Humidity ≤ 90 % | 20 % to 50% | Y |

The APRM Instrument Limits Calculation (Reference 1) cites DC-4608 Volume XI DCD (Reference 5), that includes a derivation of the accuracy of the Flow Electronics. That derivation includes a calculated temperature effect on a resistor network. The effect of temperature on the resistor network is included in the error calculation because the resistor has a specific temperature effect (i.e., error per degree Celsius) identified.

There is no equivalent humidity error effect identified and therefore no similar calculation was performed. Rather, qualification testing has demonstrated the acceptable performance of the equipment over the entire range of specified conditions in Table 1. This has been verified to envelop the expected conditions in the GGNS Control Room.

**REFERENCES**

1. GEH Report 0000-0109-0169-R1, Instruments Limits Calculation, Entergy Operations, Inc., Grand Gulf Nuclear Station, Average Power Range Monitor, Power Range Neutron Monitoring System (NUMAC)-EPU Operation, GEH Proprietary, Rev. 1, May 2011.

2. Letter Technical Specifications Task Force (TSTF) to U.S. Nuclear Regulatory Commission (NRC) “Transmittal of Revised TSTF-493 Revision 4.” TSTF-09-29, dated January 5, 2010 [ML100060064] and Letter, TSTF to NRC, “Transmittal of TSTF-493 Revision 4, Errata.” TSTF-10-07, dated April 23, 2010 [ML101160026].

3. GEH NEDC-32410P-A, Volume 1, “Nuclear Measurement Analysis and Control Power Range Neutron Monitor (NUMAC PRNM) Retrofit Plus Option III Stability Trip Function” Licensing Topical Report, GEH Proprietary, October 1995.

4. GEH 26A8153, NUMAC APRM with DSS-CD, Performance Specification, GEH Proprietary, Rev. 2, October 2010.

5. GE DC-4608 Volume XI DCD; Rev. B, “Design Calculation for NUMAC Power Range Neutron Monitoring System (PRNM),” DRF C51-00136 (4.42), October 9, 1998.

**Enclosure 2**

**to**

**Attachment 1**

**GNRO-2011/00055**

**Grand Gulf Nuclear Station Extended Power Uprate**

**Response to Request for Additional Information**

**Instrumentation and Controls Branch**

**GEH Instrument Limits Calculation**
**(Non-Proprietary)**

This is a non-proprietary version of Attachment 1 from which the proprietary information has been removed. The proprietary portions that have been removed are indicated by double square brackets as shown here: [[ ]].

Non-Proprietary

**REVISION SUMMARY to 0000-0109-0169-R1:**

| Rev | Required Changes to Achieve Revision |
|---|---|
| 0 | Initial Issue |
| 1 | a. Revised Comment 6 and Comment 20 to correctly identify safety related Scram setpoint functions, and to explain that the GEH safety analysis does not take credit for the APRM Flow Biased STP Scram.<br>b. Updated the GEH Proprietary Information markings.<br>c. Added the Technical Specification Bases to Ref. 4.1, and cited Ref. 4.1 Bases in Comments 6, 20, and 22.<br>d. Made miscellaneous editorial changes (including to page numbering). |

**Contents:**

This document is a supplement analysis data sheet to Reference 1. Included in this document in sequential order are:

- The setpoint functions for the system,
- The setpoint function analyses inputs and the source reference of the inputs,
- The devices in the setpoint function instrument loop,
- The component analysis inputs and input sources,
- The calculated results,
- Input comments and result recommendations (if any),
- References.

**System: Average Power Range Monitor (APRM)**

The following setpoint functions are included in this document:

- APRM Flow-Biased Simulated Thermal Power (STP) Scram with Clamp (TLO)
- APRM Flow-Biased STP Rod Block with Clamp (TLO)
- APRM Flow-Biased STP Scram (SLO)
- APRM Flow-Biased STP Rod Block (SLO)
- APRM Neutron Flux Scram
- APRM Setdown Scram
- APRM Setdown Rod Block
- APRM Downscale Rod Block

**Non-Proprietary**

**1. Function: Flow-Biased STP Scram, Flow-Biased Rod Block, Neutron Flux Scram, Setdown Scram, Setdown Rod Block and Downscale Rod Block**

| Setpoint Characteristics: | Definition | | | | Reference(s) |
|---|---|---|---|---|---|
| Event Protection: | Limiting event for the setpoint:<br>**Scram**:<br>• The APRM Flow Biased STP scram setpoint function is designed to protect against slow reactivity transients.<br>• The neutron flux-high scram function protects against fast reactivity transients.<br>• The APRM setdown scram setpoint function provides a redundant scram (in addition to IRM) for reactivity transients in the startup mode.<br><br>**Rod Block**:<br>• The APRM Flow Biased STP rod block function prevents operation significantly above licensed power level; the function precedes a flow biased scram.<br>• The APRM setdown rod block setpoint function provides a redundant rod block (in addition to IRM) for reactivity transients in the startup mode.<br>• The APRM downscale rod block function provides indication of instrument failure or insensitivity and assures proper overlap between the neutron monitoring systems. | | | | Ref. 2 (Sections 3.20, 3.21) |
| Function After Earthquake | ☐ | Required | ☒ | Not Required | Comment 6 |
| Setpoint Direction: | | | | | |
| ▪ APRM Flow Biased STP Scram (TLO) | ☒ | Increasing | ☐ | Decreasing | |
| ▪ APRM Flow Biased STP Rod Block (TLO) | ☒ | Increasing | ☐ | Decreasing | |
| ▪ APRM Flow Biased STP Scram (SLO) | ☒ | Increasing | ☐ | Decreasing | |
| ▪ APRM Flow Biased STP Rod Block (SLO) | ☒ | Increasing | ☐ | Decreasing | |
| ▪ APRM Neutron Flux Scram | ☒ | Increasing | ☐ | Decreasing | |
| ▪ APRM Setdown Scram | ☒ | Increasing | ☐ | Decreasing | |
| ▪ APRM Setdown Rod Block | ☒ | Increasing | ☐ | Decreasing | |
| ▪ APRM Downscale Rod Block | ☐ | Increasing | ☒ | Decreasing | Ref. 2 (Sections 3.20, 3.21) |

Non-Proprietary

| Setpoint Characteristics: | Definition | Reference(s) |
|---|---|---|
| Single or Multiple Channel<br>• Upscale setpoints<br>• Downscale setpoint | <br><br>☐ Single ☒ Multiple<br>☒ Single ☐ Multiple | <br><br><br>Comment 27 |
| LER Calculation Basis if Multiple Channel | Standard (Conservative) LER Calculation ☒ or<br>Configuration Specific LER Calculation ☐ | Ref. 1, Ref. 2 |
| Trip Logic for Configuration Specific LER Calculation | n/a | |

n/a: Not applicable
LER: Licensee Event Report
STP: Simulated Thermal Power
SLO: Single Loop Operation
TLO: Two Loop Operation

**Non-Proprietary**

| Plant Data: | Value | Sigma if not 2 | Reference(s) |
|---|---|---|---|
| Flow Primary Element (Flow Elbow)<br>a.) Accuracy (APEA)<br>b.) Drift (DPEA) | a.) ± 5% rated Recirc Flow<br>b.) n/a | | a.) Comment 30 |
| Flow Process Measurement Accuracy (PMA)<br>a.) PMA (flow noise)<br>b.) PMA (static head) | a.) ± 1.6% rated Recirc Flow<br>b.) Negligible | | a.) Comment 15<br>b.) Comment 23 |

| Plant Data: | Value | Sigma if not 2 | Reference(s) |
|---|---|---|---|
| Power Primary Element (LPRM Detector)<br>(% Power)<br>a.) $APEA_{Accuracy}$<br>b.) $APEA_{PowerSupply\ Effect}$<br>c.) DPEA | a.) ± 1%; bias 0.49%<br>b.) Negligible<br>c.) ± 0.2%/ 7days; bias 0.33 %/ 7days | | b.) Ref 2 (Section 4.5.3); Comment 16 |
| Power Process Measurement Accuracy (PMA)<br>(% Power)<br>a.) Tracking (fixed and flow-biased)<br>b.) Noise (STP)<br>c.) Noise (neutron flux) | a.) ± 1.11%<br>b.) ± 0.0%<br>c.) ± 2.0% | | b.) Comment 13<br>c.) Comment 13 |

**Components (or Devices) in Setpoint Function Instrument Loop:**

- Flow Element
- LPRM Detector
- Flow Transmitter
- Nuclear Measurement Analysis and Control (NUMAC) Chassis:
    - Instrument Loop Flow Electronics (Recirculation Flow Monitor System)
    - Instrument Loop Power Electronics (LPRM, APRM, Trip Circuit)

1.1 APRM Flow Biased Simulated Thermal Power Scram (TLO)

| Function Limits: | Value/Equation PRNMS-CLTP (% RTP) | Value/Equation PRNMS-EPU (% RTP) | Reference(s) |
|---|---|---|---|
| Analytical Limit | n/a | n/a | Comment 20 |
| Tech Spec Allowable Value | 0.65 $W_d$ + 62.9 clamped at 113 | 0.58 $W_d$ + 59.1 clamped at 113 | Comment 22 |
| Nominal Trip Setpoint | 0.65 $W_d$ + 60.9 clamped at 111.0 | Results in Section 3 | Ref. 7.6 (Section 3) |
| Operational Limit | 100 (at 77.0% Recirc flow rate) | 100 (at 92.8% Recirc flow rate) | Comment 18 |

1.2 APRM Flow Biased Simulated Thermal Power Rod Block (TLO)

| Function Limits: | Value/Equation PRNMS-CLTP (% RTP) | Value/Equation PRNMS-EPU (% RTP) | Reference(s) |
|---|---|---|---|
| Analytical Limit | n/a | n/a | Comment 20 |
| Tech Spec Allowable Value | 0.65 $W_d$ + 59.9 clamped at 110 | 0.58 $W_d$ + 56.1 clamped at 110 | Comment 22 |
| Nominal Trip Setpoint | 0.65 $W_d$ + 57.9 clamped at 108.0 | Results in Section 3 | Ref. 7.6 (Section 3) |
| Operational Limit | n/a | n/a | Comment 3 |

**Non-Proprietary**

1.3 APRM Flow Biased Simulated Thermal Power Scram (SLO)

| Function Limits: | Value/Equation PRNMS-CLTP (% RTP) | Value/Equation PRNMS-EPU (% RTP) | Reference(s) |
|---|---|---|---|
| Analytical Limit | n/a | n/a | Comment 20 |
| Tech Spec Allowable Value | $0.65W_d + 42.3$ | $0.58\ W_d + 37.4$ | Comment 22 |
| Nominal Trip Setpoint | $0.65\ W_d + 38.8$ | Results in Section 3 | Ref. 7.6 (Section 3) |
| Operational Limit | n/a | n/a | Comment 19 |

1.4 APRM Flow Biased Simulated Thermal Power Rod Block (SLO)

| Function Limits: | Value/Equation PRNMS-CLTP (% RTP) | Value/Equation PRNMS-EPU (% RTP) | Reference(s) |
|---|---|---|---|
| Analytical Limit | n/a | n/a | Comment 20 |
| Tech Spec Allowable Value | $0.65\ W_d + 39.3$ | $0.58\ W_d + 34.4$ | Comment 22 |
| Nominal Trip Setpoint | $0.65\ W_d + 35.8$ | Results in Section 3 | Ref. 7.6 (Section 3) |
| Operational Limit | n/a | n/a | Comment 3 |

**Non-Proprietary**

1.5 APRM Neutron Flux Scram

| Function Limits: | Value/Equation PRNMS-CLTP (% RTP) | Value/Equation PRNMS-EPU (% RTP) | Reference(s) |
|---|---|---|---|
| Analytical Limit | 122 | 122 | |
| Tech Spec Allowable Value | 120 | Results in Section 3 | Ref 4.1 (Table 3.3.1.1-1); Comment 22 |
| Nominal Trip Setpoint | 118 | Results in Section 3 | Ref 4.2 (Table TR3.3.1.1-1); Comment 22 |
| Operational Limit | 100 (at 77.0% Recirc flow rate) | 100 (at 92.8% Recirc flow rate) | Comment 21 |

1.6 APRM Setdown Scram

| Function Limits: | Value/Equation PRNMS-CLTP (% RTP) | Value/Equation PRNMS-EPU (% RTP) | Reference(s) |
|---|---|---|---|
| Analytical Limit | n/a | n/a | Comment 20 |
| Tech Spec Allowable Value | 20 | 20 | Ref 4.1 (Table 3.3.1.1-1); Comment 22 |
| Nominal Trip Setpoint | 15 | Results in Section 3 | Ref 4.2 (Table TR3.3.1.1-1); Comment 22 |
| Operational Limit | 12 | 12 | Comment 28 |

**Non-Proprietary**

1.7 APRM Setdown Rod Block

| Function Limits: | Value/Equation PRNMS-CLTP (% RTP) | Value/Equation PRNMS-EPU (% RTP) | Reference(s) |
|---|---|---|---|
| Analytical Limit | n/a | n/a | Comment 20 |
| Tech Spec Allowable Value | 14 | 14 | Ref 4.2 (Table TR3.3.2.1-2); Comment 22 |
| Nominal Trip Setpoint | 12 | Results in Section 3 | Ref 4.2 (Table TR3.3.2.1-2); Comment 22 |
| Operational Limit | n/a | n/a | Comment 3 |

1.8 APRM Downscale Rod Block

| Function Limits: | Value/Equation PRNMS-CLTP (% RTP) | Value/Equation PRNMS-EPU (% RTP) | Reference(s) |
|---|---|---|---|
| Analytical Limit | n/a | n/a | Comment 20 |
| Tech Spec Allowable Value | 3 | 3 | Ref 4.2 (Table TR3.3.2.1-2); Comments 22, 27 |
| Nominal Trip Setpoint | 4 | Results in Section 3 | Ref 4.2 (Table TR3.3.2.1-2); Comment 22 |
| Operational Limit | n/a | n/a | Comment 3 |

CLTP: Current Licensed Thermal Power
n/a: Not applicable
RTP: Rated Thermal Power
$W_d$: % Recirculation drive flow, may also be referred to as “W” or “WD”

## 2. Components:

### 2.2 Flow Transmitter

| Component Information: | Value/Equation | Reference(s) |
|---|---|---|
| Plant Instrument ID No. | 1B33 N014A-D,<br>1B33 N024A-D | |
| Instrument vendor | Rosemount | |
| Model ID No. (including Range Code) | 1152DP5N | |
| Plant Location(s) | Containment Building, el. 133' | |
| Process Element | Flow elbow (No component ID available) | |

**Inputs:**

| Vendor Specifications | Value / Equation | Sigma if not 2 | Reference(s) |
|---|---|---|---|
| Top of Scale | 430.3 InWC (20mA) | | Ref. 5.6 (Step 5.4.10) |
| Bottom of Scale | 0 InWC (4mA) | | Ref. 5.6 (Step 5.4.10) |
| Upper Range Limit | 750 InWC | | Ref 6.6 |
| Accuracy | ± 0.25% Span | | Ref 6.6 |
| Temperature Effect | ± (0.5% URL + 0.5% Span) per 100ºF | | Ref 6.6 |
| Seismic Effect | ± 0.25% URL during and after 3g over range of 5-100 Hz in 3 major axes | | Ref 6.6 |
| Radiation Effect | ± 8% URL during and after 5 x $10^6$ Rads TID of gamma radiation at 0.4 Mrad/hr | | Ref 6.6 |
| Humidity Effect | Included in accuracy | | Ref 6.6 |
| Power Supply Effect | ± 0.005% of output span per volt | | Ref 6.6 |
| RFI/EMI Effect | negligible | | Ref 6.6; Comment 4 |
| Insulation Resistance Effect | negligible | | Ref 6.6; Comment 4 |
| Over-pressure Effect | ± 1% URL after 2000 psig | | Ref 6.6 |
| Static Pressure Effect<br>a.) Random zero effect<br>b.) Random span effect (Correction uncertainty)<br>c.) Bias span effect | a.) ± 0.25% URL per 2000 psi<br>b.) ± 0.25% input reading per 1000 psi<br>c.) n/a | | Ref 6.6 |
| Mounting Position Effect<br>a.) Zero Shift<br>b.) Span Effect | a.) Up to 1 $InH_20$<br>b.) None | | Ref 6.6 |

**Non-Proprietary**

2.1 Flow Transmitter (cont'd)

| Plant Data: | Value | Sigma if not 2 | Reference(s) |
|---|---|---|---|
| Calib Temperature Range | 60 to 105 ºF | | Ref 5.2 (Table 1, Areas 1A311, 1A313) |
| Normal Temperature Range | 60 to 105 ºF | | Ref 5.2 (Table 1, Areas 1A311, 1A313) |
| Trip Temperature range | 60 to 105 ºF | | Comment 24 |
| Plant seismic value | n/a | | Comment 6 |
| Plant Radiation value | negligible | | Ref 5.2 (Table 1, Areas 1A311, 1A313); Comment 25 |
| Plant Humidity value | 20 to 90% | | Ref 5.2 (Table 1, Areas 1A311, 1A313) |
| Power Supply Variation value | +/- 0.9 Vdc | | |
| RFI/EMI value | negligible | | |
| Over-pressure value | 1100 psig | | |
| Static Pressure value | 1060 psig | | |

Vdc: DC voltage

| Drift: | Value | Sigma if not 2 | Reference(s) |
|---|---|---|---|
| Current Calib. Interval | 18 mo. ☐Includes extra 25% | n/a | Ref 4.1 (SR 3.3.1.17); Comment 29 |
| Desired Calib. Interval | 24 mo. ☐Includes extra 25% | n/a | |
| Drift Source | ☒Vendor ☐Calculated | n/a | Ref 6.6 |
| Drift Value | ± 0.2% URL / 30 months | | Ref 6.6; Ref 1, Ref 2 Comment 7 |

## 2.1 Flow Transmitter (cont'd)

| Calibration: | Value / equation | Sigma if not 3 | Reference(s) |
|---|---|---|---|
| As Left Tolerance (ALT) | ± 0.25% Span (± 0.04 mA) | | |
| Leave Alone Tolerance (LAT) | =ALT | | |

| **Input Calibration Tool:** | Wallace & Tiernan Model 65-120 | n/a | Ref 5.4 |
|---|---|---|---|
| Accuracy | ± 1.075 inWC(= 0.13% of Full Scale; Full Scale=850 inWC) | | Ref. 5.6 (Step 3.3) Ref 5.4 |
| Resolution / Readability | 0.5 inWC | | Comment 26 |
| Minor Division | 1 inWC | | |
| Upper Range | | n/a | |
| Temperature Effect | negligible | | Ref 5.4 |
| | | | |
| **Input Calibration Standard:** | Mensor model 8100 quartz pressure calibrator | n/a | Ref 5.4a |
| Accuracy | =1/4 input calibration tool accuracy | | Comment 8 |
| Resolution / Readability | | | |
| Minor Division | | | |
| Upper Range | | | |
| Temperature Effect | | | |
| | | | |
| **Output Calibration Tool:** | Fluke model 45 Multimeter | n/a | Ref 5.7 |
| Accuracy | ± 0.04 mA | | Ref 5.6 (Step 3.2; Ref 5.7 (Pg 1-9) |
| Resolution / Readability | 0.005 | | Ref 5.7 (Pg 1-9); Comment 26 |
| Minor Division | n/a | | |
| Upper Range | | n/a | |
| Temperature Effect | Included in accuracy | | Ref 5.7 (Pg 1-4); Comment 4 |
| | | | |
| **Output Calibration Standard:** | Fluke model 5700A Calibrator | n/a | Ref 5.7a |
| Accuracy | =1/4 output calibration tool accuracy | | Comment 8 Ref 5.7a (Pg 1-23) |
| Resolution / Readability | | | |
| Minor Division | | | |
| Upper Range | | | |
| Temperature Effect | | | |

| Application Specific Input: | Value | Sigma if not 2 | Reference(s) |
|---|---|---|---|
| n/a | | | |
| | | | |

## 2.3 Flow Electronics (Recirculation Flow Monitor System)

| Component Information: | Value/Equation | Reference(s) |
|---|---|---|
| Plant Instrument ID No. | Undefined | Comment 2 |
| Instrument vendor | GEH | |
| Model ID No. (including Range Code) | NUMAC | |
| Plant Location(s) | Control Room area, El 166-0”;<br>Control cabinet area, El 190-0” | Ref 5.2 (Table 1) |
| Process Element | n/a | |

**Inputs:**

| Vendor Specifications | Value / Equation | Sigma if not 2 | Reference(s) |
|---|---|---|---|
| Top of Scale | FS = 125% loop flow | n/a | |
| Bottom of Scale | 0% loop flow | n/a | |
| Upper Range Limit | n/a | n/a | |
| Accuracy | ± 0.122 mAdc<br>(where 16 mAdc input span from FT corresponds to 125% flow) | | Comment 9 |
| Temperature Effect | included in accuracy | | |
| Seismic Effect | included in accuracy | | Comment 4 |
| Radiation Effect | included in accuracy | | Comment 4, Comment 10 |
| Humidity Effect | included in accuracy | | Comment 4 |
| Power Supply Effect | included in accuracy | | Comment 4 |
| RFI/EMI Effect | negligible | | Comment 4 |
| Insulation Resistance Effect | negligible | | Comment 4 |
| Over-pressure Effect | n/a | | Comment 5 |
| Static Pressure Effect | n/a | | Comment 5 |

2.2 Flow Electronics (cont'd)

| Plant Data: | Value | Sigma if not 2 | Reference(s) |
|---|---|---|---|
| Calib Temperature Range | 60 to 90 ºF | n/a | Ref 5.2 (N-028 Data Sheet) |
| Normal Temperature Range | 60 to 90 ºF | n/a | Ref 5.2 (N-028 Data Sheet) |
| Trip Temperature range | 60 to 90 ºF | n/a | Ref 5.2 (N-028 Data Sheet) |
| Plant seismic value | n/a | n/a | Comment 6 |
| Plant Radiation value | 1.8 E2 Rad TID | n/a | Ref 5.2 (N-028 Data Sheet) |
| Plant Humidity value | 20 to 50% | n/a | Ref 5.2 (N-028 Data Sheet) |
| Power Supply Variation value | +/- 0.9 Vdc | n/a | |
| RFI/EMI value | negligible | n/a | |
| Over-pressure value | n/a | n/a | Comment 5 |
| Static Pressure value | n/a | n/a | Comment 5 |

| Drift: | Value | Sigma if not 2 | Reference(s) |
|---|---|---|---|
| Current Calib. Interval | 184 days ☐Includes extra 25% | n/a | Ref 4.1 (SR 3.3.1.10); Comment 29 |
| Desired Calib. Interval | 24 mo. ☐Includes extra 25% | n/a | |
| Drift Source | ☐Vendor ☒Calculated | n/a | Ref. 1; Ref. 2 |
| Drift Value<br>• (% rated drive flow) | Not specified; [[ ]]<br>= ± 0.122 mAdc / 6 months | | Ref. 1 (Section 3.3); Ref. 2 |

**Non-Proprietary**

## 2.2 Flow Electronics (cont'd)

| **Calibration:** | **Value / equation** | **Sigma if not 3** | **Reference(s)** |
|---|---|---|---|
| As Left Tolerance (ALT) | n/a | | |
| Leave Alone Tolerance (LAT) | n/a | | |
| | | | |
| **Input Calibration Tool:** | Internal to NUMAC | n/a | |
| Accuracy | ± (1.1)*0.192% units on 125% scale | | Comment 14 |
| Resolution / Readability | included in accuracy | | |
| Minor Division | included in accuracy | | |
| Upper Range | 125% | n/a | |
| Temperature Effect | included in accuracy | | |
| | | | |
| **Input Calibration Standard:** | included in calibration tool | | |
| Accuracy | n/a | | |
| Resolution / Readability | n/a | | |
| Minor Division | n/a | | |
| Upper Range | n/a | | |
| Temperature Effect | n/a | | |
| | | | |
| **Output Calibration Tool:** | n/a | | |
| Accuracy | | | |
| Resolution / Readability | | | |
| Minor Division | | | |
| Upper Range | | | |
| Temperature Effect | | | |
| | | | |
| **Output Calibration Standard:** | n/a | | |
| Accuracy | | | |
| Resolution / Readability | | | |
| Minor Division | | | |
| Upper Range | | | |
| Temperature Effect | | | |

| **Application Specific Input:** | **Value** | **Sigma if not 2** | **Reference(s)** |
|---|---|---|---|
| n/a | | | |
| | | | |

## 2.3 Power Electronics (LPRM, APRM, Trip Circuit)

| Component Information: | Value/Equation | Reference(s) |
|---|---|---|
| Plant Instrument ID No. | Undefined | Comment 2 |
| Instrument vendor | GEH | |
| Model ID No. (including Range Code) | NUMAC | |
| Plant Location(s) | Control Room area, El 166-0”;<br>Control cabinet area, El 190-0” | Ref 5.2 (Table 1) |
| Process Element | Local Power Range Monitor (LPRM) Neutron detector | |

**Inputs:**

| Vendor Specifications | Value / Equation | Sigma if not 2 | Reference(s) |
|---|---|---|---|
| Top of Scale | FS = 125% | n/a | |
| Bottom of Scale | 0% | n/a | |
| Upper Range Limit | n/a | n/a | |
| Accuracy<br>• LPRM Detector<br>• LPRM Electronics | $A_{LPRM\ Detector}$ = APRM PEA<br>± 0.943% (% local power) | | Ref. 1; Ref. 2 |
| Temperature Effect | included in accuracy | | |
| Seismic Effect | included in accuracy | | Comment 4 |
| Radiation Effect | included in accuracy | | Comment 4, Comment 10 |
| Humidity Effect | included in accuracy | | Comment 4 |
| Power Supply Effect (Detector) | See APRM PEA | | |
| RFI/EMI Effect | negligible | | Comment 4 |
| Insulation Resistance Effect | negligible | | Comment 4 |
| Over-pressure Effect | n/a | | Comment 5 |
| Static Pressure Effect | n/a | | Comment 5 |

2.3 Power Electronics (LPRM, APRM, Trip Circuit) (cont'd)

| Plant Data: | Value | Sigma if not 2 | Reference(s) |
|---|---|---|---|
| Calib Temperature Range | 60 to 90 ºF | n/a | Ref 5.2 (N-028 Data Sheet) |
| Normal Temperature Range | 60 to 90 ºF | n/a | Ref 5.2 (N-028 Data Sheet) |
| Trip Temperature range | 60 to 90 ºF | n/a | Ref 5.2 (N-028 Data Sheet) |
| Plant seismic value | n/a | n/a | Comment 6 |
| Plant Radiation value | 1.8 E2 Rad TID | n/a | Ref 5.2 (N-028 Data Sheet) |
| Plant Humidity value | 20 to 50% | n/a | Ref 5.2 (N-028 Data Sheet) |
| Power Supply Variation value | +/- 0.9 Vdc | n/a | |
| RFI/EMI value | negligible | n/a | |
| Over-pressure value | n/a | n/a | Comment 5 |
| Static Pressure value | n/a | n/a | Comment 5 |

| Drift: | Value | Sigma if not 2 | Reference(s) |
|---|---|---|---|
| Current Calib. Interval | 7 days ☐Includes extra 25% | n/a | Ref. 4.1 (SR 3.3.1.1.2); Comment 29 |
| Desired Calib. Interval | 7 days ☐Includes extra 25% | n/a | Ref. 4.1 (SR 3.3.1.1.2) |
| Drift Source | ☒Vendor ☐Calculated | n/a | Ref. 1, Ref. 2 |
| Drift Value<br>▪ (% power) | ± 0.5% FS / 700 hours | | |

**Non-Proprietary**

## 2.3 Power Electronics (LPRM, APRM, Trip Circuit) (cont'd)

| **Calibration:** | **Value / equation** | **Sigma if not 3** | **Reference(s)** |
|---|---|---|---|
| | Included in APRM calibration | | |
| As Left Tolerance (ALT) | AGAF | | Comment 11 |
| Leave Alone Tolerance (LAT) | = ALT | | Ref 4.1 (SR 3.3.1.1.2); Comment 11 |
| | | | |
| **Input Calibration Tool:** | n/a | | Comment 11 |
| Accuracy | | | |
| Resolution / Readability | | | |
| Minor Division | | | |
| Upper Range | | | |
| Temperature Effect | | | |
| | | | |
| **Input Calibration Standard:** | n/a | | Comment 11 |
| Accuracy | | | |
| Resolution / Readability | | | |
| Minor Division | | | |
| Upper Range | | | |
| Temperature Effect | | | |
| | | | |
| **Output Calibration Tool:** | n/a | | Comment 11 |
| Accuracy | | | |
| Resolution / Readability | | | |
| Minor Division | | | |
| Upper Range | | | |
| Temperature Effect | | | |
| | | | |
| **Output Calibration Standard:** | n/a | | Comment 11 |
| Accuracy | | | |
| Resolution / Readability | | | |
| Minor Division | | | |
| Upper Range | | | |
| Temperature Effect | | | |

| **Application Specific Input:** | **Value** | **Sigma if not 2** | **Reference(s)** |
|---|---|---|---|
| Minimum no. of LPRMs per APRM Channel | 21 of 44 | n/a | |
| APRM Gain Adjustment Factor (AGAF) | ± 2% RTP | 3 | Ref 4.1 (SR 3.3.1.1.2) |

**Non-Proprietary**

## 3. Summary Results:

**Calculated Values**

| Setpoint Function | Analytical Limit (AL) (from Section 1) %RTP | - Allowable Value (AV) (from Section 1) %RTP | Nominal Trip Setpoint (NTSP) %RTP | Meets LER Avoidance Criteria | Meets Spurious Trip Avoidance Criteria |
|---|---|---|---|---|---|
| APRM Flow Biased STP Scram (TLO) | n/a | $0.58\ W_d + 59.1$ clamped at 113 | $0.58\ W_d + 57.1$ clamped at 111.0 | Y | Y |
| APRM Flow Biased STP Rod Block (TLO) | n/a | $0.58\ W_d + 56.1$ clamped at 110 | $0.58\ W_d + 54.1$ clamped at 108.0 | Y | n/a |
| APRM Flow Biased STP Scram (SLO) | n/a | $0.58\ W_d + 37.4$ | $0.58\ W_d + 34.3$ | Y | n/a |
| APRM Flow Biased STP Rod Block (SLO) | n/a | $0.58\ W_d + 34.4$ | $0.58\ W_d + 31.3$ | Y | n/a |
| APRM Neutron Flux Scram | 122 | 119.3 | 117.3 | Y | Y |
| APRM Setdown Scram | n/a | 20 | 18 | Y | Y |
| APRM Setdown Rod Block | n/a | 14 | 12 | Y | n/a |
| APRM Downscale Rod Block | n/a | 3 | 5 | Y | n/a |

$W_d$: % Recirculation drive flow
n/a: Not applicable
Y: Yes

**Application Specific Setpoint Adjustments**

APRM Flow Biased STP Scram Nominal Trip Setpoints (NTSPs):

- Two Loop Operation (TLO): $0.58\ W_d + 57.1$ %RTP clamped at 111.0 %RTP
- Single Loop Operation (SLO): $0.58\ W_d + 34.3$ %RTP

where "$W_d$" is defined as the % Recirculation drive flow; 92.8% drive flow is that required to achieve 100% core power and flow at EPU. The TLO to SLO Setting adjustment, $SLO_{SettingAdj}$, is found as indicated below:

| Function | Calculated TLO to SLO Setting Adjustment | Reference |
|---|---|---|
| TLO to SLO Setting Adjustment for NUMAC setpoints | $SLO_{SettingAdj}$ = 39.4% | Comment 12 |

**4. Comments and Recommendations:**

1. Unless specifically identified as "bias" errors in this document, all instrument uncertainty errors will be considered to be random in nature, even when the "±" symbol is not shown.

2. Some plant specific information has not been provided or is not currently available in the current GGNS documentation, but is considered unnecessary because the effects of this information are included within the instrument accuracy values or are not necessary for setpoint evaluation.

3. STA evaluations are not performed for rod blocks or permissives per GEH setpoint methodology (References 1 and 2), such as the APRM Rod Blocks. Therefore, the Operational Limits (OLs) are not applicable.

4. Seismic effect, radiation effect, humidity effect, power supply effect, Radio Frequency Interference / Electromagnetic Interference (RFI/EMI) effect, and insulation resistance effect errors are marked "negligible" or "included in accuracy" and are considered to have negligible impact on the manufacturer's accuracy terms if they are not identified separately. Temperature effect of the Output Calibration Tool is assumed to be included in the accuracy as specified for the Input Calibration Tool.

5. Per References 1 and 2, overpressure effects are applicable only to pressure measurement devices (e.g., differential pressure transmitters), and static pressure effects are applicable only to differential pressure measurement devices. These effects are marked "n/a" for other devices or not considered.

6. The APRM Flow Biased STP and Setdown Scram setpoint functions are safety functions. However, the GEH safety analysis conservatively does not take credit for the APRM Flow Biased STP scram in the Minimum Critical Power Ratio (MCPR) determination, so the APRM Flow Biased STP setpoint does not protect a safety limit, and therefore has no AL. Consequently, for GEH methods and calculations, the Flow Biased STP Scram setpoint margin does not have any safety significance. The Downscale setpoint function is not safety related. Also, there are no safety functions associated with the other Rod Blocks. Therefore, these setpoint functions are not required to function after a seismic event. The Setdown Scram is a backup to the safety related Intermediate Range Monitor (IRM) scram function, but no specific safety analyses take direct credit for the Setdown function (Ref. 4.1 Bases). Also, the Setdown setpoint is not a flow biased setpoint function. Thus, the Seismic Effect for the flow transmitters and associated electronics is not considered in this evaluation.

7. The current approach in GEH setpoint calculation methodology treats the Flow Transmitter drift for this instrument to be a 2-sigma value.

8. The error of the calibration standard used to calibrate a calibration tool will not exceed ¼ of the error associated with the calibration tool. Temperature effects and readability errors need not be considered for calibration standards.

9. The accuracy of the flow electronics is not given in the NUMAC specifications, and [[

]] The combined error for the loop flow electronics is ± 0.122 mA at 2σ.

10. The NUMAC electronics are located in the Control Room or Control Room area at GGNS, where the radiation dose is expected to be within equipment qualification requirements as indicated by Ref. 5.2 (Area N-028).

11. The APRM subsystem is calibrated on-line weekly (Reference 4.1) using the AGAF process, where the gain of the APRMs is adjusted to read the Core Thermal Power determined by the Process Computer, within a specified As Left Tolerance. [[

]] Thus, the only calibration error to consider for the APRM electronics sub-loop is the As Left Tolerance specified by the AGAF process.

12. [[

]] As indicated in Section 3, the NTSP for TLO is 0.58 $W_d$ + 57.1 %, indicating an intercept of 57.1 %. The NTSP for SLO, 0.58 $W_d$ + 34.3%, has an intercept of 34.3%. [[

]] The resulting TLO to SLO setting adjustment is 39.31. Because the Setting Adjustment is programmed into the NUMAC equipment to one decimal place, each calculated number is rounded up to one decimal place for conservatism. This adjustment may be used in the implementation of the new NUMAC equipment.

13. The neutron noise value is not applied to the APRM flow-biased setpoints because they are based on an STP signal. The high neutron flux scram in "Run" and "Setdown" modes is based on the neutron flux signal; the rod block is based on the STP signal. The neutron noise value is conservatively applied to the Setdown rod block as well as the Setdown scram setpoint evaluation.

14. Complete inputs are unavailable for the Flow Electronic calibration errors for all Maintenance and Testing Equipment (M&TE) to be used at GGNS. Therefore, the Flow Electronics calibration errors are based on using errors that are 10% higher than the errors for assumed calibration tools. Moreover, the error of the calibration standard used to calibrate a calibration tool is conservatively assumed to be equal to the error of the calibration tool.

15. For the flow noise PMA, a typical value of ±1% rated Recirc flow can be used. However, that study reviewed several plants, some with Recirculation System flow elements being a venturi, and some being a flow elbow. Grand Gulf Nuclear Station has flow elbows, so the largest number for a plant with flow elbows from the referenced study is used, rounded up to one decimal place for conservatism.

16. [[

]] (Reference 2, Section 4.5.3)

17. Some of the references were submitted to GEH in support of related activities, e.g., PRNMS installation at CLTP (Reference 7.6).

18. The Operational Limit in the non-clamped region is determined by maintaining the same margin between the NTSP at the intercept point and OL as between the NTSP and OL in the clamped region.

19. An STA evaluation is not performed for single loop operation due to the rarity of plant operation in this configuration; thus, the OL is not applicable.

20. The APRM Flow Biased Simulated Thermal Power scram (TLO and SLO) functions are safety functions after installation of the PRNMS. However, the GEH safety analysis conservatively does not take credit for the APRM Flow Biased STP scram in the Minimum Critical Power Ratio (MCPR) determination, so the APRM Flow Biased STP setpoint does not protect a safety limit, and therefore has no AL. Consequently, for GEH methods and calculations, the Flow Biased STP Scram setpoint margin does not have any safety significance. No specific safety analyses take direct credit for the Setdown Scram function (Ref. 4.1 Bases). Also, the Setdown rod block and Downscale functions are not safety related; there are no safety functions associated with these Rod Blocks. Thus, an Analytical Limit is not applicable and the Nominal Trip Setpoint is calculated based on the Allowable Value.

21. The Operational Limit is the same as that used for the clamped region of the Flow-Biased STP scram.

22. The “Tech Spec Allowable Value” may be retained in the Technical Specifications or a supporting document such as the Core Operating Limits Report (Ref. 4.1 Bases). The calculations were performed based on the AV point values indicated; a “≤” or “≥” sign typically accompanies the values retained in licensing documentation.

23. For the static head portion of Flow PMA, installation of the differential pressure (dP) transmitter nozzle taps on the Recirculation pipes and instrument lines must be evaluated for a random error due to ambient temperature fluctuations in the section of instrument line producing a static head. This error is negligible if the static head difference for the dP measurement is less than 1 foot, and the high and low pressure instrument lines are routed close together. The static head difference for the taps is 16.8 inWC at room temperature. Consideration of system operating temperatures reduces the static head to less than 1 foot, thus, this error is considered to be negligible.

24. The Neutron Monitoring System performs its trip functions before accident temperatures are reached, so temperatures for trip and normal conditions are assumed to be the same.

25. Ref. 5.2 provides a Total Integrated Dose (TID) of 2.8 x $10^3$ Rads for 40 yrs and dose rate of 0.008 Rad/hr gamma for “Normal Environment N-028”. These values are negligible in comparison to flow transmitter capability as indicated in Ref 6.6.

26. Readability of the analog Input Calibration Tool is based on ½ of minor division, which is more conservative than 0.02% full-scale value. Readability of the digital Output Calibration Tool (Ref. 5.7) is based on three digits after decimal on range used, but conservatively assumes staff does not use last decimal.

27. The APRM Downscale Rod Block provides an indication of equipment function and overlap of neutron monitoring systems. Because it provides indication of channel function, a single channel configuration is assumed in the setpoint calculation. The AV for the Downscale Rod Block is an operational choice to detect a malfunctioning APRM and is generally conservatively selected. As such, the AV is anticipated not to change with EPU.

28. For the APRM Setdown Scram, the Operational Limit was set equal to the NTSP for the APRM Setdown Rod Block. This ensures that a Rod Block occurs prior to reaching a Scram for the setdown function.

29. The “current” calibration interval refers to CLTP values prior to PRNMS installation. Ref. 7.6 evaluated extended calibration intervals for APRM flow-biased setpoints. For EPU, the “desired” calibration interval was used in the setpoint calculation for all functions considered in this evaluation.

30. The flow elbow PEA is estimated for use in this calculation based on generally accepted references and experience, as a GGNS plant-specific value is not available.

31. Transfer functions used in this calculation:

| | |
|---|---|
| Flow Transmitter: | Output (mA) linearly converted from input (InWC). |
| Flow Electronics: | Output proportional to the square root of the two inputs, which are then summed. |
| Power Electronics: | Output is proportional to the average of the inputs and a comparison of the APRM signal with the flow-biased reference is made. |

**5. References:**

1. NEDC-32889P, Rev. 3, GEH Proprietary, “General Electric Methodology for Instrumentation Technical Specification and Setpoint Analysis,” November 2002.

2. NEDC-31336P-A, GEH Proprietary “General Electric Instrument Setpoint Methodology,” September 1996.

3. Current applicable Grand Gulf Nuclear Station setpoint calculations:

    3.1 Not used.

4. Grand Gulf Nuclear Station Licensing and related documents:

    4.1 Grand Gulf Nuclear Station Technical Specifications and Bases, as revised through Facility Operating License Amendment 182.

    4.2 Grand Gulf Nuclear Station Technical Requirements Manual, as revised through as revised through Facility Operating License Amendment 182.

5. Applicable Grand Gulf Nuclear Station procedures/documents:

    5.1 Not used.

    5.2 GGNS-E-100, “System Energy Resources, Inc. Grand Gulf Nuclear Station Environmental Parameters for GGNS Safety Related,” Rev. 6, 04/23/08.

    5.3 Not used.

    5.3a Not used.

    5.4 Vendor Manual 460001012, “Wallace & Tiernan Portable Pneumatic Calibrator, Series 65-120,” 06/26/95.

    5.4a. Vendor User’s Manual PN 0017108001A, “Mensor 8100 Quartz Pressure Calibrator,” March 2001.

    5.5 Not used.

    5.5a. Not used.

    5.6 Surveillance Procedure 06-IC-1C51-R-0075, “APRM Recirculation Flow Transmitter Calibration,” Rev. 103, 03/08/07.

    5.7 Vendor Service Manual 460003671, “Fluke Model 45 Multimeter,” July 1989.

    5.7a Vendor Operator Manual 460003696, “Fluke 5700A Calibrator,” 02/8/89.

6. Vendor Specifications

    6.1 Not used.

    6.2 Not used.

    6.3 Not used.

    6.4 Not used.

    6.5 Not used.

    6.6 Rosemount Nuclear Product Data Sheet, 00813-0100-4235, Rev. BA, “Model 1152 Alphaline® Nuclear Pressure Transmitter,” April 2007.

    6.7 Not used.

7. GEH Letters / Reports:

    7.1 Not used.

    7.1a Not used.

    7.2 Not used.

    7.3 Not used.

    7.4 Not used.

    7.5 Not used.

    7.6 GEH Report 0000-0102-8815-R2, “Instrument Limits Calculation, Entergy Operations, Inc., Grand Gulf Nuclear Station, Average Power Range Monitor Power Range Neutron Monitoring System (NUMAC)-CLTP Operation,” GEH Proprietary, Rev. 2, May 2011.

    7.7 Not used.

**Attachment 2**

**GNRO-2011/00055**

**Grand Gulf Nuclear Station Extended Power Uprate**

**Response to Request for Additional Information**

**Instrumentation and Controls Branch**

**GEH Affidavit for Withholding Information from Public Disclosure**

## GE-Hitachi Nuclear Energy Americas LLC

## AFFIDAVIT

**I, Edward D. Schrull, PE** state as follows:

(1) I am the Vice President, Regulatory Affairs, Services Licensing, GE-Hitachi Nuclear Energy Americas LLC ("GEH"), and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in Enclosure 1 of GEH letter, GEH-GGNS-AEP-462, L. King (GEH) to M. Smith (Entergy Operation, Inc.), "GGNS Supplement I&C Branch RAI Responses," dated July 28, 2011. The GEH proprietary information in Enclosure 1, which is entitled "GGNS Supplement I&CB RAIs" is identified by a dotted underline inside double square brackets. [[This sentence is an example.{3}]] In each case, the superscript notation {3} refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination.

(3) In making this application for withholding of proprietary information of which it is the owner or licensee, GEH relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for trade secrets (Exemption 4). The material for which exemption from disclosure is here sought also qualifies under the narrower definition of trade secret, within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975 F2d 871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704 F2d 1280 (DC Cir. 1983).

(4) The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a. and (4)b. Some examples of categories of information that fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GEH's competitors without license from GEH constitutes a competitive economic advantage over other companies;

b. Information that, if used by a competitor, would reduce their expenditure of resources or improve their competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information that reveals aspects of past, present, or future GEH customer-funded development plans and programs, resulting in potential products to GEH;

d. Information that discloses trade secret and/or potentially patentable subject matter for which it may be desirable to obtain patent protection.

(5) To address 10 CFR 2.390(b)(4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GEH, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GEH, not been disclosed publicly, and not been made available in public sources. All disclosures to third parties, including any required transmittals to the NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary and/or confidentiality agreements that provide for maintaining the information in confidence. The initial designation of this information as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in the following paragraphs (6) and (7).

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, who is the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or who is the person most likely to be subject to the terms under which it was licensed to GEH. Access to such documents within GEH is limited to a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist, or other equivalent authority for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GEH are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary and/or confidentiality agreements.

(8) The information identified in paragraph (2), above, is classified as proprietary because it contains detailed GEH design information of the methodology used in GEH setpoint calculations for the GEH Boiling Water Reactor (BWR). Development of these methods, techniques, and information and their application for the design, modification, and analyses methodologies and processes was achieved at a significant cost to GEH.

The development of the evaluation processes along with the interpretation and application of the analytical results is derived from the extensive experience databases that constitute major GEH asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GEH's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GEH's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GEH. The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial. GEH's competitive advantage will be lost if its competitors are able to use the results of the GEH experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GEH would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GEH of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing and obtaining these very valuable analytical tools.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Executed on this 28th day of July 2011.

Edward D. Schrull, PE
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